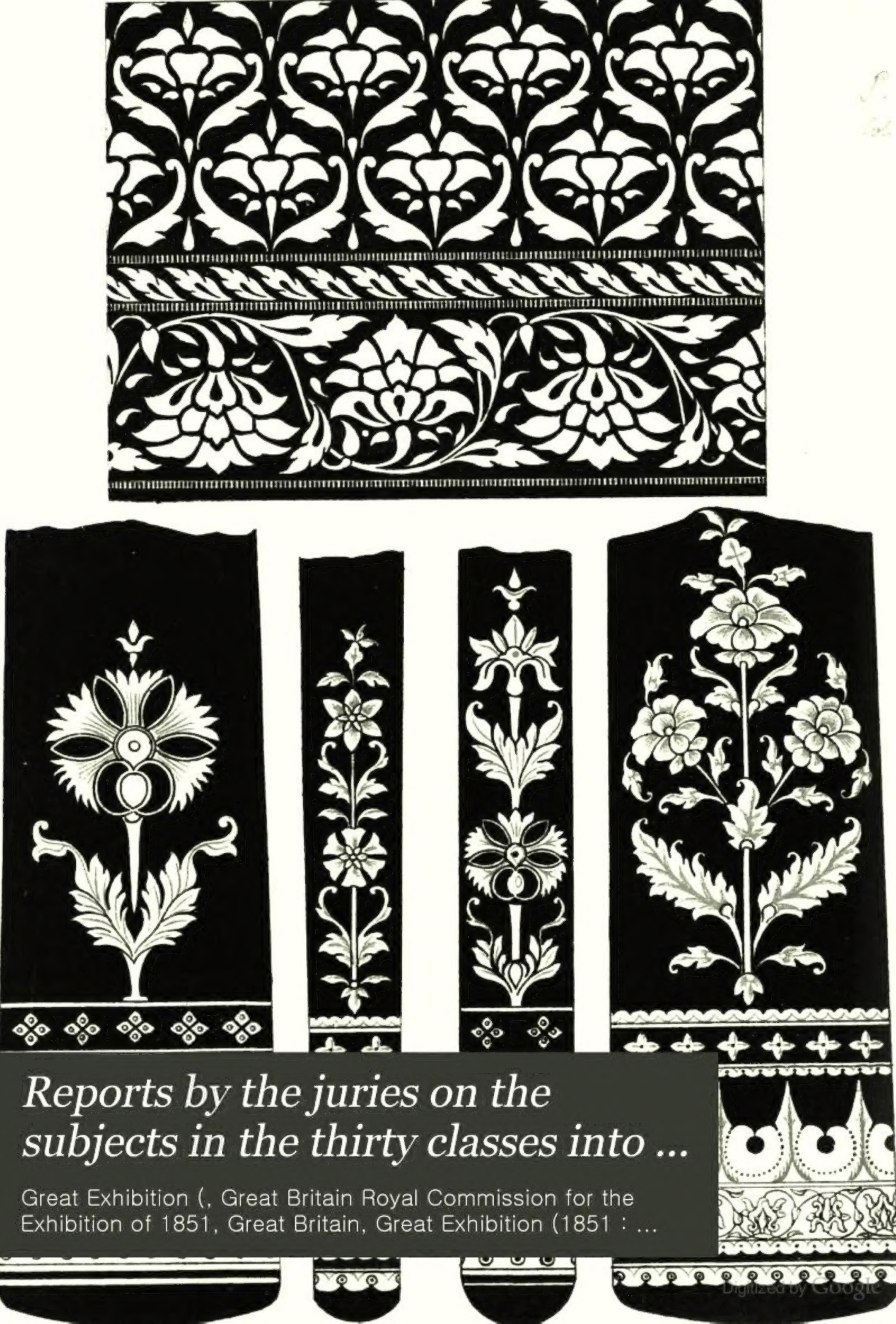

Reports by the juries on the subjects in the thirty classes into ...

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Exhibition of the Works of Industry of All Nations,
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REPORTS

BY

THE JURIES

ON

THE SUBJECTS IN THE THIRTY CLASSES INTO WHICH THE EXHIBITION WAS DIVIDED.

PRESENTATION COPY.

LONDON:
Printed for the Royal Commission,
BY
WILLIAM CLOWES & SONS, STAMFORD STREET AND CHARING CROSS.
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FROM the unexpected length of some of the REPORTS, they were found to be inconveniently bulky in the large type in which they were originally composed, and they have been accordingly carefully reprinted in their present form. In this edition the references were re-arranged by the printers, referring uniformly to the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE; in all other respects the two editions are perfectly identical.

WM. CLOWES AND SONS,
Printers to the Commission.

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* Sir CHARLES LYELL and Sir W. CUBITT were elected Members of the Commission on the expiration of their term of office as Presidents of their respective Institutions.

† Successor to Sir A. GALLOWAY, K.C.B. (*deceased.*)

‡ Appointed by Royal Warrant, 12th February, 1850.

§ Mr. EDGAR BOWRING was appointed Secretary in April, 1852.

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ON the 3rd January, 1850, HER MAJESTY was graciously pleased, on the representation of the *Society of Arts, Manufactures, and Commerce,* of which His Royal Highness PRINCE ALBERT is President, to appoint a Commission for the purpose of conducting an EXHIBITION OF THE WORKS OF INDUSTRY OF ALL NATIONS.

Among the duties entrusted by Her Majesty to the Commissioners, were the determination of the nature of the Prizes, and the means of securing the impartial distribution of them.

For this purpose certain general principles were laid down by Her Majesty's Commissioners, and Juries were appointed to whom the application of those principles was entirely left.

The present volume, containing the Decisions of Her Majesty's Commissioners upon this subject, the names of the persons to whom the important duties of adjudication were entrusted, and the Reports submitted by the different Juries to the Commissioners, has been ordered by them to be published for general information, and a copy to be presented to every Exhibitor.

By Order of Her Majesty's Commissioners,

(Signed) EDGAR A. BOWRING, *Secretary.*

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REPORT

OF

VISCOUNT CANNING,

President of the Council of Chairmen of Juries,

ON PRESENTING THE AWARDS OF THE JURIES TO THE ROYAL COMMISSION.

HAVING had the honour of acting as President of the Council of Chairmen of the Juries, it falls to me to lay before your Royal Highness and Her Majesty's Commissioners the Reports of several Juries upon the subjects submitted to them for examination, and the names of the exhibitors whom they have judged entitled to rewards.

In doing so, it will be convenient that I should state briefly the Principle upon which, by the authority of Her Majesty's Commissioners, the Juries were constituted.

The various Subjects included in the Exhibition were divided, in the first instance, into Thirty Classes. Of these, two were subsequently found to embrace fields of action too large for single Juries, and were therefore divided into Sub-Juries. This increased the number of Acting Juries to Thirty-four.

Each of these Thirty-four Juries consisted of an equal number of British subjects and of Foreigners. The British Jurors were selected by Her Majesty's Commissioners from lists furnished by the Local Committees of various towns, each town being invited to recommend persons of skill and information in the manufactures or produce for which it is remarkable. The Foreign Jurors were appointed by authorities in their own countries, in such relative proportion amongst themselves as was agreed upon by the Foreign Commissioners sent here to represent their respective Governments.

In the event of a Jury finding themselves deficient in technical knowledge of any article submitted to them, they were empowered to call in the aid of Associates. These Associates, who acted as advisers only, without a vote, but whose services were of the greatest value, were selected either from the Jurymen of other classes, or from the lists of persons who had been recommended as Jurors but who had not been permanently appointed to any Jury.

Each Jury was superintended by a Chairman, chosen from its number by Her Majesty's Commissioners. The Deputy-Chairman and the Reporter were elected by the Jurors themselves.

Such was the constitution of the Thirty-four Juries taken singly. They did not, however, act independently of each other, inasmuch as they were associated into six Groups, each Group consisting of such Juries as had to deal with subjects in some degree of kindred nature; and before any decision of a Jury could be considered as final, it was required that it should be brought before the assembled Group of which that Jury formed a part, and that it should be approved by them.

The chief object of this provision was, that none of the many Foreign Nations taking part in the Exhibition should incur the risk of seeing its interests overlooked or neglected from the accident (an unavoidable one in many instances) of its being unrepresented in any particular Jury.

Each Group of Juries received the assistance of a Deputy Commissioner and of a Special Commissioner, appointed by Her Majesty's Commissioners to record its proceedings, to furnish information respecting the arrangements of the Exhibition, and otherwise to facilitate the labours of the Juries composing the Group.

It was further determined by Her Majesty's Commissioners that the Chairmen of the Juries, consisting of British subjects and of Foreigners in equal numbers, should be formed into a Council; and that the duties of the Council should be, to determine the conditions upon which, in accordance with certain general principles previously laid down by Her Majesty's Commissioners, the different Prizes should be awarded; to frame rules to guide the working of the Juries; and to secure, as far as possible, uniformity in the result of their proceedings.

These are the most important features of the system upon which the Juries found themselves organized. I will now refer briefly to their course of action.

The Council of Chairmen, in proceeding to the discharge of their duties, were met at the outset by a serious difficulty. Her Majesty's Commissioners had expressed themselves desirous that merit should be rewarded wherever it presented itself, but anxious at the same time to avoid the recognition of competition between individual Exhibitors. They had also decided that the Prizes should consist of three Medals in different sizes; and that these should be awarded, not as first, second, and third in degree for the same class of subjects and merit, but as marking merit of different kinds and character.

The Council of Chairmen found, to their regret, that it would be impossible to lay down any rules for the awarding of the three Medals by which the appearance at least of denoting different degrees of success amongst exhibitors in the same branch of production could be avoided. Accordingly, after fully explaining their difficulty to Her Majesty's Commissioners, they requested, as a course by which it might be materially diminished, that one of the Medals might be withdrawn.

Of the remaining two, they suggested that one, the Prize Medal, should be conferred wherever a certain standard of excellence in production or workmanship had been attained—utility, beauty, cheapness, adaptation to particular markets, and other elements of merit being taken into consideration according to the nature of the object; and they recommended that this Medal should be awarded by the Juries, subject to confirmation by the Groups.

In regard to the other and larger Medal, they suggested that the conditions of its award should be some important novelty of invention or application, either in material, or processes of manufacture, or originality combined with great beauty of design; but that it should not be conferred for excellence of production or workmanship alone, however eminent: and they further suggested that this Medal should be awarded by the Council of Chairmen upon the recommendation of a Jury, supported by its Group.

The principle thus described met the views of Her Majesty's Commissioners, and was subsequently further developed by them in a Minute which they communicated to the Council of Chairmen. (See APPENDIX C.) Its application, however, was not without difficulties, especially as regarded the Foreign Jurors. Many of these had taken part in the National Exhibitions of France and Germany; and to them the distinctive character of the two Medals, and the avoidance of all recognition of degrees of merit between the recipients of prizes, were novel principles, and at variance with their experience; inasmuch as one of the chief purposes of the National Exhibitions of the Continent has been to distinguish the various degrees of success attained by rival exhibitors.

It was to be expected, therefore, that cases would arise in which the Council Medal, as the higher reward, would be asked for Exhibitors whose claims were only somewhat stronger in degree, without differing in kind from those of others to whom the Prize Medal had been awarded. In such cases it became the duty of the Council of Chairmen to refuse their sanction to the award of the Council Medal; without, however, necessarily impugning the alleged superiority of the article for which it was demanded. On the other hand, some instances have occurred in which they have felt themselves called upon to confirm the claim to a Council Medal, where the object for which it was claimed showed, in itself, less merit of execution or manufacture than others of its Class. It follows, therefore, that the award of a Council Medal does not necessarily stamp its recipient as a better manufacturer or producer than others who have received the Prize Medal. It is rather a mark of such invention, ingenuity, or originality as may be expected to exercise an influence upon industry more extended, and more important, than could be produced by mere excellence of manufacture.

This is to be borne in mind in considering the List of Awards which I have the honour to lay before your Royal Highness; and I trust it will be found that the Juries have succeeded in doing justice to the Exhibitors of every Nation and Class, and that they have not departed in any important degree from the purpose of Her Majesty's Commissioners.

One of the first instructions addressed to the Juries by the Council of Chairmen was to the effect that the Prizes should be awarded without reference to the country of the Exhibitors, the Exhibition being considered in this respect as recognizing no distinction of Nations.

It is gratifying to add that the Jurors of every country cordially acquiesced in this principle, and that, notwithstanding unavoidable differences of opinion, uninterrupted harmony prevailed amongst them throughout the whole course of their labours. It is not too much to hope that the happy influence of this intercourse may extend and endure far beyond the present occasion.

It is not necessary that I should detain your Royal Highness and Her Majesty's Commissioners with a recital of the other instructions framed by the Council of Chairmen for the guidance of the Juries, or with a detailed account of their proceedings in the discharge of their own functions.

The number of Prize Medals awarded is 2,918. The number of Council Medals is 170.

It is important to observe that no more than one Medal of either denomination has been allotted to one Exhibitor in the same Class, although he may have contributed to that Class more than one article deserving of reward.

The Juries have found it just, in framing their Reports, to make Honourable Mention of certain Exhibitors whose contributions were not such as to entitle them to receive a Medal. Some have applied specimens of raw materials, which, although curious and instructive, do not imply any great merit of production on the part of the Exhibitor; and others have furnished articles of manufacture which, without reaching a high degree of excellence, are interesting as examples of the processes, or present condition of the trades which they illustrate.

Before concluding, I trust I may be allowed to add that it would be difficult duly to estimate the time and labour expended by the Jurors in their endeavour to discharge faithfully the important duty confided to them. The number of Exhibitors was about 17,000. Of these many, who were reckoned but once in the Catalogue, contributed a large variety of objects, and came within the province of more than one Jury; whilst in other cases towns, and even whole countries, were counted as single Exhibitors, although they presented for examination every kind of manufacture and raw produce which their ingenuity and natural resources could furnish. Upon the whole, the task of the Juries involved the consideration and judgment of at least a million articles; the difficulties attending it being not a little increased by the want of a uniform system of classification of the subjects in some of the foreign divisions, and by unavoidable imperfections in the Catalogue.

In these circumstances the Juries can scarcely venture to hope that accidental omissions may not have occurred; but they have the satisfaction of feeling that these, if any, are not attributable to a want of care or diligence on their part.

It now only remains for me, in laying the result of our labours respectfully before your Royal Higness and Her Majesty's Commissioners, to offer, on behalf of my Colleagues and myself, our grateful acknowledgment of the honourable confidence which you have placed in us; and to express the hope that we shall be found to have fulfilled our trust in a manner worthy of the noble undertaking in which we are proud to have been called upon to bear a part.

CANNING.

Appendix A.

DECISIONS REGARDING JURIES.

General Conditions.

1. There shall be one Jury to each of the Thirty Classes, into which the Exhibition is divided.

2. The number of Jurors in each Jury is determined by the amount of articles exhibited in each Class, and the greater or less diversity of the subjects included in it, but no abstract idea of the relative importance of the Classes is involved in the numbers attached to them.

3. The following list describes the Thirty Juries, and the number of Jurors to each Jury:—

A. Raw Materials.

		Number of Jurors.
I.	Mining, Quarrying, Metallurgical Operations, and Mineral Products	8
II.	Chemical and Pharmaceutical Processes and Products generally	8
III.	Substances used as Food	6
IV.	Vegetable and Animal Substances chiefly used in Manufactures, as Implements, or for Ornament	8

B. Machinery.

V.	Machines for direct use, including Carriages and Railway and Naval Mechanism	12
Va.	Carriages	6
VI.	Manufacturing Machines and Tools	12
VII.	Civil Engineering, Architectural and Building Contrivances	8
VIII.	Naval Architecture and Military Engineering; Ordnance, Armour, and Accoutrements	8
IX.	Agricultural and Horticultural Machines and Implements	15*
X.	Philosophical Instruments and processes depending upon their use; Musical, Horological, and Surgical Instruments	12
Xa.	Musical Instruments	10
Xb.	Horological	4
Xc.	Surgical	6

C. Manufactures.—*Textile Fabrics.*

XI.	Cotton	10
XII.	Woollen and Worsted	12
XIII.	Silk and Velvet	10
XIV.	Manufactures from Flax and Hemp	10
XV.	Mixed Fabrics, including Shawls, but exclusive of Worsted Goods (Class XII.)	12
XVI.	Leather, including Saddlery and Harness, Skins, Fur, Feathers, and Hair	10
XVII.	Paper and Stationery, Printing, and Bookbinding	8
XVIII.	Woven, Spun, Felted, and laid Fabrics, when shown as specimens of Printing or Dyeing	10
XIX.	Tapestry, including Carpets and Floor-cloths, Lace and Embroidery, Fancy and Industrial Works	10
XX.	Articles of Clothing for immediate Personal or Domestic Use	8

D. *Metallic, Vitreous, and Ceramic Manufactures.*

XXI.	Cutlery and Edge Tools	6
XXII.	Iron and General Hardware	12
XXIII.	Working in Precious Metals, and in their imitations, Jewellery, and all articles of Virtu and Luxury, not included in the other Classes	10
XXIV.	Glass	8
XXV.	Ceramic Manufacture, China, Porcelain, Earthenware, &c.	8

E. *Miscellaneous Manufactures.*

		Number of Jurors.
XXVI.	Decorative Furniture and Upholstery, including Paper Hangings, Papier Maché, and Japanned Goods	12
XXVII.	Manufactures in Mineral Substances, used for building or decoration, as in Marble, Slate, Porphyries, Cements, Artificial Stones, &c.	8
XXVIII.	Manufactures from Animal and Vegetable Substances, not being Woven or Felted, or included in other Sections	8
XXIX.	Miscellaneous Manufactures and Small Wares	8

F. Fine Arts.

XXX.	Sculpture, Models, and Plastic Art	15
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4. A classified List of Subjects under the province of each Jury is prepared, and forms the limitation to each Class.

5. The Articles in the Building are arranged as much as possible in the 30 Classes, so as to be coincident with the field of action of each Jury, and to facilitate its labours.

6. If Exhibitors accept the office of Jurors, they cease to be competitors for prizes in the Class to which they are appointed, and these cannot be awarded either to them individually, or to the firms in which they may be partners.

7. Juries may take evidence when a majority of the Jury deem it advisable, and name the persons to be consulted. Jurors of another Class may also be called in aid by a Jury, when information involved in that Class is required.

8. Juries may act in matters of detail by sub-committees, but no award can be made except by the majority of the Jury.

9. Before a Jury can finally make its awards, they must be submitted to a meeting of the Juries of allied subjects, as indicated in the groups in the Decision 3. These Meetings of allied Juries will have power to confirm the award of the Juries, and to investigate any disputed decisions. Before, however, the awards are published, they must be submitted to a Council, consisting of the Chairmen of the Juries, in order to secure uniformity of action—and a compliance with the regulations originally laid down by that body.

10. The awards of a Jury, when reported by the Council of Chairmen as being made in conformity to the rules, are final.

11. The Juries will commence their duties on Monday the 12th May, at 12 o'clock, and will be aided in the general transaction of the business by a person to be named by the Royal Commissioners, who by himself, or by a deputy to be approved of by the Commission, may be present at their deliberations, for the purpose of explaining the rules of the Commission. This Nominee of the Commission will not have a vote in any of the Juries, or at all interfere in the adjudication of awards.

Constitution of Juries.

12. The Jury will in general consist of an equal number of British subjects and of Foreigners.*

13. If Foreign Commissions do not send a sufficient number of Foreigners to represent one-half of the Jurors in each Class, the deficient numbers may be completed by the appointment of British subjects.

14. Country as well as metropolitan districts will be represented on the Jury.

---

* The Jury for Agricultural Implements is made exceptional, as the Agricultural Committee, consisting of eminent Members of the Royal Agricultural Society, have undertaken the functions of the Jury. Foreigners may be added to this Committee if desired.

* The following list contains the actual number of the Jurors sent by each country:—

Austria	17	Russia	7
Belgium	14	Sicily	1
Denmark	1	Spain	4
Egypt	2	Switzerland	7
France	33	Sweden	1
Great Britain	160	Turkey	5
Greece	1	United States	24
North Germany	2	Zollverein	23
Holland	2		
Italy	6	Total	183
Portugal	2		

15. Each Jury will be presided over by a Chairman to be nominated by the Commissioners, and he will be aided by a Deputy-Chairman to be elected by the Jury.

16. Juries may appoint one of their own body as a Reporter.

Council of Chairmen.

17. The Chairmen of the Thirty Juries will be associated as a body, to be called the "Council of Chairmen."

18. In the absence of a Chairman, the Deputy-Chairman will take his seat at the Council.

19. The Council of Chairmen will be constituted, as far as practicable, of British subjects and Foreigners in equal numbers.

20. The first and chief duties of the Council of Chairmen will be to frame the rules for the guidance of the Juries.

21. The Council will also have to determine the conditions under which the 1st, 2nd, and 3rd Class Medals respectively are to be awarded, and to define the general principles to which it will be advisable to conform in the awards in the several departments of the Exhibition. It is the wish of the Commission that Medals should be awarded to articles possessing decided superiority, of whatever nature that superiority may be, and not with reference to a merely individual competition. The three Classes of Medals are intended to distinguish the respective characters of subjects, and not as first, second, and third in degree for the same class of subjects.*

22. The Council of Chairman must see that the awards of the individual Juries are in accordance with the rules before they are considered final.

23. Although the Commissioners may be disposed, under peculiar circumstances, as set forth in the undermentioned decision,* to consider the propriety of pecuniary grants to individual exhibitors, they will only take such applications into consideration on the recommendation of the several Juries, sanctioned by the Council of Chairmen.

24. As some of the most important duties of the Council of Chairmen are preliminary to the action of the Juries, it is necessary that they should meet one week previous to the assembling of the Juries. The duties of the Council will therefore commence on Monday, the 5th of May.

25. In order to represent the wishes of the Commission, and to explain its rules, a nominee of the Commission will attend the meetings of the Council, and aid it in the transaction of business; but he will not possess a vote, or act as a member of the Council.

Mode of Appointing the English Jurors.

26. Those towns which exhibit to a considerable extent in any of the Classes will be invited to send a list of names of persons who would efficiently represent the knowledge of those Classes as Jurors.

27. It will be necessary to state, according to the classified Jury list, the subdivisions of the Class with which the person recommended is specially acquainted; and all nominations must be made in classes, and not in the aggregate.

28. As it is necessary to reduce the lists to the standard number for each Jury, the Commission charges itself with this duty.

29. Those persons who have been recommended as Jurors, but who from the small numbers of the Jury are not placed on it, may, on the application of a Jury, be called in on special occasions, to give aid, under the title of Associates, but without a vote.

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* The following decisions relative to Prizes and Juries, already published, are repeated for the purpose of more detailed information :—

"Her Majesty's Commissioners have had under their consideration the subject of the Prizes to be awarded to exhibitors, and have resolved to take immediate steps for having (three) Medals struck of various sizes and different designs, it being their opinion that this is the form in which it will, generally speaking, be most desirable that the rewards should be distributed. They have decided to select bronze for the material in which the Medals are to be executed, considering that metal to be better calculated than any other for the development of superior skill and ingenuity in the medallic art, and at the same time the most likely to constitute a lasting memorial of the Exhibition.

"With regard to the mode in which the Prizes are to be awarded, the Commissioners think it inexpedient to establish beforehand rules so precise as to fetter the discretion of the Juries upon which the task will ultimately devolve. It will be sufficient for the present to indicate the general principle to which it will probably be advisable to conform in the award of Prizes for successful competition in the several departments of the Exhibition.

"In the department of Raw Materials and Produce, for instance, Prizes will be awarded upon a consideration of the value and importance of the article, and the superior excellence of the particular specimens exhibited; and in the case of prepared materials, coming under this head of the Exhibition, the Juries will take into account the novelty and importance of the prepared product, and the superior skill and ingenuity manifested in the process of preparation.

"In the department of Machinery, the Prizes will be given with reference to novelty in the invention, superiority in the execution, increased efficiency, or increased economy, in the use of the article exhibited. The importance, in a social or other point of view, of the purposes to which the article is to be applied, will also be taken into consideration, as will also the amount of the difficulties overcome in bringing the invention to perfection.

"In the department of Manufactures, those articles will be rewarded which fulfil in the highest degree the conditions specified in the sectional list, viz. :—Increased usefulness, such as permanency in dyes, improved forms and arrangements, in articles of utility, &c. Superior quality, or superior skill in workmanship. New use of known materials. Use of new materials. New combinations of materials, as in metals and pottery. Beauty of design in form, or colour, or both, with reference to utility. Cheapness, relatively to excellence of production.

"In the department of Sculpture, Models, and the Plastic Art, the rewards will have reference to the beauty and originality of the specimens exhibited, to improvements in the processes of production, to the application of art to manufactures, and, in the case of models, to the interest attaching to the subject they represent.

"These general indications are sufficient to show that it is the wish of the Commissioners, as far as possible, to reward all articles in any department of the Exhibition which may appear to competent judges to possess any decided superiority, of whatever nature that superiority may be. It is the intention of the Commissioners to reward excellence in whatever form it is presented, and not to give inducements to the distinctions of a merely individual competition. Although the Commissioners have determined on having three Medals of different sizes and designs, they do not propose to instruct the Juries to award them as first, second, and third in degree for the same class of subjects. They do not wish to trammel the Juries by any precise limitation; but they consider that the Juries will rather view the three kinds of Medals as a means of appreciating and distinguishing the respective characters of the subjects to be rewarded, and not of making distinctive marks in the same class of Articles exhibited. They fully recognise that excellence in production is not only to be looked for in high-priced goods, in which much cost of labour and skill has been employed, but they encourage the exhibition of low-priced fabrics, when combining quality with lowness of price, or with novelty of production. They can readily conceive that Juries will be justified in giving the same class Medal to the cheapest Calico Print, made for the Brazilian or other South American market, as they would to the finest piece of *Mousseline de Soie* or *Mousseline de Laine*, if each possessed excellence of its own kind.

* "Lastly, the Commissioners in announcing their intention of giving Medal Prizes, do not propose altogether to exclude pecuniary grants, either as Prizes for successful competition, or as awards under special circumstances, accompanying, and in addition to, the honorary distinction of the Medal. There may be cases in which, on account of the condition of life of the successful competitor (as, for instance, in the case of workmen), the grant of a sum of money may be the most appropriate reward of superior excellence; and there may be other cases of a special and exceptional nature, in which, from a consideration of the expense incurred in the preparation or transmission of a particular article entitled to a Prize, combined with a due regard to the condition and pecuniary circumstances of the party exhibiting, a special grant may with propriety be added to the honorary distinction. The Commissioners are not prepared, for the present at least, to establish any regulations on these heads. They consider it probable that a wide discretion must be left to the Juries to be hereafter appointed in respect to the award of Money Prizes, or the grant of money in aid of honorary distinctions; it being understood that such discretion is to be exercised under the superintendence and control of the Commission."

MODE OF APPOINTING FOREIGN JURORS.

Note.—The decisions regarding Foreign Jurors are delayed until the opinions of the Agents of Foreign Commissions are obtained as to the proportions in which each nation should be represented in the respective classes, and as to the principles of nomination most agreeable to the countries which they represent.

MEETING OF JURIES.

31. The Jurors, on being appointed, will receive immediate notice of appointment, and their names will be published.

32. The Chairman will be required to meet on Monday the 5th May, at 10 o'clock.

33. The Juries will meet for the transaction of business, on Monday the 12th May, at 10 o'clock.

34. Although impossible to set apart special days in which the Juries alone can examine the Articles exhibited, to the exclusion of the public, arrangements will be made to carry on these examinations with as little delay as possible.

35. Jurors, immediately on their arrival in London, are requested to report themselves at the Jury Office, in the Exhibition Building, where they will obtain their Juror's Ticket, and receive all necessary information.

APPENDIX A 1.

CLASSIFICATION OF SUBJECTS IN THE THIRTY CLASSES INTO WHICH THE EXHIBITION IS DIVIDED.

RAW MATERIALS.

I. Mining, Quarrying, Metallurgical Operations, and Mineral Products.
II. Chemical and Pharmaceutical Processes and Products generally.
III. Substances used for Food.
IV. Vegetable and Animal Substances, chiefly used in Manufactures, as Implements, or for Ornament.

MACHINERY.

V. Machines for direct use, including Carriages and Railway and Naval Mechanism.
VI. Manufacturing Machines and Tools.
VII. Civil Engineering, Architectural and Building Contrivances.
VIII. Naval, Architectural, and Military Engineering; Ordnance, Armour, and Accoutrements.
IX. Agricultural and Horticultural Machines and Implements.
X. Philosophical Instruments and Processes depending upon their use; Musical, Horological, and Surgical Instruments.

MANUFACTURES.

XI. Cotton.
XII. Woollen and Worsted.
XIII. Silk and Velvet.
XIV. Manufactures from Flax and Hemp.
XV. Mixed Fabrics, including Shawls, but exclusive of Worsted Goods (Class XII.).
XVI. Leather, including Saddlery and Harness, Skins, Fur, Feathers, and Hair.
XVII. Paper and Stationery, Printing and Bookbinding.
XVIII. Woven, Spun, Felted, and laid Fabrics, when shown as specimens of Printing or Dyeing.
XIX. Tapestry, including Carpets and Floor-cloths, Lace and Embroidery, Fancy and Industrial Works.
XX. Articles of Clothing for immediate Personal or Domestic Use.
XXI. Cutlery and Edge Tools.
XXII. Iron and General Hardware.
XXIII. Working in precious Metals, and in their imitations, Jewellery, and all articles of Virtu and Luxury, not included in all other Classes.
XXIV. Glass.
XXV. Ceramic Manufactures, China, Porcelain, Earthenware, &c.
XXVI. Decorative Furniture and Upholstery, including Paper-hangings, Papier Maché and Japanned Goods.
XXVII. Manufactures in Mineral Substances, used for building or decoration, as in Marble, Slate, Porphyries, Cements, Artificial Stones, &c.
XXVIII. Manufactures from Animal and Vegetable Substances, not being Woven or Felted, or included in other Sections.
XXIX. Miscellaneous Manufactures and Small Wares.

FINE ARTS.

XXX. Sculpture Models and Plastic Art.

I. *Mining, Quarrying, Metallurgical Operations, and Mineral Products.*

A. MINING AND QUARRYING OPERATIONS.
  1. Quarries and open workings.
  2. Streaming; washing alluvial deposits.
  3. Mines worked on the lode.
    a. Sinking of shafts.
    b. Cutting adits.
    c. Driving levels.
  4. Mines worked on the bed.
    a. Sinking shafts.
    b. Driving levels.
    c. Cutting stalls or headings.
  5. Salt deposits.
  6. Ventilation; Safety Lamps, and other modes of Lighting.
  7. Methods of raising Men, Ore, and Water.
    a. Raising Ore.
    b. Lowering and raising Miners.
    c. Draining.

B. GEOLOGICAL MAPS, PLANS, AND SECTIONS.

C. ORES AND METALLURGICAL OPERATIONS.
  1. Ores, and the Methods of dressing and rendering Ores merchantable.
    a. Ores of the more common Metals, as of Iron, Copper, Zinc, Tin, Lead.
    b. Native Metals, as Gold, Silver, Copper, &c.
    c. Ores used for various purposes, without reduction, as Peroxide of Manganese, &c.
  2. Methods of roasting, smelting, or otherwise reducing Ores.
    a. The common Metals, as Iron, Copper, Zinc, Tin, Lead.
    b. The Metals more generally used in combination, as Antimony, Arsenic, Bismuth, Cadmium, Cobalt, Nickel, &c.
  3. Methods of preparing for use the nobler Metals, as Gold, Silver, Mercury, Palladium. Platinum, &c.
  4. Adaptation of Metals to special purposes.
    a. Metals in various Chemical states, as Iron in the condition of Cast and Malleable Iron, Steel, &c.
    b. Metals in their progress to finished Manufactures, as Pigs and Ingots, Sheets, Bars, Wires, &c.
  5. Alloys, and methods of rendering more generally useful metals and their alloys—
    a. Statuary, Bronze, Gun, Bell, and Speculum Metals.
    b. Brass, and alloys used as a substitute for it.

c. White alloys, as Britannia Metal, German Silver, Pewter, &c.
d. Type, Sheathing Metals, and other alloys.

D. Non-Metallic Mineral Products.

1. Minerals used as Fuel—
a. All kinds of Coal and derived products.
b. Lignite and Peat ,, ,,
c. Bituminous bodies and native Naphtha.

2. Massive Minerals used in construction.
a. For purposes of construction generally—
Siliceous or Calcareous Free Stones and Flags.
Granites, Porphyritic and Basaltic Rocks.
Slates.
b. For purposes of Ornament, Decoration, and the Fine Arts—
Marbles.
Alabaster, Spar, &c.
Serpentine and other hard rocks susceptible of high polish.
c. Cements and Artificial Stones—
Calcareous and Hydraulic Cements.
Puzzuolanas, Trass, &c.
Gypsum for plaster.
Artificial Stones.

3. Minerals used in the Manufacture of Pottery and Glass.
Sands, Limestones, &c., for Glass-making.
Various Clays and felspathic Minerals, as those used for Bricks, Tiles, and various kinds of Pottery and Porcelain.
Siliceous, Calcareous, and other Minerals, used in Plastic Arts.

4. Minerals used for personal Ornaments, or for Mechanical and Scientific purposes.
a. Gems and precious Stones.
b. Models of Minerals and Crystals, &c.
c. Collections of Minerals for scientific or educational use.

5. Minerals used in various Arts and Manufactures.
a. Simple bodies or compounds containing the Alkalies or Alkaline Earths—
Those used principally for culinary purposes or for Medicine, as Salt, Mineral Waters, &c.
Those used in various manufactures, as Sulphur, Borax, &c.
b. Earthy and semi-crystalline Minerals.
Minerals used for grinding and polishing, as Grindstones, Honestones, Emery, &c.
Lithographic Stones, Drawing Chalks, and Slate Pencils.
Graphite.
Earthy and other Minerals used as pigments, or for staining, dyeing, and colouring.
Various Minerals used in Manufactures; as Alum, Schist, Fuller's Earth, French Chalk, Casting Sands, &c.

6. Soils and Mineral Manures.

II. *Chemical and Pharmaceutical Processes and Products generally.*

A. Chemical Substances used in Manufacture.

1. From the Mineral Kingdom.
a. Non-metallic substances.
Those used principally in their elementary state, as Sulphur, Phosphorus, &c.
Acids, as Sulphuric, Muriatic, Nitric, Boracic, &c.
Miscellaneous Manufactures, as Sulphuret of Carbon, Chloride of Sulphur, &c.
b. Alkalies, Earths, and their compounds.
Alkalies and their Alkaline Salts, as Soda, Potash, Ammonia, and the Carbonates, &c.
Neutral Salts of the Alkalies, as Sulphate, Nitrate of Soda, Saltpetre, Borax, &c.
Earths and their compounds, as Lime, Magnesia, Barytes, Strontia, Alumina, &c.
c. The compounds of Metals proper, as Salts of Iron, Copper, Lead, &c.
d. Mixed Chemical Manufactures, as Prussiate of Potash, &c.

2. From the Organic Kingdom, and not included in Sections III. and IV.

3. Manufactured Pigments, Dyes, and miscellaneous Chemical Manufacturers. (See also Section IV.)
a. Pigments employed in House Decoration, and for colouring Woods.
b. Pigments used for Textile Fabrics.
c. Pigments used for Paper Hangings, and for felted and laid Fabrics generally.
d. Artists' Colours.
e. Miscellaneous Chemical Manufactures.

B. Rarer Chemical Substances manufactured chiefly for the use of the Scientific Chemist.

1. From Substances of the Mineral Kingdom.
2. ,, Vegetable ,,
3. ,, Animal ,,

C. Chemical Substances used in Medicine and in Pharmacy.

1. From the Mineral Kingdom.
a. Non-metallic substances and their compounds.
b. Alkalies, Earths, and their compounds.
c. Metallic Preparations.

2. From the Vegetable Kingdom, when shown for Pharmaceutical Purposes. (See also Sections III. and IV.)
a. Vegetable Infusions, Decoctions and Solutions, clear or saccharine.
b. Tinctures.
c. Extracts and Inspissated Juices.
d. Resins, Gum Resins, and Oleo Resins, and Balsams.
e. Aloes, &c.
f. Gums as Acacia, Tragacanth, &c.
g. Essential Oils, Cajeput, Savine, Turpentine, &c.
h. Fixed Oils, as Castor, Croton, Almond, Olive, &c.
i. Vegetable parts, as leaves of Digitalis, Hemlock, roots of Japan, Ipecacuanha, &c.
j. Barks as Imported, Cinchona, Cascarilla, Cusparia, &c.
k. Vegeto-Alkalies, their Salts and other Crystalline principles of medicinal substances.
l. Vegetable Acids.
m. Miscellaneous Compounds.

3. From the Animal Kingdom.
a. Cod-liver and other Animal Oils for internal or external application.
b. Unguents of Spermaceti, Lard, Oil, and combinations of them.
c. Antispasmodics, as Musk, Castoreum, Civet, Ambergris, &c.
d. Phosphorus, Ammonia, and their products.
e. Irritants, as Cantharides.
f. Antacids, as Crab's-eyes, Calcareous concretions of the Craw-fish, Cuttle-bone, &c.

III. *Substances used as Food.*

VEGETABLE KINGDOM.

A. Agricultural Produce—Cereals, Pulses, Oils, Seeds, etc.

1. Common European Cereals.
2. Cereals more rarely cultivated in Europe.
3. Millet and other small Grains used as food.
4. Pulses and Cattle Food.
5. Grasses, Fodder Plants, and Agricultural Roots.
6. The Flours or preparations of the above classes.
7. Oil Seeds and their Cakes.
8. Hops and other aromatic plants used for like purposes.

B. Dried Fruits and Seeds.

1. Raisins, Currants, Figs, Plums, Cherries, Apricots, &c.
2. Dates, Tamarinds, Dried Bananas, &c.
3. Almonds, Chesnuts, Walnuts, &c.
4. Cocoa-nuts, &c.

C. Substances used in the preparation of Drinks.

1. Real Teas of all kinds.
2. Substitute for Teas, as Paraguay, Arabian, Bencoolen, &c.
3. Coffee of all kinds, and Cocoa Seeds and Nibs.
4. Various substances, as Chicory Roots, Amande de Terre, Guarana Bread, &c.

D. Intoxicating Drugs, Fermented Liquors, and Distilled Spirits from unusual Sources.

1. Fermented Liquors and Spirits from unusual sources.
2. Tobacco.

  3. Opium.
  4. Hemp, and other Intoxicating Drugs.

E. Spices and Condiments.
  1. Cinnamon, Cassia, and their substitutes.
  2. Nutmegs and Mace; Cloves and Cassia Buds.
  3. Peppers, Capsicum, Mustard, Vanilla, Pimento, Cardamums, &c.
  4. Ginger, Turmeric, &c.

F. Starch Series.
  1. Starches of all kinds prepared from Wheat, Rice, Potatoes, Maize, &c.
  2. Arrowroots of all kinds, Tois les Mois.
  3. Sagos from the Palms, Cassava, Tapioca, &c.
  4. Lichens of all kinds.
  5. Other Starchy Substances, as Portland Sago from *Arum maculatum*, and from various like plants.

G. Sugar Series.
  1. Sugars from the Cane and Beet.
  ,, Maple and Palms.
  ,, Birch, Poplar, Oak, and Ash.
  Grape Sugar.
  2. Liquorice, Sarcocoll, &c.

ANIMAL KINGDOM.

H. Animal Food and Preparations of Food as Industrial Products.
  1. Specimens of preserved Meats.
  2. Portable Soups, and concentrated nutriment, as consolidated Milk, &c.
  3. Caviare, Trepang, &c.
  4. Articles of Eastern commerce, as Shark Fins, Nest of the Java Swallow, &c.
  5. Honey and its preparations.
  6. Blood and its preparations.
  7. Industrial Products, as Glue, Gelatine, Isinglass, Gluten, &c.

IV. *Vegetable and Animal Substances, chiefly used in Manufactures, as Implements, or for Ornaments.*

VEGETABLE.

A. Gum and Resin Series.
  1. Gums of all kinds of natural occurrence—
    Gums made artificially, as British Gum.
    Mucilaginous Seeds, Barks, Pods, and Seaweeds.
  2. Resins—
    Resins and Balsams of all kinds.
    Gum Resins.
    Gum Elastics and Gutta Percha.
    Distilled Resins and Varnishes.

B. Oil Series.
  1. Volatile Oils, including Camphor.
  2. Drying Fat Oils.
  3. Non-drying Fat Oils.
  4. Solid Oils.
  5. Wax.
  6. Distilled Fat Oils.

C. Acids, as Acetic, Citric, Tartaric, Oxalic, &c.

D. Dyes and Colours.
  1. Indigos.
  2. Madders.
  3. Lichens and their preparations.
  4. Dying Barks, as Acacias, Quercitron, Mangrove, &c.
  5. Woods, as Log-wood, Brazil-wood, Peach-wood, Fustics, &c.
  6. Flowers and Berries, as Persian Berries, Safflower, Saffron.
  7. Miscellaneous, as Turmeric, &c.

E. Tanning Substances.
  1. Pods, Berries, Seeds, and Fruits of various kinds, as *Algaroub, Acacia*, Nib-nib and Divi-divi Pods, &c.
  2. Barks of various kinds, as Barks of the Babool, Brazilian Acacias, Murici, Bucida, Gordonia.
  3. Galls, and similar Tanning Materials.
  4. Catechu, Kino, Gambeer, &c.

F. Fibrous Substances, including Materials for Cordage and Clothing.
  1. Cottons of all kinds.
  2. Hemp and Flax; Manilla Hemp and New Zealand Flax.
  3. China Grass, Nettle Fibre, Plantain, and Pine Apple Fibre.
  4. Sunn, Jute, and other tropical substitutes for Hemp, Flax.
  5. Coir, or Cocoa-Nut Fibre, Gomuti, &c.
  6. Rushes and Miscellaneous Substances.

G. Cellular Substances.
  1. Corks of all kinds.
  2. Woods and Roots used for Corks, as the *Ochroma lagopus* and *Anona palustris*.
  3. Rice-paper of China.
  4. Birch Bark, Pottery Bark, Citrus Rind, &c.
  5. Substances used as Amadou.

H. Timber and Fancy Woods used for Construction and Ornament, and prepared by Dyeing.
  1. Suited chiefly for purposes of construction, or for the Navy.
  2. Suited chiefly for Ornamental Work.
  3. Prepared Woods, as by Kyan's, Payne's, Bethell's, and Boucherie's processes.

I. Miscellaneous Substances.
  1. Substances used as Soap, as Quillai Bark, Soap Berries (*Sapindus saponaria*), Soap Roots (*Saponaria officinalis, &c.*).
  2. Perfumes, as Pucha Pat, Vetiver, Spikenard, Tonka beans, &c.
  3. Substances used mechanically, as Teazels, Dutch Rushes, &c.
  4. Seeds and fruits used for Ornamental purposes, as Ganitrus Beads, the Ivory Nut, the Doom Palm, Coquilla Nuts, Bottle Gourds, &c.

ANIMAL.

J. For Textile Fabrics and Clothing.
  1. Wool, Hair, Bristles, Whalebones.
  2. Silk from the Silk-worm *Bombyx mori*, and from other species in India, *e. g. Bombycilla Cynthia* and *Atticus Paphia*.
  3. Feather, Down, Fur, Skins.
  4. Miscellaneous.

K. For Domestic or Ornamental Purposes, or for the Manufacture of Implements.
  1. Bone, Horn, Hoofs, Ivory, Tortoiseshell, Shagreen, Quills.
  2. Pearls, Seed Pearl, Mother-of-Pearl, Coral, and Shells generally.
  3. Oils, Tallows, Spermaceti, Wax, Lard.
  4. Miscellaneous, as Sponge, Goldbeater's-skin, Catgut, Silkworm-gut, Bladders, &c.

L. As Agents in the Manufacture of various Articles.
  1. Glue, Isinglass, Gelatine, Bone-black, Ivory black, Animal Charcoal.

M. For the Production of Chemical Substances.
  Blood, Bones, Horns, &c., for the production of Phosphorus, the Prussiates, the Superphosphates, &c.

N. For Pigments and Dyes.
  1. Cochineal and Carmine.
  2. Dyes from the Galls of the Aphides.
  3. Gall-stone, pigment from Ox-gall.
  4. Indian dyes from the Coccus, the various kinds of Lacs.
  5. Miscellaneous, as Sepia, Enena d'Orient, &c.

MACHINERY.

V. *Machines for direct use, including Carriages and Railway and Naval Mechanism.*

A. Steam Engines and Boilers, Water and Wind Mills, and various other Prime Movers.
  1. Boilers.
  2. Land Engines.
  3. Marine Engines.
  4. Windmills.
  5. Water-wheels and Turbines.
  6. Water-pressure Engine, as Richenback's and Armstrong's.
  7. Vacuum Power Engines.
  8. Electro-Magnetic Engines, &c.
  9. Miscellaneous.

B. Separate parts of Machines, Specimens of Workmanship. (See also Water and Gas Works in VII.)
  1. As heavy Castings or Forgings in the rough; Castings or Forgings, plain, intricate, or beautiful, in the Rough.
  2. Specimens of Turning in Metals.
  3. Specimens in filing and finished Work in Metals, such as Surfaces, Irregular Figures, &c.
  4. Valves, Cocks, Pistons, Governors, &c.

C. Pneumatic Machines.
  1. Air Pumps.
  2. Blowing Fans.
  3. Blast Engines for Furnaces, &c.
  4. Miscellaneous.

D. Hydraulic Machines, Cranes, etc., Pile Drivers, etc. (See also VII.)
  1. Hydraulic Machines—
    Pumps and Fire Engines.
    Water Rams.
    Hydraulic Presses, &c.
    Water-meters, &c.
  2. Cranes—
    Any sort of Crane motion and contrivances, Jacks of all sorts. (For Windlasses, Capstans, and Blocks, see VIII. E.)
  3. Piling Engines.—(See also VII. A.)
    By hand power, or steam.
    Pile Sawing Machines.
    Pile Extractors, &c.

E. Locomotives and Railway Carriages, &c.
  1. Railway Locomotives.
  2. Common Road Locomotives.
  3. Railway Carriages, Trucks, and Waggons.
  4. Railway Velocipedes, &c. &c., of all sorts.
  5. Atmospheric Railway Apparatus.
  6. Carriage Breaks.
  7. Buffers, Couplings, &c.

F. Railway Machinery and Permanent Way.
  1. Permanent Way complete.
  2. Sleepers.
  3. Chairs, &c.
  4. Rails.
  5. Switches.
  6. Turntables.
  7. Station Arrangements.
  8. Signals.
  9. Miscellaneous.

G. Weighing, Measuring, and Registering Machines, for Commercial and not for Philosophical Purposes.
  1. Commercial Weighing Instruments.
  2. Instruments of Measure.
  3. Registering Instruments, Gauges, Indicators, and Telltales.

V.a. *Carriages generally—not including those connected with Rail or Tram Roads.*

A. For Town Use.
Dress Vis-à-Vis.
Dress Coach.
Dress Chariot.
Landau.
Landaulet.
Step-piece.
Barouche.
Sociable.

B. Travelling Carriages.
Coach.
Driving Coach.
Chariot.
Britska Chariot.
Dormeuse Post Chariot.
Post Chariot.
Britska.
Droitska.
Fourgon.
Invalid Carriage.
Sledges, &c.

C. For General Use.
Basterna.
Brougham.
Double Brougham.
Clarence.
Pilentum.
Cariole.
Domestic.
Driving Phaeton.
Mail Phaeton.
Cabriolet Phaeton.
Park Phaeton.
Pony Phaeton.
Curricle.
Cabriolet.
Headed Chase.
Tilbury.
Stanhope.
Dennett.
Gig.
Irish Car.
Dog Car.
Pony Chaise.
Invalid Bath Chair.
Velocipedes.

D. Public Carriages.
Mail Coach.
Stage Coach.
Omnibus.
Hackney Coach.
Hackney Chariot.
Glass Coach.
Hansom's Cab.
Street Cab.
Fly.
Hearse.
Caravan.

E. Carts and Waggons of all Kinds, not being Agricultural.

VI. *Manufacturing Machines and Tools, or systems of Machinery, Tools, and Implements employed for the undermentioned purposes.*

A. Manufactures of all Spun, Woven, Felted, or Laid Fabrics.
  1. Machinery for the complete formation from the Raw Material of all Fabrics of Cotton, Wool, Flax, Hemp, Silk, Caoutchouc, Gutta Percha, Hair.
  2. Paper-making and Staining.
  3. Printing and Bookbinding.

B. Manufactures of Metals.
  1. The manufacture of Metals from the Ore into Bars, Rods, Wire, Sheets, and other general forms; also casting and polishing of Metal, &c.
  2. The cutting and working of Metals by Machine Tools, such as Lathes; Machines for Planing, Drilling, Boring, Slotting, Sawing, Stamping, Shearing, Riveting, Punching.
  3. Machines and Tools used by the Makers of Gold, Silver, and Plated Goods.
  4. Machines and Tools used by the Makers of Cutlery, Nails, Screws, Pins, Needles, Buttons, and metallic Pens, &c.
  5. Machines and Tools used by Locksmiths, Diesinkers, &c.

C. Manufactures of Mineral Substances and Mining Machinery. (See also Section I.)
  1. Machines and Tools for the preparation and working of all kinds of Glass, Stone, Granite, Alabaster, Slate, Clay, &c.
  2. Machines and Tools used in the preparation and working of Gems, &c.

D. Manufactures of Vegetable Substances.
  1. Machines and Tools for the preparation and working of all kinds of Wood.
  2. Mills and other machinery for Grinding, Crushing, or preparing Vegetable Products.

E. Manufacture of Animal Substances.
Machinery and Tools for working in Horn, Bone, Ivory, Leather, &c.

F. Machinery and Apparatus for Brewing, Distilling, and Manufacturing Chemistry.

VII. *Civil Engineering, Architectural and Building Contrivances.*

A. Foundations and Building Contrivances connected with Hydraulic Works.
  1. Application of the Screw Pile for the Foundations of Piers, Jetties, &c., Beacons, and Ships' Moorings.
  2. Pneumatic Piling, Machinery illustrative of the mode of sinking and guiding the Cylinders, also Contrivances for overcoming difficulties where obstructions are offered to their sinking.
  3. Coffer-dams on soft and rocky bottoms, and Apparatus connected with them.
  4. Foundations of Lighthouses exposed to the violent action of the sea.
  5. Diving-bells, Helmets, and Apparatus connected with them.
  6. Boring Tools, and Contrivances for ascertaining the stratification on Sites of intended Structures.

B. Scaffolding and Centerings.
  1. Scaffolding for the erection of Brick Chimney Shafts, Columns of Masonry, Towers, and Spires.
  2. Portable Scaffoldings, Ladders, and Fire Escapes.
  3. Scaffolding for the erection of Monolithic Blocks, as Obelisks, &c., and for the hoisting of great Weights.

4. Fixed and Turning Scaffolding for the repairs, &c., of Domes, &c., internally and externally.
5. Scaffolding and Contrivances for the erection of large Girder Bridges (as Britannia Bridge).
6. Centerings for Arched Bridges, Domes, and Vaults.
7. Centerings for Tunnels, Shields, and Contrivances for facilitating their excavation.

C. Bridges, Tunnels, and Engineering Contrivances for crossing Rivers, Ravines, &c.

1. Timber Bridges.
2. Cast-iron Bridges.
3. Wrought-iron Bridges (Girder or Lattice).
4. Turning or Swing Bridges.
5. Lifting or Bascule Bridges.
6. Draw and Rolling Bridges.
7. Suspension Bridges.
8. Temporary Bridges. (See also VIII. M.)
9. Floating Bridges, as across the Hamoaze, and to receive Railway Trains, as across the Humber.
10. Examples of Brick and Stone Bridges.

D. Dock, Harbour, River, and Canal Works.

1. Docks and Slips for the building and repairing of Ships.
2. Mercantile Docks, and Arrangements connected therewith, for the loading and unloading of Ships.
3. Sea and Canal Locks, Gates and Entrances, Stop-gates, Sluices, &c.
4. Marine Railway Slips and Hydraulic Docks.
5. Harbours of Refuge.
6. Breakwaters, Piers, Jetties, Wharfs, and Landing-piers.
7. Groynes, Sea-defences, &c.
8. Perpendicular Lifts for Canals, and other Engineering Contrivances instead of Locks.
9. Dredging-machines, Hedgehogs, and other Machines employed in Harbour Works, for removing Shoals, &c.

E. Lighthouses and Beacons.

F. Roofs, Buildings, and Contrivances for covering large Areas.

1. Examples of Timber and Iron Trusses.
2. Roofs for Markets, Railway Stations, &c.
3. Roofs for Theatres.
4. Fire-proof Buildings, arranged so as to be applicable to the economical methods of construction.
5. Coverings for Roofs.

G. Water-Works, and the Engineering Contrivances connected with the Obtaining, Storing, and Distribution of Water in Towns.

1. Well-sinking and Boring, and the Apparatus connected therewith.
2. Storing, Filtering, and Distributing Reservoirs, and the Contrivances connected with them.
3. Contrivances for maintaining and producing efficient Heads, and the Apparatus connected with Street Mains.
4. Services, and Apparatus connected with Domestic Water Supply (See also V., B.)

H. Gas-Works, and Contrivances connected with the economical Production of Artificial Light.

1. Retorts and Distillatory Apparatus.
2. Condensing, Separating, and Purifying Apparatus.
3. Governors and Station Meters.
4. Gauges, Valves, and contrivances connected with the Mains for the Distribution of Gas. (See also XXII.)

I. Sewerage, Cleansing, Paving, and the Contrivances connected with the Sanitary Condition of Towns.

1. Forms of Sewers, their Entrances and Junctions.
2. Contrivances for Cleansing, Flushing, and Ventilating Sewers.
3. Contrivances for removing and distributing Sewage.
4. Traps, and other Means of preventing emanations. (See also XXII.)
5. House Drains, and the Internal Sanitary arrangements of Houses. (See also XXII.)
6. Pavements.

J. Warming and Ventilating Domestic Residences and the Contrivances connected therewith.

1. Arrangements for Warming, as with Hot Air, Water, Steam, &c.
2. Contrivances for preventing Smoke, and Chimney-sweeping Machines.
3. Contrivances for Ventilation on a large Scale.

K. Miscellaneous.

VIII. *Naval Architecture, Military Engineering; Ordnance, Armour, and Accoutrements.*

A. Illustrations by Models of Shipbuilding for Purposes of Commerce.

1. Ships.
2. Barks.
3. Brigs and Brigantines.
4. Snows and Ketches.
5. Schooners.
6. Sloops and Cutters.
7. Luggers, Barges, &c.

B. Illustrations by Models of Shipbuilding for Purposes of War.

1. Ships of the Line.
2. Frigates.
3. Sloops, Corvettes, and Brigs.
4. Cutters, Brigantines, Ketches, Schooners, Barges, &c.
5. Bomb or Mortar Vessels, Fire-ships, Gun-boats, &c.

C. Illustrations by Models of Shipbuilding for the application of Steam or other Powers.

1. Great War Steamers.
2. Steam-vessels of large burden for long Passages.
3. Steam-vessels for Inland, River, or Lake Navigation.
4. Sailing-vessels fitted for the temporary appliance of Steam or Human Power.
5. Miscellaneous.

D. Vessels used for Amusement, and Small Vessels generally.

1. Seagoing Yachts of all Kinds.
2. River Yachts, and Pleasure Boats of a smaller class.
3. Rowing Boats of all kinds.
4. Fishing Boats and Vessels.
5. Life Boats and Paddle-box Boats.

E. Rigging, Anchors, Windlasses, Capstans, Sheathing, and Articles connected with practical Seamanship and the Saving of Life from Shipwreck.

F. Infantry Army-Clothing and Accoutrements.

G. Cavalry Army-Clothing and Accoutrements.

H. Camp Equipage, such as Marquees, Tents, &c.

I. Naval Gunnery, and Weapons of Attack and Defence more especially adapted to Naval Purposes.

J. Artillery Equipments, both in Garrison and the Field, Machines for Mounting and Dismounting Ordnance.

1. Garrison Equipments.
2. Field Equipments.
3. Machinery for Mounting, Dismounting, and Transporting Ordnance, Carriages, &c.

K. Ordnance and Projectiles.

1. Guns.
2. Howitzers.
3. Mortars.
4. Shot, Shells, and other Projectiles.

I. Small Arms.

1. Rifles.
2. Muskets.
3. Carbines.
4. Pistols.
5. Lances.
6 Swords
7. Bayonets.
8. Cartridges.

M. Military Engineering, Field Equipments, Methods of Passing Rivers and other Obstacles, the Attack and Defence of Fortresses, and Field Fortification.

1. Field Engineer Equipments.
2. Military Bridges, Pontoons, Rafts, Boats, &c.
3. Field Fortification and Materials used in the Attack and defence of Fortresses.
4. Permanent Fortification.

IX. *Agricultural and Horticultural Implements.*

A. Implements for Tillage.

1. Ploughs, including Subsoil Ploughs and Pulverisers.
2. Harrows.
3. Scarifiers, Cultivators, and Grubbers.
4. Clod Crushers and Norwegian Harrows.
5. Rollers.
6. Digging and Trenching Machines.

B. Drilling, Sowing, Manuring, and Hoeing Machines.

1. Pressers.
2. Drills.
3. Dibblers.
4. Horse Hoes.
5. Broadcast Sowing Machines.
6. Contrivances connected with the Distribution of Manure.

C. Harvesting Machines.

1. Machines for Cutting Corn or Grass.
2. Tedding Machines for Hay.
3. Rakes for Hay, Corn, Stubble, &c.

D. Barn Machinery.

1. Steam Engines and Water-power Machines.
2. Horse Works.
3. Threshing Machines.
4. Straw Shakers.
5. Winnowing, Corn Cleaning, and Barley Hummelling.
6. Crushing and Splitting Mills.
7. Flour and Meal Mills.
8. Chaff Cutters.
9. Corn Weighing Machines and Meters.
10. Gorse Bruisers and Cutters.
11. Chicory Cutters.
12. Cider Presses.

E. Field, Fold, and Yard Machinery.

1. Turnip-cutters.
2. Root Grating and Squeezing Machines.
3. Potato-washers.
4. Steaming Apparatus.
5. Feeding Apparatus.
6. Weighing Machines for Cattle, &c. (See G.V.)
7. Watering Engines, for Fire or Garden Purposes. (See D.V.)
8. Contrivances connected with the Stack-yard and Storing.
9. Contrivances for Fencing, Folding, &c.
10. Fittings for Stables, Cow-houses, &c.

F. Agricultural Carriages, Harness, and Gear.

1. Waggons, Carts, &c.
2. Brakes.
3. Separate parts, as Wheels, Axles, &c.
4. Harness and Gear.

G. Drainage Implements.

1. Machines for making Pipes, Tiles, and Bricks.
2. Implements for Draining, and Tools.
3. Tiles, Pipes, and other Materials used in draining.
4. Scoop Wheels and other Machines used in Draining or Lifting Water.
5. Machines and Contrivances for Irrigating Lands.
6. Sluices, Draw Gates, &c.

H. Dairy Implements.

1. Churns.
2. Cheese-presses.
3. Miscellaneous contrivances used in the Dairy.

I. Miscellaneous Implements used in Agriculture.

1. Rick Ventilator.
2. Ladders.
3. Pitch and Tar Melters.
4. Sheep-dipping Apparatus.
5. Farm Railway.
6. Models of Farm Buildings.
7. Alarm Guns for protecting Crops.
8. Beehives.
9. Instruments for Cattle, Probangs, &c.
10. Tree Remover.
11. Various Miscellaneous Articles.

J. Garden Engines and Tools.

X. *Philosophical Instruments and Processes depending upon their use: Musical, Horological, and Surgical Instruments.*

A. Instruments for the Measurement of Space.

1. In fixed observatories, as Transits, Transit Circles, great Quadrants, Mural Circles, Zenith Sectors, Altarimeters, Equatorials, Collimators, &c.
2. For Nautical Astronomy and Observations, as Sextants, Reflecting and Repeating Circles, Dip Sectors, &c.
3. Astronomical and Topographical Illustrations, as Globes, Orreries, Planetariums, Maps, Charts, &c.
4. Optical Instruments, as great Refracting and Reflecting Telescopes, with their appurtenances, equatorial motions, &c.
5. Apparatus subordinate to Graduated Instruments, as divided Object Glasses and Heliometers, Eyepieces, Micrometers, Micrometer Microscopes, &c.
6. Survey Instruments.
   - *a.* Topographical, as Base apparatus, Theodolites, Repeating Circles, Geodetic Signals, Levelling Apparatus, Miners' and Prismatic Compasses, Pocket Sextants, Perambulators, Pedometers.
   - *b.* Hydrographical, as Sounding Machines, Patent Logs, Current Meters, Silometers.

B. Instruments to Measure the Effects of Mechanical and Physical Forces.

1. Mechanical, as Dynamometers, Tachymeters.
2. Mass (Weighing Instruments), as Weighing Machines, Scales, Chemical and Assay Balances.
3. Density, as Areometers and other Instruments to determine Specific Gravity, Invariable Pendulums, Atwood's Machine.
4. To measure other Physical Effects, including Meteorological Instruments, as Barometers, Hydrometers, Eudiometers, Thermometers, Pyrometers, Electrometers, Rheometers, Magnetometers, &c.

C. Instruments to illustrate the Laws of Mechanical and Physical Science.

1. "Kinematics,"—Instruments to exhibit and describe Motions and their Combinations, as Compasses, Pentagraphs, Instruments for describing Elliptical and other Figures, &c.
2. Mechanics, or Instruments to illustrate the Laws of Static and Dynamic Forces.
   - *a.* Stereo Mechanics, as for illustrating Mechanical Powers, accelerated and retarded Motion, Equilibrium and Parallelogram of Forces, Levers, Cathetometers, Centripetal and Centrifugal Forces, Elasticity, &c.
   - *b.* Hydro-Mechanics, as Instruments to illustrate the motion and Impinging Force of Waves, &c.
   - *c.* Pneumo-Mechanics, as Apparatus connected with the Air-Pump, &c.
3. Instruments to illustrate the Laws of Corpuscular Forces, as Whitworth's Planes, Endosmometers, &c.
4. Instruments to illustrate the Laws of Sound.
5. ,, ,, ,, Light.
6. ,, ,, ,, Heat.
7. ,, ,, ,, Electricity, including Voltaic and Thermo-Electricity, Magnetism, Electro-Magnetism, Magnetic Electricity, Dia-Magnetism, &c.

D. Application of Mechanical and Physical Science to Useful Purposes, not included in any of the preceding or subsequent Sections.

1. Mechanics.
   - *a.* Stereo-Mechanics } when not included in Sections describing their more extended uses.
   - *b.* Hydro-Mechanics }
   - *c.* Pneumo-Mechanics, as Air Pumps, Rarefying and Condensing, Diving Bells, Air Balloons, &c.

2. Sound (not including Musical Instruments).
   - a. Instruments to assist Hearing.
   - b. Alarums, Bells.
   - c. Models of Acoustical Buildings, &c.
3. Light—Instruments to assist Vision, as smaller Telescopes, Opera Glasses, Spectacles, Microscopes, Lenses, Mirrors, Signals, Visual Telegraphs, Lighthouses, Optical Illusions, Gas and Solar Microscopes, Cameras, Photography, Polarization of Light, &c.
4. Heat—Apparatus for producing Heat, for Freezing, Thermostats, Burning Lenses, and Mirrors, &c.
5. Magnetism and Electricity—Mariners' Compasses, Electric and Electro-Magnetic Telegraphs, Electric Light, applications of Electro-Magnetism as a Motive Power, Therapeutic Applications of Electricity, Electrotype Apparatus, and Specimens, &c.

E. CHEMICAL AND PHARMACEUTICAL APPARATUS.

F. MISCELLANEOUS.

X.A. *Musical Instruments, &c.*

A. WIND INSTRUMENTS.

1. Wood—
   - Flutes (also in Metal, &c.)
   - Flageolets.
   - Oboes.
   - Clarinets.
   - Bassoons.
   - Serpents.
2. Metals—
   - French Horns.
   - Trumpets.
   - Bugle Horns.
   - Cornets à Pistons.
   - Cornopeans.
   - Trombones.
   - Ophicleides.

B. STRINGED INSTRUMENTS.

- Harps.
- Guitars.
- Violins.
- Violas.
- Violoncellos.
- Double Basses.

C. KEYED INSTRUMENTS WITH FIXED TONES.

- Organs.
- Pianofortes.
- Seraphines.
- Harmoniums.
- Concertinas.
- Accordions.

D. INSTRUMENTS OF PERCUSSION.

1. Drums
   - Bass Drums.
   - Kettle Drums.
   - Side Drums.
   - Tambourines.
2. Cymbals.
   - Triangles.

E. AUTOMATIC INSTRUMENTS.

- Mechanical Organs.
- Musical Boxes, &c.

F. MISCELLANEOUS ARTICLES IN CONNEXION WITH MUSICAL INSTRUMENTS.

- Tuning Forks, Tuning Hammers, Pitch Pipes, &c.
- Wire Strings, Catgut Strings, &c.

G. MUSICAL DIAGRAMS.

X.B. *Horology.*

A. GREAT CLOCKS FOR CHURCHES, CASTLES, STABLES, AND PUBLIC BUILDINGS IN GENERAL.

1. With three and four wheel Trains.
2. With Remontoires and with various Escapements.
3. To strike the Hours, and the Hours and Quarters.
4. The various Compensation Pendulums in use.
5. The various modes of making the work to carry the Hands, and communicating the motion from the Clock to the Hands.
6. Electric or Magneto-Electric Clocks.

B. ASTRONOMICAL CLOCKS.

1. The various Escapements employed.
2. The various Compensation Pendulums used.
3. Equation Clocks.
4. Clocks, commonly called Journeymen Clocks, for Observatories.

C. CLOCKS APPLIED IN REGISTRATION.

1. To register the Barometer daily for twelve months, or other periods.
2. To register Tides and Winds.
3. To register the punctual attendance of Watchmen and others.

D. CLOCKS SHOWING DIFFERENT PHENOMENA.

1. Cycle of the Sun and Moon, Eclipses, Moon's Age, Equation of Time, the Golden Number, Tides, &c.

E. CLOCKS FOR THE COMMON PURPOSES OF LIFE.

1. Weight Clocks.
2. Spring Clocks with Pendulums.
3. Balance Clocks of various descriptions.

F. CLOCKS AND TIME-PIECES IN DECORATED CASES, COMMONLY CALLED ORNAMENTAL CLOCKS, FOR DRAWING-ROOMS, LIBRARIES, &c.

1. In Metal Cases, Gilt and Lacquered.
2. In Buhl Cases.
3. In Wood Cases.
4. In China Cases.

G. SUNDRIES APPLICABLE TO CLOCKS.

1. The various modes by which Clocks are kept going while being wound.
2. The various escapements employed in Clocks of different descriptions.
3. Various portions of Mechanism forming parts of, or applicable to, Clocks.

H. MARINE CHRONOMETERS.

1. Eight-day.
2. Two-day.
3. Thirty-hour.
4. The various descriptions of Compensation Balances applied to Chronometers.
5. The various descriptions of Pendulum Springs applied to Chronometers.
6. Pocket Chronometers.

I. POCKET WATCHES OF VARIOUS DESCRIPTIONS.

1. For measuring Minute Portions of Time and registering Observations.
2. With Compensation Balances.
3. ,, Duplex Escapement.
4. With Horizontal Escapement.
5. ,, Lever Escapement upon different constructions.
6. ,, the old original Vertical Escapement.
7. Repeaters upon different constructions to strike the Hours and Quarters.
8. The same to strike the Hours, Quarters, and Half-Quarters.
9. The same to strike the Hours, Quarters, and Minutes.
10. Clock-watches to strike the Hours and Quarters in a similar manner to Clocks.
11. Clock-watches, and, in addition, Repeaters.
12. Watches with Alarums.
13. Watches known by the denomination of Ladies' Watches, with the cases decorated in various ways.
14. Various portions of Mechanism forming parts of Watches.

J. WATCHES FOR DIFFERENT MARKETS—

1. As for Turkey, with three Cases and Turkish Dials.
2. For China, with peculiar Cases and Dials.
3. For India and South America.
4. For Home Country Districts.

K. MISCELLANEOUS.

X.C. *Surgical Instruments.*

A. FOR OPERATIONS ON THE EYE.

Special Instruments for—

1. Operation on the Eyelids.
2. Fistula Lachrymalis.
3. Strabismus.
4. Artificial Pupil.
5. Cataract.
   - By Depression.
   - By Extraction.
   - a. Including Elevators in Silver and Ivory, Fine Bistouries, Trocars, Canulas, Styles, Sounds, various Needles, &c.
   - b. Cataract Knives, Hooks, Capsular Forceps, &c.

B. OPERATION ON THE EAR.

Special Instruments for—

1. Exploration of the Aural and Eustachian Passages.
   - a. Sounds, Catheters, Speculums, &c.
2. The Conveyance of Air or Liquid into the Tympanic Cavity.
   - b. Pneumatic and other Syringes in Metal, Glass, and Caoutchouc, &c.
3. The Removal of Foreign Bodies from the Meatus.
   - a. Levers, Branch Forceps &c.

4. Perforation of, and other Operations on, the Membrana Tampani.
5. The Conduction of Sound.
    - *a.* Including all kinds of Acoustic Instruments and Contrivances, Ear Cornets, Speaking Trumpets, &c.

C. Operations on the Nose—Nasal Fossæ and Antrum.

Special Instruments for—

1. The Removal of Polypi.
    - *a.* Various Forceps, Porte-ligatures, Serre-nœuds, &c.
2. The Removal of Extraneous Substances.
3. The Arrest of Hæmorrhage from the Posterior Nares.
    - *a.* Including all Contrivances for "Tamponnement."
4. Exploration and Injection of the Maxillary Sinus.
    - *a.* Including Jourdain's Sounds, Catheters, &c.
5. Perforation and Injection of the Antrum.
    - *b.* Including Liston's Drills, Antrum Syringes, Plugs, &c.

D. Operations on the Mouth and Pharynx.

Special Instruments for—

1. Hare Lip.
2. Operations on the Teeth (Dental Instruments).
3. Myotomy and Ligature of the Tongue.
4. Cleft Palate and other Operations on the Roof of the Mouth (Staphyloraphic Instruments).
    - *a.* Including Obturators, Cleft and Notched Needles, Palate Holders, Porte-Sutures, &c.
5. Excision of the Uvula and Tonsils.
6. Cauterization and other Operations on the Pharynx.
    - *a.* Tonsillar Guillotines, Pharyngotomes, &c.
7. Salivary Fistula.
    - *b.* Parotidean Canulas, Leaden Threads, &c.

E. Operations on the Thorax and Respiratory Organs.

Instruments for—

1. Tracheotomy and Laryngotomy.
    - *a.* Including Marshall Hall's Tracheotome, Sampson's Springs and Tubes, &c.
2. The Removal of Foreign Bodies from the Larynx, Trachea, and Bronchi.
3. Paracentesis Thoracis (Empyema).
4. Various Purposes.
    - *a.* Including Inhalers for the administration of Chloroform, Æther, and other Medicinal vapours. *b.* Instruments used to restore Suspended Animation. *c.* Respirators in all Materials.
5. Physical Examination of the Chest.
    - *a.* Instruments for Auscultation, Percussion, and Admeasurement of the Chest; Stethoscopes and Pleximeters in all materials; Spirometers and Stethometers, as suggested by Quain and Sibson, &c.

F. Operations on the Abdominal Walls and Alimentary Canal.

Special Instruments for—

1. Stricture and other morbid states of the Œsophagus, the removal of Foreign Bodies, &c.
    - *a.* Including Œsophagus Bougies and Probangs in elastic gum and other materials, Œsophagotomes, Gullet-forceps, &c.
2. The introduction and withdrawal of Fluids from Stomach; the removal of Poison, &c.
    - *a.* The Stomach Pump and its appendages, Enema Syringes, &c.
3. The formation and maintenance of artificial Anus.
    - *a.* Enterotomes, Porte-Sutures, &c., by Dupuytren, Blandin, and others.
4. Prolapsus Ani.
    - *a.* All kinds of Rectum-Plugs, in metal, elastic gum, &c.
5. Fistula, Fissures, and Vegetations in Ano.
    - *a.* Fistula Knives, Directors, &c.
    - *b.* Porte-ligatures (on Luke's and Sampson's plan).
6. Hernia.
    - *a.* Cutting Instruments for its radical cure.
    - *b.* Trusses and all artificial means of support.
7. Paracentesis Abdominis.
8. Physical examination of the rectum.
    - *a.* Various Speculums (by Hilton and others).

G. Operations on the Genito-Urinary System in the Male.

Instruments for—

1. Lithotomy.
    - *a.* Including Lithotomes, Gorgets, Staffs, Forceps, Scoops, &c.
2. Lithotrity.
    - *a.* Lithotrites, which disintegrate the Stone by Perforation.
      Ditto ditto by Concentric Pressure.
      Ditto ditto by Percussion.
    - *b.* Syringes and other Instruments to inject and explore the Bladder.
    - *c.* Dilators, Sliding-scoops, and Apparatus to remove Calculi impacted in the Urethra; Instruments for Lithectasy, &c.
3. Urinary Fistula.
    - *a.* Including all Urethroplastic Instruments, Urethrotomes, &c., for Recto-Urethral, Perineal, and Recto-Vesical Fistulæ.
4. Stricture, Postatic and Vesical Disease, and retention of Urine.
    - *a.* Every variety of Catheter, Bougie, Sound, Porte-Caustique, and Urinal; Curved Trocars for Puncture of the Bladder above the Pubes, through the Rectum, &c.
5. Phymosis.
    - *a.* Apparatus employed by Jews. *b.* By the Profession.
8. Hydrocele.
7. Variocele.
    - *a.* Including Instruments for obliteration of the Spermatic Veins (Ricord's), as well as those for simple support; Suspensory and other Bandages; Scrotal Rings, &c.

H. Operations on the Genito-Urinary System in the Female.

Instruments for—

1. Exploration.
    - *a.* Including Speculums in all Materials, Sounds, Dilators, &c.
2. Operations on the Uterus, Vagina, and Cervex Uteri.
    - *a.* Hysteronomes and Instruments for Paracentecis Uteri (Lisfranc's and Simpson's), Uterine Scissors and dressing Forceps (curved and straight), Porte-Caustiques, &c.
3. Polypus Uteri.
    - *a.* Vulcella and other Forceps, Porte-ligatures, Serre-nœuds, &c.
4. Prolapsus and Procidentia Uteri.
    - *a.* Including Pessaries, Bandages, and artificial support of all kinds.
5. Vesico-Vaginal Fistula and Recto-Vaginal Fistula.
    - *a.* Hancock's new Instruments, Urinary Receptacles, &c.
6. Obstetrical Purposes.
    - *a.* Including all Midwifery Instruments, and Contrivances to remedy Lacerated Perineum.

I. Operations on the Extremities.

Special Instruments for—

1. Amputations.
    - *a.* Army (portable) and Hospital Cases, &c.
2. The Adjustment of Fractures.
    - *a.* Including Splints, Inclined Planes, Pads, Slings, and Bandages, in all Materials.
3. The Reduction of Dislocations.
    - *a.* Pulleys, Rings, Staples, &c.

K. Operations on the Osseous System.

Special Instruments for—

1. Trepanning.
2. Resection and Exarticulation.
3. The Extraction of Sequestra, &c.

L. Operations on the Vascular System.

1. Venæsection.
    - *a.* Cupping Instruments, Lancets, Leech-tubes, &c.
2. The Control of Hæmorrhage.
    - *a.* Tourniquets, Compressors, Torsion Forceps, &c.
3. Transfusion.

- 4. Aneurism.
    - By Ligature:—*a*. Aneurism Needles, Porte-ligatures, Sampson's Speculum, &c.
    - By Compression:—*b*. New Instruments, by Wyld, Bellingham, and others.
- 5. Nævus.
    - *a*. Needles, Porte-aiguilles, &c. (Liston's and Brodie's).
- 6. Varices.
    - *a*. Including Elastic Bandages, Stockings, Anklets, &c.

M. Autoplastic and Orthopædic Operations.

Special Instruments for—

- 1. The various Taliacotian Processes.
    - *a*. Rhinoplasty.
    - *b*. Chiloplasty, &c.
- 2. Tenotomy and Myotomy.
    - *a*. Including long-bladed Knives for the subcutaneous division of Muscles and Tendons, &c.
- 3. Mechanical Compensation of Lost Parts.
    - *a*. Artificial Eyes, Noses, Ears, Chins, Palates, Teeth, Hands, Arms, Legs, &c.
- 4. Orthopædic Processes.
    - *a*. Including all Orthopædic Apparatus, Back and Leg Boards and Irons, Stays, Belts, Supports, Suspenders, Boots, Shoes for the cure of Bunions (Lanagan's).

N. Dressing Instruments.

- *a*. Surgeons' Pocket Cases and their usual contents; Spring Bistouries, Tenaculums, Scalpels, Scissors, Forceps, Spatulæ, Probes and Directors, Needles, Ligature-Silks, &c.

O. Miscellaneous Philosophical Apparatus applied to the Investigation and Treatment of Disease.

- *a*. Microscopes, Engiscopes, and Lenses; Urinometers and Thermometers; Volta-electric Apparatus; various illuminating Speculums; Instruments in India-rubber for the application of Intense Cold; Hooper's Water Cushions for the reception of fluids of any temperature; Spongio-piline, Patent Lint, Plaisters, Collodion, Nipple Shields, Breast-pumps, &c.

P. Surgical Tables, Beds, Mattresses, Chairs, Cradles, Rests, &c.

Q. Post-mortem and Dissecting Instruments, and Instruments for Embalmment.

R. Instruments applied to Veterinary Purposes.

MANUFACTURES.

XI. *Cotton*.

A. Cotton Yarn and Thread.

- 1. Grey Twist in Hanks and Bobbins, from No. 20 to 600.
    - White and Bleached Yarn.
    - Dyed Yarn, assorted Colours.
    - „ Turkey-red and Pink.
- 2. Cotton Thread—
    - Two-fold Lace; 2, 3, 4 6, and 9-cord sewings.
    - Two-fold Lisle; knittings.
    - Crochet Cottons.
    - Wire Thread.
- 3. Crape Yarn—
    - Bleached.
    - Coloured.

B. Calicoes.

- Sheetings (Grey and Bleached)—
    - 7/4 and 9/4 Super.
- Shirtings (Grey and Bleached).
- Domestics.
- Madapollams—
    - 7/8 and 9/8, and 40-inch Printers'.
- Long-cloths (Plain and Twilled)—
    - Imitation Irish.

C. Cords and Beaverteens.

- 1. 3/4 ell and 4/4 Cords.
    - Genoa.
    - Beaverteens.
- 2. Drabbetts.
    - Twilletts.
    - Fancy Drills.
    - Grey Twills.
    - Swansdowns.
    - Jeans.
    - Ticks.
- 3. Velvets and Velveteens.

D. Muslins, &c.

- 1. Cambric and Jaconnet—
    - Mulls and Books.
    - Bishop and Victoria Lawns, &c.
    - Jaconnet, Organdies, Lenos, and Fancy Checks for Printing (Grey and Bleached).
- 2. Figured Muslins—
    - Lappets, Lenos, and Nets, White and Dyed.
    - Jacquard-made Goods.
    - Lappets, Japan Spots and Honeycombs.
    - „ Striped and Corded.
    - „ Allover and Diagonal Spider.
    - „ Bengal Scarf Spot, assorted.
    - Harness, assorted.
    - „ Garments.
    - Window Curtains.
    - „ Spot.
    - Book Jaconnet and Dacca Lappets.
    - Lenos, Plain.
    - „ Figured.
    - Small Stripe and Check Doriahs.
    - Mexican Lappets, Coloured and White.
    - Turkey Gauze, White and Dyed.
- 3. Shawls, Handkerchiefs, and Dresses—
    - Imitation Cambric Handkerchiefs, Plain and Embroidered.
    - Lappet Shawls.
    - Book Muslin Dresses, Checks.
    - Tapes and Cords.
    - Book Handkerchiefs.
    - Specimens of Madapollams.
    - Bleached Goods of various Finishes.
    - „ Cambric Finish.
    - „ Jaconnet Finish.
    - „ Book Muslins, Hard, Elastic, and London Finish.
    - „ richly Ornamented.

E. Dimities, &c.

- 1. Furniture Dimities, Plain and Figured—
    - Hair, Cord, and India, Plain and Figured.
    - Quilting.
    - Satteen and Twilled Jean.
- 2. Marseilles and Summer Quilts—
    - Counterpanes (White and Coloured).
    - Toilet Covers (Plain and Coloured).
    - Anti-Macassars.
    - Grey Sheets.
    - Window Hollands.
    - Cotton Diapers and Damasks.

F. Coloured Woven Cotton.

- 1. Handkerchiefs for the Pocket, Head, Neck, and Shoulders—
    - Imitation Madras and Pulicat.
    - „ Java and Manilla.
    - Fancy White Grounds, Checks
    - Imitation Manilla Pine-Apple Cloth.
    - „ White Cambric.
    - „ „ Figured Borders.
    - Cravats, assorted colours.
- 2. Ginghams.
    - Common Light Grounds, assorted, Plain.
    - „ Dark Grounds, assorted, Plain.
    - Earlston Gingham.
    - Power-loom Seersuckers and Checks.
    - Turkey-red Grounds.
    - Blue and Black heavy Checks.
    - Muslin Ground Stripes and Checks.
    - Coloured Diapers.
    - Crossover Stripes.
    - Jean Stripes.
    - Derries.
    - Hungarians.
    - Umbrella Ginghams.
- 3. Dresses, Scarfs, &c.
    - Java Bugis, and Manilla Sarongs.
    - „ Chinlies and Scarfs.
- 4. Zebras—
    - Blue and White Striped Dresses.
    - Orange-pine „
    - Blue pine „
    - Robe de Chambre.

G. Oiled Calicoes or Cambrics for Packing.

XII. *Woollen and Worsted.*

A. BROAD CLOTHS.

1. Single Milled, 52 to 63 inches wide.
    - Wool-dyed Woaded Colours—
        - Blue.
        - Black.
        - Medleys.
        - Oxford and other Mixtures.
            - N.B. The term "Medleys" includes all Wool-dyed Colours, excepting Blue and Black.
    - Wool-dyed, common colour, unwoaded.
        - Black.
        - Medleys.
        - Oxford and other Mixtures.
        - Drab.
    - Piece-dyed, Woaded Colours—
        - Black.
        - Blue.
        - Fancy Colours.
    - Piece-dyed, unwoaded.
        - Black.
        - Scarlet.
        - Gentian.
        - Other Fancy Colours.
2. Double Milled, 52 to 57 inches wide.
    - Subdivided same as No. 1.
3. Medium Cloths, 54 to 63 inches wide.
    - Subdivided same as No. 1.
4. Ladies' Cloths, 54 to 63 inches wide.
    - Subdivided same as No. 1.
5. Venetians, 54 to 58 inches wide.
    - Subdivided same as No. 1.
6. Army Cloth, 52 to 54 inches wide.
    - Subdivided same as No. 1.
7. Beavers.
    - Subdivided same as No 1.
8. Pilots.
    - Subdivided same as No. 1.
9. Mohair, 54 to 58 inches wide.
    - Subdivided same as No. 1.
10. Cloakings, 54 to 58 inches wide.
    - Subdivided same as No. 1.
11. Tweeds—
    - Single Milled.
    - Double Milled.
    - Treble Milled.
12. China Stripe Cloths, list, piece-dyed, and other Cloths, 60 inches wide.
13. India Cloths, piece-dyed, 60 inches wide.
14. Billiard Cloths, piece-dyed, 72 to 81 inches wide.
15. Elastic Glove Cloth, 54 to 70 inches wide.
    - Subdivided same as No. 1.
16. Union Cloths, Cotton Warps, piece dyed, 52 to 54 inches wide.
17. Double Colours, piece dyed, 54 to 63 inches wide.

B. NARROW CLOTHS.

1. Cassimere double milled, 27 to 29 inches wide.
    - Subdivided same as Broad Cloths, No. 1.
2. Cassimere, single milled, 27 to 29 inches wide.
    - Subdivided same as No. 1.
3. Doe-Skins, treble milled, 27 to 29 inches wide.
    - Subdivided same as No. 1.
4. Doe-Skins, double milled, 27 to 29 inches wide.
    - Subdivided same as No. 1.
5. Doe-Skins, single milled, 27 to 29 inches wide.
    - Subdivided same as No. 1.
6. Cashmerettes, 27 to 29 inches wide.
    - All Colours.
7. Tweeds, Wool-dyed, 27 to 29 inches wide.
    - Double milled.
    - Single milled.
8. Fancy Trouserings.

C. FLANNEL.

1. Saxony Flannel.
    - White.
    - Coloured.
2. Various Flannels.
    - Lancashire.
    - Real Welsh.
    - Imitation Welsh.
    - Bath Coating.

D. BLANKETS.

1. Cloth Blankets.
2. Superfine Blankets
3. Medium Blankets.
4. Ordinary Blankets.

E. WOOLLEN CLOAKING.

1. Plain.
2. Mixtures.
3. Fancy.

F. SERGES.

Long Ells, White and Coloured.

G. TARTANS.

1. Plain.
2. Fancy.

H. WORSTED STUFF GOODS.

1. Fabrics composed entirely of Wool.
    - Merinos.
    - Shalloons, Says, Serges, and Plainbacks.
    - Calimancos, Plain and Figured.
    - Lastings, Princettas, Serges de Berry.
    - Coatings.
    - De Laines.
    - Alepinas.
    - Durants and Buntings.
    - Moreens.
    - Damasks.
    - Damask Aprons, Damask Table Covers, &c.
    - Russels.
    - Camlets.
2. Fabrics composed of Wool and Cotton.
    - Coburg and Paramatta Cloths.
    - Union Double Twills.
    - Plain Orleans Cloths, Single and Double Warps.
    - Plain Muslin de Laines, Barèges, &c.
    - Shawl Cloths.
    - Union Coatings.
    - ,, Lastings, Princettas, and Serges de Berry.
    - Stockinetts.
    - Fancy Lastings.
    - ,, Worsted and Cotton Goods.
    - Figured Coburgs, Orleans, &c.
    - Aprons, plain and figured.
    - Linings, plain and figured.
    - Union Damasks.
    - ,, Damask Table Covers, &c.
3. Fabrics composed of Wool and Silk.
    - Silk-warp Coburgs and Orleans.
    - ,, Double Twills.
    - ,, Coatings.
    - ,, Russels.
    - Silk-weft Lastings.
    - Silk-warp Damasks.
4. Fancy Goods composed of Wool, Silk, and Cotton.
4. Fabrics composed of Alpaca and Mohair mixed with Cotton or Silk.
    - Plain Alpaca Lustres.
    - ,, Mixtures.
    - Twilled Alpaca Mixtures.
    - Plain Mohair Lustres.
    - Silk-warp Alpaca Lustres.
    - Alpaca and Mohair Linings.
    - ,, Mohair, and Silk Fancy Goods.
    - ,, Umbrella and Parasol Cloth.

I. WOOLLEN, WORSTED, ALPACA, AND MOHAIR YARNS.

XIII. *Silk and Velvet.*

A. SILK YARNS.

1. Spun Silks.
2. Thrown Silks.
3. Sewing Silks.

B. PLAIN SILKS.

1. Gros, Sarsnets, Persians, Satinets, Armures, and other plain Silks.
2. Satins black or coloured.
3. Armozines, Barattees, and Serges.
4. Serges and Lutestrings, for Parasols, and Umbrellas.
5. Brussells, Ducape, Satin and other plain Cravats for Men's wear.
6. Satin twilled and other plain Handkerchiefs for Ladies' wear.
7. Bandanas, Corahs, and other Cloth for Printing.
8. Spun Silk Handkerchiefs (for printing).

C. FANCY SILKS.
1. Shot, striped, checked, watered (moiré), shaded, clouded (chiné), or striped with satin.
2. Floret, Damask, Tobine, Brocade, and other Figured Silks.
3. Figured Vestings, Cravats and Scarfs.
4. Figured Handkerchiefs, Scarfs, Aprons, and Veils, for Ladies' wear.
5. Parasol and Umbrella Silks figured, or with figured borders.
6. Furniture Damasks and Brocades.
7. Gold and Silver Tissues, figured and plain.
8. Figured Pocket Handkerchiefs for Gentlemen's wear.

D. VELVETS.
1. Plain Velvets, black and coloured.
2. Plain Terry.
3. Figured and Embossed Velvets.
4. Plush (Ladies', &c.).
5. Hat Plush.

E. GAUZES AND CRAPES.
1. Lisse, Areophane, and other Gauzes.
2. Plain and coloured Crapes.
3. Figured Gauze (Blonde, &c.).
4. Fancy Gauze or Crape Handkerchiefs.

F. PLAIN RIBBONS.
1. Sarsnet and Lutestring Ribbon.
2. Satin Ribbons.
3. Gauze Ribbons.
4. Velvet Bands or Bindings.

G. FANCY RIBBONS.
1. Shot, striped, checked, shaded, clouded (chiné), or striped with satin.
2. Figured or Brocaded.
3. Gauze or Crape, with brocaded or cut figures.
4. Embossed Satin.
5. Figured or checked Velvet.

XIV. *Manufactures from Flax and Hemp.*

A. FLAX FIBRE.
1. Steeped, scutched Flax Fibre, both systems.
2. Unsteeped Flax Fibre, from dried Straw.
3. Hackled Flax from both systems, and Hackled Tow.
4. Tow from both systems, and from the unsteeped process.
5. Tow in the forms to mix with Wool.
6. Flax, Hemp, &c., prepared as a substitute for Cotton and Silk.

B. LINEN YARN AND THREAD.
1. Linen Yarn, Thread, &c.: English, Scotch, and Irish (Tow and Linen Yarn, 1½ to 430 lea).
2. Hand-Spun Thread, as used for some fine Cambrics, &c. (240 to 800 lea).
3. Dyed Yarns and Threads of various colours.
4. Dyed Yarns and Threads to resemble Lustre of Silk.
5. Flax-Cotton, Flax-Fibre, Flax Wool, and Flax-Silk Yarns.
6. Flax Thread from unsteeped Fibre.

C. PLAIN LINENS OF ALL WIDTHS, BLEACHED, UNBLEACHED, AND DYED.
1. Canvas—
English, Scotch, Irish, French, Dutch, and Russian.
2. Heavy Linens—
As Crash, Huckabacks, Glass Cloths, and Sheetings: Yorkshire, Newark, Scotch, Drogheda, Courtrai, Ghent, Russia. Tubing for Irrigation, and Banding for Machinery.
3. Irish Manufacture—
Brown, Black, and coloured Linens.
4. Platillas, Creas, Britannias, German ditto ditto.
5. Irish Linens and Sheetings—
Courtrai, Ghent, Bielefield, Prussian.

D. DAMASKS, DIAPERS, DRILLS, AND OTHER TWILLED LINENS: BLEACHED, UNBLEACHED, OR DYED.
1. Damasks and Diapers—
English, Scotch, Irish, Saxon.
2. Drills—
English, Scotch, Irish, French, Saxon, Russian.
3. Linen Velveteens, Linen Velvets, and Linen Cords.

E. CAMBRICS, CAMBRIC AND LINEN HANDKERCHIEFS, PLAIN, BORDERED, EMBROIDERED, PLAIN, PRINTED OR DYED; PRINTED LINENS, LAWNS, CAMBRICS, BLEACHED, UNBLEACHED, OR DYED.
1. Irish.
2. French.
3. Irish, Scotch, and Swiss Embroidering (in Cambric).

F. CORDAGE OF ALL KINDS.
Ropes, Lines, Twines, Nets, &c.

XV. *Mixed Fabrics, including Shawls; but exclusive of Worsted Goods.* (Class XII.)

A. MIXED WOVEN FABRICS.
1. Cotton Warp, plain, watered, or figured.
Shot with Wool or Worsted.
,, Mohair.
,, Linen.
,, Silk.
,, Silk and Worsted.
,, Silk and Cotton.
,, China Grass.
For Dresses, Damasks, Aprons, Shoe, and Boot Cloths, Linings, Cravats, Vestings, Ponchos, Pantaloons, Shawls, Scarfs, Coatings, Tweeds, Quiltings, Plaids, &c.
2. Spun Silk Warp, plain, watered, or figured.
Shot with Wool or Worsted.
,, Mohair.
,, Linen.
,, Net Silk.
,, Silk and Worsted.
,, All Cotton.
Dresses, Damasks, Vestings, &c.
3. Silk Warps, plain, watered, figured, or embossed.
Shot with Cotton.
,, Wool or Worsted.
,, Mohair.
,, Linen.
,, Cotton and Silk.
,, Cotton & Worsted graduated.
Tabinets; Poplins; Paramattas; Chalis; Bareges; Cashmeres, &c.
4. Linen Warps, plain, watered, or figured.
Shot with Wool or Worsted.
,, Mohair.
,, Cotton and Silk.
,, Silk.
5. Cotton and Silk Warps, plain, watered, or figured.
Shot with Cotton.
,, Mohair.
,, Silk.
,, Worsted.
,, China Grass.
For Dresses, Articles of Furniture, Shawls, &c.

B. SHAWLS.
1. Woven Shawls.
Chenille, all Silk, or Silk and Cotton.
Cashmere from the East.
Imitation Cashmeres, that is, Harness or Jacquard Wove Shawls.
Plain Silk and Satin.
Figured Silk and Satin.
Crape, plain and embroidered.
Gauze, plain and figured.
Lace, plain and figured.
Shetland or knitted Woollen.
Barège, all Wool and Silk and Wool.
Grenadine and other thin texture, in Silk and Silk and Wool.
Embroidered Lace, Silk, and Cashmere.
Woollen, plain, tartan, and fancy.
2. Printed Shawls,
Barège.
Silk, including Silk, Grenadine, and other thin mixtures.
Cashmere.
Chiné, or Shawls printed on the warp before they are woven.

XVI. *Leather, including Saddlery and Harness, Skins, Furs, Feathers, and Hair.*

A. LEATHER.
1. Rough tanned Leather—
Tanned Butts.
,, Crop-hides.
,, Offal, *i. e.* Shoulders and Bellies.
,, Horse Butts.
,, Dressing-hides.
,, Horse-hides.
,, Kips.

Tanned Calf-skins.
„ Seal-skins.
„ Hog-skins.
„ Brazils.
„ Varieties.

2. Curried Leather—
Curried Calf-skin, Russet (*i. e.* Natural Colour).
„ „ Waxed (*i. e.* Black).
„ „ Butts, Russet.
„ „ Butts, Waxed.
„ Kips, Russet.
„ Kips, Waxed.
„ Cordovan, Waxed.
„ Cordovan, Grain.
„ Shoe-hides.
„ Seal-skins.
„ Dog-skins.
„ Goat-skins.
„ Boot-legs.
„ Boot-fronts.
„ Varieties.
„ Saddler's Hides.
„ Rein-hides.
„ Collar-hides.
„ Chaise-hides.
„ Pouch and Scabbard Hides.
„ Powder Hides.
„ Bellows Hides.
„ Pipe Backs.
„ Bag Hides.
„ Pig-skins.
„ Hog-skins.
„ Russia Leather.

3. Enamelled Leather—
Black Enamelled Horse-hides.
„ Cow-hides.
„ Calf-skins.
„ Seal-skins.
„ Goat-skins.
„ Roans.
„ Skivers.
Coloured Enamelled Calf-skins.
„ Sheep-skins.
Black Japanned Horse-hides.
„ Cow-hides.
„ Calf-skins.
„ Sheep-skins.
Coloured Japanned Skins, various.

4. Dyed Leather—
Dyed Morocco *i. e.* (Goat-skins) for Furniture and Coach purposes.
„ Roan, *i. e.* (Sheep-skins) for Furniture and Coach purposes.
„ Morocco, for Shoe purposes.
„ Roan ditto.
„ Morocco for Bookbinding and Pocketbooks, &c.
„ Roan for Bookbinding and Pocketbooks, &c.
„ Skiver ditto ditto.
„ Calf ditto ditto.
Striped Seal-skin for Shoe-binding, &c.
„ Cape Sheep-skins „
„ Sheep „ „
„ Goat „ „
„ Horse-hide „

5. Oil Leather—
Buck skins, finished natural colour.
Doe „ „
Calf „ „
Lamb „ „
Sheep „ „
Ox and Cow Hides „
Buck-skins, dyed or coloured.
Doe „ „
Calf „ „
Lamb „ „
Sheep „ „

6. White or Alum Leather—
Alumed Horse-hides.
„ Calf-skins.
„ Sheep-skins strained white.
„ Lamb-skins „
„ Lamb-skins coloured.
„ Kid-skins for Gloves, White.
„ „ „ Dyed.
„ Lamb-skins „
Alumed Sheep-skins for Gloves.
„ Kid-skins for Shoes.
„ Calf-skins „
„ Sheep-skins „
„ Varieties.
Gaiter Leather.

7. Sheep and Skin Rugs—
Sheep and Lamb, Brown Rugs.
„ Coloured.
„ White.
Sheep Rugs for Cavalry Saddles.
Angola Goat, Coloured.
„ White.
Various Wild Animal Skins for Rugs.

8. Parchment and Vellum.
Sheep-skin Parchment for Deeds.
„ „ Bookbinding, White.
„ „ „ Coloured.
Vellum for Bookbinding, White.
„ „ Coloured.
„ Painting.
„ Tambourines.
„ Drum-heads.
„ Gunpowder sieves.

B. SADDLERY AND HARNESS.
1. Harness; Carriage, Gig, Cart.
2. Saddlery.
3. Whips.

C. MISCELLANEOUS.
1. Leather Manufactures, such as Bellows, &c.
2. Braces, Webbing-belts, &c.

D. SKINS AND FUR.

1. Sable and Martin—

Russian or Siberian Sable . . .	As manufactured for Muffs, Tippets, Trimmings, Cuffs, &.
Hudson's Bay Martin or Sable, next in repute and value	
The North American or Canadian Baum or Wood Martin, a native of the Forests of Germany, &c.	
Stone Martin, living in rocks, old ruined castles, buildings, &c.	
English Martin	
Dyed Sable and Martin. . . .	

2. Otter—

Nootka Sound, or Sea Otter	As used in China for Royal robes, and by the Russians, Chinese, Greeks and Persians, for Caps, &c.
Hudson's Bay and North American Otter . . .	
European Otter	
Pull-dyed Otter. . . .	

3. Fox—

Hudson's Bay and North American Black and Silver Fox	As used abroad for Dresses, and in this country for Coat-linings, Carriage Wrappers, Ottomans, Foot-Muffs, &c.
Blue Fox	
White Fox	
Red Fox	
Cross Fox	
Grey Fox	
Kitt Fox	
European Red Fox . .	

4. Bear—

Black Bear of Hudson's Bay and North America .	Army Clothing and Accoutrements, and for Hearth-rugs and Sleigh coverings.
Brown or Isabella . . .	
Grey „	
European Grey and Black Bear	
Polar or White Bear . .	

5. Beaver—

Beaver from Hudson's Bay and North America . .	As made into Muffs, Tippets, Cuffs, and other articles of Apparel.
Manufactured . . .	
Dyed ditto	

6. Swan—

Swan Skin	For Boas, Trimmings, Puffs, &c.
Swansdown Skin . . .	
Swan Feathers	
Swan Quills	

7. Goose—

Goose Skin . . .	Used as Swansdown.
Goose Down . . .	

8. Mink—
North American and Hudson's Bay Mink; as used for Muffs, Tippets, Cuffs, &c.

9. Buffalo, for Sleigh Coverings, Open Carriages, and for Railway purposes.

10. Hudson's Bay and North American Skins.

Lynx Lynx-cat Dyed Lynx Raccoon Wolf Fisher Wolverin	As used in America, when dyed for Muffs and Tippets, and in the undyed state by the Chinese, Greeks and Persians. The Raccoon as linings of Shakos and Coats in Russia and Germany.

11. Ermine or Weasel tribe—

Ermine Weasel Polecat or Fitch Russian Fitch Dyed Fitch Kolinski and Dyed Kolinski Kolrosk and Dyed Kolrosk	For general purposes of Ladies' Apparel.

12. Seal—

South Georgia, Shetland, and Falkland Isles Lomar's Island and Cape The Plucked and Manufactured Seal Seal when dyed The Greenland and Newfoundland Hair Seals The Labrador Spotted and Silver Seal The same in its dyed state.	Men's Coats and Ladies' Dresses, Muffs, Capes, Cuffs, Caps, Waistcoats, Shoes, Boots, &c.

13. Musquash, or large North American Rat, for Ladies' wear, as for Muffs, Boas, &c.

Hamster Opossum Perewiazka	As for Muffs, Tippets, Linings, Cuffs, &c.

14. Hare and Rabbit—

White Hare from Russia and the Polar Regions European or Grey Hare Hudson's Bay and North American Rabbit English Rabbit Flemish Rabbit Silver-grey Rabbit White Polish Rabbit Black and Blue Rabbit Australian Rabbit Dyed Rabbit	Muffs, Tippets, Linings, Cuffs, &c.

15. Lamb, &c.

Grey Russian Crimea Lamb Black Ukraine Lamb Black Astrachan Lamb Persian Grey Lamb Persian Black Lamb Hungarian Lamb Spanish Lamb English Lamb	For general purposes of Dress.

16. Squirrel.

Black Russian Blue Siberian Kazan Siberian American Squirrel English Squirrel Indian Striped Squirrel Flying Squirrel Dyed Squirrel	For Ladies' wear, and for Muffs, Tippets, Cuffs, Linings, Trimmings, &c.

17. Chinchilla.

African Chinchilla Buenos Ayres Chinchilla Lima or bastard Chinchilla	As made into various articles of Ladies' Dress.

18. Cat.

Dutch Cat or Jennet European Cat Wild Cat African Cat	For Coat Linings, Sleigh Coverings, Travelling Bags, &c.

19. Grebe Eider Duck Penguin	For Ladies' use.
20. Tartar Foal Angora Goat Dyed Goat	Various purposes.

21. Skins from the Tropics.

Lion Royal Tiger Cape Tiger Leopard Panther Zebra Antelope Black Monkey Ant-eater	Mounted for ornamental purposes and for Furniture.

22. Miscellaneous—Moose Deer.
Deer.
Roebuck.
Badger; the hair of the European badger, as used for shaving-brushes, &c.

E. FEATHERS.

1. Ostrich,

Aleppo Mogador Alexandria Senegal Cape Algoa Bay Dyed	As worn in Plumes on Court occasions by Knights of various Orders, and for Military purposes, also in their application to general Dress for Ladies and for Funeral Plumes.

2. Marabouts.

Marabout Stork Adjutant Paddy or Rice Bird White Grey Dyed	As Plumes for Head Dresses, Bonnets, Trimmings for Dresses, Muffs, Tippets, and Fans, and as used with Gold, Silver, or Pearls.

3. Rhea. Long Flossy Short Flossy Brown	The Feathers known by the Plumassiers as "Vulture's," and used for Ladies' wear, made up into fanciful forms, and for military purposes, in America: the common sorts made into dusting-brooms.
4. Osprey. Large Small Egrett	The Feathers of the small Egrett, as used for Ladies only. Those of the large Osprey for Ladies, and the Feathers of the back, as used for Military Plumes for the Hussar Regiments.
5. Emu	The Feathers varying in shades, as used in their natural colour for Ladies' Bonnets, and dyed darker colours and black.
6. Birds of Paradise. The Large Emerald The Small Emerald The King Bird	The Feathers, as worn by persons of rank in the East, also by Ladies in Europe and America, arranged as a Bird.
7. Heron. The Heron The White-bellied Darter	The Feathers of the head and breast of the *Andrea cinerea*, as used for Ladies, and by Knights at their installation. Those from the back of the *Plotus anhinga*, as used in England by Ladies, and in the Eastern Countries by Princes and persons of Rank.
8. Ibis.	The Feathers of their natural scarlet colour, as made into Wreaths for the Head.
Swan	For Ladies' Bonnets and Military Plumes.
Turkey	The Down of these birds as used for Ladies' Plumes and Trimmings.
Cock	The Feathers of the neck, back, and tail made into Plumes for Ladies' and Children's Hats and Military Plumes.
Peacocks	For Plumes and Screens.
Argus Pheasant	The Feathers marked with eyes, are used, the small for Plumes, the large for Tiaras for the head.
Common Pheasant.	Made into Trimming.
Eagle	The Feathers forming the wing of this Bird, as used for the Highland Bonnet.
9. Miscellaneous	The Feathers of the Jay, Duck, Grebe, and Tucan, as also several Birds from the Tropics, in their applications to Ladies' dresses.

F. HAIR.

1. Hair as a substitute for Human Hair, as Wigs, Curls, Fronts, &c.
2. Ornaments in Hair, as Plumes, Bracelets, Guards, &c. (See also XXIII. C.)
3. Hair Cloth for the purposes of Furniture.
4. Hair for miscellaneous purposes, as for stuffing Furniture.

XVII. *Paper and Stationery, Printing and Bookbinding.*

A. PAPER IN THE RAW STATE AS IT LEAVES THE MILL.

1. Brown Paper and Packing Papers.
2. Millboards and Glazed Boards for pressing.
3. Printing Papers.
4. Drawing Papers.
5. Writing Papers.
6. Tissue Papers, white and tinted.
7. Papers tinted in the Pulp.
8. Tracing Papers, made so in the Pulp.
9. Papers ornamented in the Water-mark.
10. Cartridge Paper.

B. ARTICLES OF STATIONERY.

1. Envelopes, plain and ornamental.
2. Embossed and Lace Papers.
3. Printed Fancy Papers and Surface-coloured Papers, Printed and Embossed Ornaments.
4. Wedding Stationery (Cards, Papers, and Envelopes).
5. Mourning Stationery (Cards, Papers, and Envelopes).
6. Specimens of Ornamenting, Glazing, and Packeting Writing Papers.
7. Sealing-wax and Wafers.
8. Pens.
9. Small Wares for Stationery.
10. Tracing Paper, made transparent by Varnishes.
11. Inks of all kinds.

C. PASTEBOARDS, CARDS, &c.

1. Playing Cards.
2. Message Cards, plain and ornamental.
3. Drawing Boards.
4. Mounting Board, plain and ornamental.
5. Pasteboard and Cardboard.

D. PAPER AND SCALEBOARD BOXES, CARTONS (CARTONNERIE).

All kinds of Boxes and Cases made of Pasteboard and Paper (not being Papier-maché), plain or ornamented.

E. PRINTING (NOT INCLUDING FINE ART PRINTING).

1. Type-printing generally.
2. Printing Inks and Varnishes.

F. BOOKBINDING, &c.

1. Binding in Cloth.
2. ,, Vellum.
3. ,, Leather.
4. ,, Velvet.
5. ,, Wood, Papier-maché, or Metal.
6. Albums, Scrap-books, Portfolios, Music-books, Manuscript-books, Memorandum-books.
7. Ledgers and Account-books.
8. Blotting-cases, Desks, Cabinets, Pocket-books, Card-cases, Note-cases, &c.
9. Porte-monnaie, and other Articles of a similar nature.

XVIII. *Woven, Spun, Felted, and Laid Fabrics, when shown as specimens of Printing or Dyeing.*

A. PRINTING OR DYEING OF WOOLLENS, OR ANY MOUSSELINE DE SOIE, DE LAINE, OR ALPACA MIXTURE.

1. Mousseline de Laine, de Soie, &c.—
    Made of all Wool.
    ,, Cotton and Wool.
  Cashmere—
    Made of all Wool.
    ,, Cotton and Wool.
  Barège—
    Made of Silk and Wool.
    ,, Cotton and Wool.
    ,, all Wool.
    ,, Cotton, Silk, and Wool.
  Balzarine, plain and figured—
    Made of Cotton and Wool.
    ,, Silk and Wool.
    ,, Cotton, Silk, and Wool.
2. Printed or Dyed Cotton or Silk Warps, afterwards woven, known as Chiné.
3. Printed Woollen Table-covers.
    ,, ,, Japanned.
4. Printed and Dyed Silks—
    India Corahs in the Grey.
    ,, dyed.
    ,, printedin England.
    India Bandanas (tied and dyed in India).
    ,, Choppahs (printed in India).
    British Corahs in the Grey.
    ,, dyed.
    ,, printed.
    British Twills in the Grey.
    ,, dyed.
    ,, printed.
    British Spun Silks, printed.
    British Cambrics, printed.
    ,, dyed.
    British Spun Silk Dresses, dyed.
    ,, ,, printed.
    British Corah Dresses, printed.
    India Corah Dresses, printed.
    Printed China Crape Shawls.

B. PRINTED CALICOES, CAMBRICS, MUSLINS, VELVET, AND VELVETEENS.

1. Cottons printed by Machines only.
    ,, by Block only.
    ,, partly by Block and Machinery.
    Turkey-red, printed or dyed.
    ,, ,, Mules.
    Muslins printed by Machinery.
    ,, by Block only.
    ,, partly by Block and Machinery.
    Prints and Furniture by Machine only.
    ,, by Block only.
    ,, partly Block and Machine.
2. Handkerchiefs for the pocket, head, neck, and shoulders.
    Single Colours, blue ground, &c.
    Assorted Colours, fast and loose.
    Turkey-red, Bandanas printed.
    ,, ,, discharged.
    ,, Chintz pattern.
    Printed Border Handkerchiefs.
    Imitation Cambric.
    ,, Fancy Muslin.
    Imitation Java batticked Handkerchiefs.
    Printed Aprons.
3. Printed Shawls and Dresses.
    Shawls, assorted Colours. . . } part with fringe,
    ,, Turkey-red, or purple. } part without.
    Java Sarongs batticked.
    ,, Turkey-red.
    Java Slendrongs, Turkey-red, and batticked,
    Malay Chindey or Imitation.
    Bombay Patolio.
    Siam Shawls,
    Scarfs,
    Dresses.

C. DYED COTTON GOODS.

Cambrics and Madapollams, assorted Colours.
,, Turkey-red.
Imitation blue Morries and Basstas.
Long Cloths of all kinds.
Mull and Book Muslin of all kinds.
Cotton Drills (blue).
Velvet.
Velveteens.

D. DYED LINEN GOODS.

Printed Linens.
Cambric Handkerchiefs.
Lawn Shirt Fronts.
Lawn Handkerchiefs.

E. DYEING OR PRINTING OF LEATHER, HAIR, FUR, ETC.

XIX. *Tapestry, including Carpets and Floor-cloths, Lace, Embroidery, Fancy and Industrial Work.*

A. TAPESTRY.

1. Carpets of all kinds, in which the Pattern is produced by Weaving or by the Hand, in the manner of Tapestry proper, including Hall Carpets, Rugs, Stair, &c.
    a. Axminster Carpets, Flax or Jute, Chain, Woollen, or Worsted Pile, worked by hand.

b. Table and Chair Covers, &c., worked in the same way.
c. Patent Axminster Carpets, manufactured at Glasgow, made firstly as a woven Fringe, and that adapted afterwards to a thick Flax Surface.
d. Patent Tapestry Carpet, Pattern printed in warp, any number of Colours used; Table-covers and curtains made in same way.
e. Patent Tapestry Rugs, Velvet Pile Surface, with a thick weft shoot of Cotton, Flax, or other material.
f. Brussells and Velvet Pile Carpet.
g. Tapestry Brussells Carpets, called Moquette, of a fine quality.
h. Kidderminster and Venetian Carpets.
i. Patent Mosaic Tapestry and Rugs, where the cut Wool is fixed to a ground by caoutchouc, &c.
j. Printed Felt Carpet, Plain and Printed Druggets, Printed and Embossed Cloth for Table-covers and Curtains.
k. Patent Printed Carpets with Terry Pile Surface; the same Moquette for Curtains or Furniture.
l. Cloth Embroidered by Machinery for Table-covers or Curtains.

2. Matting of Hemp, Cocoa-nut Fibre, Straw, Reeds, and Grasses, for Floor and Walls.
3. Oil-cloth for Floor or Table, whether painted or printed.
4. Woven or Embroidery, Crochet and Net Work.
5. Counterpanes and Quilts for Bed-covers; Quilting and Dimity for Bed-room Hangings.
6. Ornamental Tapestry of Silk, Wool, Linen, Mohair, Cotton, or of these materials mingled together, or with Metal Wires, whether woven in the Loom or of any kind of Needlework, but of Patterns having so much artistic excellence as to entitle them to be exhibited in Section XXX. as Works of Fine Art.

B. Lace.

1. Pillow Lace, the article or fabric being wholly made by hand (known as Valenciennes, Mechlin, Honiton, Buckingham); or guipure made by the Crochet Needle; and Silk Lace, called "Blonde" when white, and Chantilly, Puy, Grammont, and Black Buckinghamshire when black.
2. Lace, the ground being Machine-wrought, the Ornamentation made on the Pillow and afterwards applied to the Ground (known as Brussells, Honiton, or appliquée Lace).
3. Machine-made Nets and Quillings, wholly Plain, whether Warp or Bobbin (known as Bobbin Net, Tulles, Blondes, Cambrais, Mechlins, Malines, Brussells, Alençon, &c.)
4. Lace, the Ground being wholly made by Machine; partly Ornamented by Machine and partly by Hand, or wholly Ornamented by Hand, whether Tamboured, Needle-Embroidered, or Darned.
5. Lace actually Wrought and Ornamented by Machinery; comprising Trimming Laces of every description, Veils, Falls, Scarfs, Shawls, Lappets, Curtains, &c.

C. Sewed and Tamboured Muslins.

Ladies' Collars, Cuffs, &c.
Children's Robes.
Handkerchiefs.
Trimmings and Insertions.
Vest Pieces.
Shirt Fronts.
Mantles.
Dresses.
Curtains, &c.

D. Embroidery.

1. Gold and Silver and Glass.
2. Silk, as Shawls, Dresses, Mantles, Table Covers, and Curtains, &c.
3. Berlin Wool, Chair Covers and Fancy Articles for the Drawing-room.
4. Embroidery by Machinery.

E. Fringes, &c.

1. Fringes, Tassels, Gimps, &c., suitable as Trimmings for Upholstery.
2. Ditto for Dresses and other fine Work.

F. Fancy and Industrial Works.

1. Berlin Wool Work.
2. Needlework.
3. Miscellaneous Industrial Works.

XX. *Articles of Clothing for immediate Personal or Domestic Use.*

A. Hats, Caps, and Bonnets.

1. Hats, made of Silk, Beaver, or other materials, for Men.
2. Caps, for Men.
3. Bonnets of Straw, Silk, or other material.
    a. British Chip Bonnet made from the Poplar.
    b. Willow Bonnet.
    c. Brazilian Grass Hats.
    d. Tuscan and Leghorn Plaiting and Bonnets.
    e. Straw Plait Bonnets.
    f. Straw Trimmings and Bonnets.
    g. Horse-hair Trimmings and Bonnets.
    h. Silk and other Bonnets made by Milliners.

B. Hosiery.

1. Cotton.
2. Woollen.
3. Linen.
4. Silk.

C. Gloves.

1. Made of Leather or Skins.
2. Made of any other materials.

D. Boots, Shoes, and Lasts.

1. Made of Leather.
2. Made of other materials.

E. Under Clothing.

1. For Ladies.
2. For Gentlemen.

F. Upper Clothing.

1. For Ladies, including all kinds of Millinery.
2. For Gentlemen, including all kinds of Tailor's work.

XXI. *Cutlery and Edge-tools.*

A. Cutlery, such as Knives and Forks, Pen and Pocket Knives, Razors, Scissors, and Shears.

1. Knives and Forks—
    Table, Dessert, Carving.
    Dessert or Fruit, with plated and silver blades.
    Cake and Melon Carvers, „ „
    Fish Knives and Forks, „ „
2. Spring Knives—
    Pen and Pocket Knives of every description.
    Hunting and Sportsmen's Knives.
3. Knives of all other descriptions—
    Paper Knives of all kinds.
    Desk or Office Knives.
    Palette Knives.
    Knives for Hunting and Self-defence, as Couteaux-de-Chasse, Bowie Knives, &c.
    Knives for Kitchen and Domestic Purposes, as Books', Oyster, Onion, Bread and Butter, and Cheese Knives.
    Knives used in various Trades, as Butchers', Shoemakers', Glaziers', Gardeners', &c.
4. Scissors and Shears—
    Ladies' Work and Cutting-out Scissors of every description.
    Nail, Button-hole, Barbers', and Trimming Scissors.
    Shears used in various Trades, as Tailors', Brushmakers', &c.
    Garden and Sheep Shears.
5. Razors of all kinds.
6. Miscellaneous
    Corkscrews, Button-hooks, Boot-hooks, Nail-nippers, Nail-files, Tweezers, &c.

B. Files and other small Edge Tools, not included in Manufacturing Tools in Section VI.

1. Files and Edge-tools used by Engineers, Smiths, or other Metal Workers.
2. „ for purposes of Building, by Masons, Bricklayers, and Plasterers.
3. „ for fine Metal and other work, as for Clock and Watch makers, Jewellers, Lapidaries, Engravers, and Modellers.
4. „ for Wood-work, as for Carpenters, Joiners, Cabinet-makers, Coopers, &c.
5. „ for Leather or Skins, as for Saddlers, Curriers, Shoemakers, and Bookbinders.
6. Drawing, Artists' and Engraving Instruments.
7. Files and Edge-tools for other purposes than those specified.

XXII. *Iron and General Hardware.*

A. Brass Manufacture.

1. Cabinet and general Brass Foundry, consisting of Hinges, Fastenings, Escutcheons, Bell-pulls, Brass-foundry used in Ships, Knockers, Door-springs, Castors, &c.
2. Plumbers' Brass Foundry, Cocks, Valves, Pumps, Water-Closets, &c.
3. Stamped Brass Foundry, Cornices, Curtain-bands, Finger-plates, &c.
4. Gas-fittings, Brackets, Chandeliers, Pillars, Gas Burners, and Consumers' Meters, &c.
5. Tubing, plain and ornamental.
6. Metallic Bedsteads, Brass and Iron.
7. Chandeliers, Lamps, and Candelabra, for Oil, Candles, or Camphine, and Lamp Chains.
8. Railway and Carriage Brass Foundry, and Signal Lamps and Lanterns.
9. Bronze Figures, Busts, and Chimney Ornaments.
10. Bells, House, Church, Ship, Table, &c., and Alarums.
11. Candlesticks, Table and Bedroom.
12. Monumental Brasses and Ecclesiastical Brass-work.
13. Copper and Steel Plate for Engravers.
14. Miscellaneous.

B. Copper, Zinc, Tin, Pewter, and General Braziery.

1. Kettles, Coalscuttles, Coppers, Saucepans, Steamers, Plate-warmers, &c.
2. Bronzed Tea and Coffee Urns, Kettles, &c.
3. Tubing—Copper, Tin, Lead, &c.
4. Pewter, German Silver, and Britannia-metal Tea-pots, Basins, Dishes, Spoons, Ladies' Inkstands, &c.
5. Coffin Furniture—Plates, Escutcheons, &c.
6. Zinc Articles generally.

C. Iron Manufacture. (See also I. and V.)

1. Stoves, Grates, Fenders and Fire Irons, Kitchen Ranges, Cooking Apparatus, Smoke-jacks.
2. Warming Apparatus, for Halls and Rooms, Ships, &c., either by Water, Coal, Coke, Wood, Charcoal, or Gas.
3. Shower, Vapour, Air, and Warm-water Baths.
4. Ventilators—Metallic and others.
5. Pipes and Gutters, &c.
6. Locks and Hinges.
7. General Ironmongery.
8. Ice Machines.
9. Knife-cleaning Machines.
10. Letter-copying Machines and Presses.
11. Saddlers' Ironmongery.
12. Hollow Ware, cast and wrought, tinned and enamelled.
13. Spades, Shovels, Pickaxes, Hoes, Rakes, Garden-rollers, &c. (See also S. IX.)
14. Nails, cut, cast, and wrought, in Iron, Copper, and other Metals.
15. Screws and Railway Bolts, &c.
16. Iron Safes, Cash-boxes, fire-proof and otherwise.
17. Horse-shoes.
18. Gates, Railings, Hurdles, and Stable Fittings.
19. Mangles, Washing Machines, &c.

D. Steel Manufacture.

1. Tools and heavy Steel Toys, Hammers, Vices, &c.
2. Steel Ornaments, and light fancy Steel Toys, Brooches, Buckles, &c.
3. Steel Pens and Metallic Pens.
4. Needles, Fish-hooks, and Fishing Tackle.

E. Buttons, etc.

1. Buttons—Metallic, Florentine, Pearl, Bone, &c.
2. Metal Boxes, Watch Boxes, &c.

F. Wire Work, &c.

1. Wire Gauze, for Window Blinds, Fencing, Pheasantry, Birdcages, &c.
2. Wire—Iron, Brass, Steel, and Copper.
3. Pins—white and black.
4. Hooks and Eyes.
5. Metallic Wire Baskets.
6. Wire Rope.

XXIII. *Working in Precious Metals and in their imitations; Jewellery, and all articles of Virtu and Luxury not included in the other Classes.*

A. Communion Services.

As Altar-dishes, Flagons, Chalices, Patens, Plates, &c.

B. Articles of Gold and Silver Plate, for Decorative Purposes and Presentation Pieces.

1. Racing Prizes, Testimonials, allegorical, historical, and emblematic Groups and Compositions, Shields, Centre Pieces, Vases, Tazzas, Ewers, Salvers, Candelabra, &c.
2. The same Articles made in hammered or repoussé metal.

C. Smaller Articles for more general Domestic Use.

1. For the Dinner Table; as smaller Candelabra with branches, Candlesticks, Centre Pieces, Soup and Sauce Tureens, Covered Dishes, smaller Mounted Dishes, Flat Dishes, Flower-stands and Epergnes, Dessert Services, Table and Dessert Knives, Spoons and Forks, Salvers, Bread and Cake Baskets, Claret Jugs, Wine Coolers, Cruet Frames, Mustard Pots, Salts, &c.
2. Breakfast and Tea-table Service; as Tea and Coffee Urns and Kettles, Tea and Coffee Pots and Stands, Sugar Basins, Milk and Cream Jugs, Ewers and Basins, Toast Racks, &c.
3. Dressing and Library Table and Travelling Utensils; as Inkstands and Writing Appendages, Dressing Cases and Instruments, &c.
4. Miscellaneous; as Watch and Clock Cases, Toys, Pencil Cases, Seals and Keys, Filigree Baskets and Ornaments.

D. Electro-plated Goods of all descriptions, comprehending all that can be executed in Silver and other Metals.

E. Sheffield and other Plated Goods.

Centre and Side covered Dishes and Warmers, Soup Tureens, Cruet Frames, Liqueur Frames, Pickle ditto, Candlesticks and Branches, Candelabra, Bread and Cake Baskets, Snuffers and Trays, Tea and Coffee Services, Tea-trays, Hand Waiters, Claret Jugs, Decanter Stands, Sugar Stands, Flower Stands, Nut Crackers, Grape Scissors, Mustard Pots, &c.

F. Gilt and Or-molu Work.

1. Gilt by the Electro process.
2. Gilt by amalgamation, or "Water Gilding."
3. Imitation Jewellery and Toys.

G. Jewellery.

1. Works exhibiting the Precious Stones and Pearls, as Diamonds, Rubies, Sapphires, Emeralds, Opals, Turquoise, and the manner of setting them in Crowns, Coronets, Stars, Orders, Tiaras, Head Ornaments, Bouquets, Necklaces, Bracelets and Armlets, Presentation Snuff-Boxes, Brooches, Ear Pendants, Medallions, Studs, and Buttons.
2. Ornaments similar to those of the former class, in which are exhibited the setting of the inferior Stones, Amethysts, Topazes, Carbuncles, Aquamarines, Jacinths, Crysophrases, Carnelians, Onyxes, whether plain or set, Cameos or Intaglios, Engraved Shells, &c. &c.
3. Ornaments made of Gold, whether plain or enamelled; as Bracelets, Brooches, Necklaces, Earrings, Pins, Waist-Buckles, Chains, Buckles, Studs, Chatelaines, &c. &c. &c.
4. Jewellery by imitations of Precious and other Stones
5. Ornaments worked in Ivory, Jet, Horn, Hair, and other materials, of which the Precious Stones or Metals do not form the principal feature.

H. Ornaments and Toys worked in Iron, Steel, and other Metals, which are neither Precious Metals nor Imitations of them, as Chatelaines of Steel, Chains of Steel, Sword-hilts, Cut-Steel Shoe and Knee Buckles, Berlin Iron Ornaments, Chains, Necklaces, Bracelets, etc.

I. Enamelling and Damascene Work.

1. Enamelling of subjects on Gold and Precious Metals. (Except when shown in the Section of Fine Arts.)
2. Damascene Work, or insertion of one Metal in another, not included in the above-named Classes, as forming a minor ingredient in some more important species of Manufactures.

J. Articles of Use or Curiosity not included in the previous Enumeration.

XXIV.—*Glass.*

A. WINDOW GLASS, INCLUDING SHEET GLASS, CROWN GLASS, AND COLOURED SHEET GLASS.

1. Crown.
2. Sheet.
3. Brown Plate Glass, silvered and unsilvered.
4. Coloured Sheet, Pot Metal, or flashed.
5. Glass Ventilators.
6. Glass Shades, round, oval, and square.

B. PAINTED AND OTHER KINDS OF ORNAMENTED WINDOW GLASS.

1. Enamelled, Embossed, Etched, painted white, or coloured Window Glass.
2. Painted and Leaded Windows.

C. CAST PLATE GLASS.

1. Rough Plate.
2. Ground and polished, silvered and unsilvered.
3. Pressed Plate.
4. Rolled Plate, white and coloured.

D. BOTTLE-GLASS.

1. Ordinary Bottle-glass, including Moulded Bottles.
2. Medicinal Bottle-glass, including Phials, &c., blown and moulded, of all kinds and shapes.
3. White Bottle-glass. Crown, Pressed, and Moulded Bottles.
4. Water-pipes and Tubing.

E. GLASS FOR CHEMICAL AND PHILOSOPHICAL APPARATUS.

1. Glass for Matrass, Retorts, and other kinds of Chemical and Philosophical Apparatus.
2. Water-pipes and Tubing.

F. FLINT GLASS OR CRYSTAL, WITH OR WITHOUT LEAD, WHITE, COLOURED, AND ORNAMENTED FOR TABLE VASES, ETC.

1. Blown.
2. Moulded and Pressed.
3. Cut and Engraved.
4. Reticulated and spun with a variety of colours, incrusted, flashed, enamelled of all colours, opalescent, imitation of Alabaster, gilt, platinised, silvered, &c.
5. Glass Mosaic, Millefiori, Aventurine, and Venetian Glass Weights, &c.
6. Beads, Imitation Pearls, &c.
7. Chandeliers, Candlesticks, and all Glass Apparatus for Lamps, Candlesticks, Girandoles, Wall Brackets, with or without drops, &c.

G. OPTICAL GLASS, FLINT AND CROWN.

1. Rough Discs of Flint and Crown, to make Lenses for Telescopes, Microscopes, Daguerrotype and Calotype Apparatus, &c.
2. Flint and Crown, blown or cast in plates for the Optician.
3. Thin Glass for Microscopes.
4. Refractive Apparatus, Prismatic Lenses for Lighthouses. (See also Class J.)

XXV. *Ceramic Manufactures—Porcelain, Earthenware, &c.*

A. PORCELAIN, HARD.

1. Chinese.
2. Japanese.
3. Continental, as Berlin, Meissen, &c.

B. STATUARY PORCELAIN.

1. Statuary.
2. Parian.
3. Carrara.

C. TENDER PORCELAIN.

1. English Porcelain, soft or tender.
2. French, with Silicious body.

D. STONEWARE, GLAZED AND UNGLAZED.

1. Ironstone, or Stone China, glazed.
2. White Stone body, unglazed.
3. Coloured body, Jasper „
4. „ Egyptian black, unglazed.
5. „ Red „
6. „ Cane, „
7. „ Drab, „
8. Brownware, with salt glaze. (The Lambeth, Chesterfield, and Beauvais manufactures are included in this class.)
9. Chemical utensils. (These are made both in Stoneware and Hard Porcelain.)

E. EARTHENWARE.

1. White body for Printing, Painting, or Enamelling in different Colours.
2. Common Cream-colour.
3. Green glazed ware.
4. Rockingham „
5. Delft ware.
6. Majolica ware.
7. Mocha and Dipped Ware.
8. Common Lead glazed ditto, for utensils.
9. Coloured body, Turquoise.
10. „ Drab.
11. „ Olive.
12. „ Buff.
13. „ Cottage brown.

F. TERRA COTTA.

1. Vases and Garden-pots.
2. Ornaments for Architecture.
3. Encaustic or Inlaid Tiles.
4. Tesseræ of various colours, compressed from powdered clay.
5. Superior Plain Tiles for pavements, ditto ditto.
6. „ Bricks, ditto ditto.
7. „ Roofing Tiles, ditto, ditto.
8. Chimney Pipes.
9. Common Bricks.
10. „ Roofing Tiles, &c.

G. ORNAMENTED OR DECORATED.

1. Ornamented on *Bisque*—
    Painted by hand.
    Printed and transferred in various colours.
2. Ornamented *on the glaze.*
    Painted by hand.
    Printed by the press.
    Printed by hand.
    Gold Lustre.
    Silver „
    Steel „
    Enamelling in various colours.
    Gilding.

H. PRODUCTIONS FOR ARCHITECTURAL PURPOSES.

XXVI. *Decorative Furniture and Upholstery, including Paper-hangings, Papier-maché, and Japanned Goods.*

A. DECORATION GENERALLY, INCLUDING ECCLESIASTICAL DECORATION.

1. Ecclesiastical Decoration generally.
2. Ornamental coloured Decoration, as executed by hand.
3. Imitations of Woods, Marbles, &c., ditto.
4. Relievo Decoration, mechanically produced.

B. FURNITURE AND UPHOLSTERY.

1. Cabinet Work, plain.
2. Cabinet Work, carved or ornamental,
3. Marqueterie, inlaid Work, in Woods, &c.
4. Buhl or Metallic inlaid Work.
5. Chairs, Sofas, and Beds, and generally Upholstery.

C. PAPER-HANGINGS.

1. Damask Patterns.
2. Flower Patterns.
3. Flock and Metal Papers,
4. Decorative Paper-hangings by Block-work
5. „ „ by any other process.
6. Machine-printed Paper-hangings.

D. PAPIER-MACHE, JAPANNED GOODS, PEARL AND TORTOISESHELL WORK.

1. Papier-maché, japanned, inlaid, and decorated.
2. Papier-maché (not japanned), produced in ornamental forms for decoration.
3. Japanned Goods in Iron, &c.
4. Pearl and Tortoiseshell Work.

XXVII. *Manufactures in Mineral Substances used for Building or Decoration, as in Marble, Slate, Porphyries, Cements, Artificial Stones, &c.*

A. MANUFACTURES IN COMMON STONES.

1. For Building, and constructions not strictly decorative.
2. For Decorative purposes.

B. MANUFACTURES IN SLATE.

1. For Construction.
2. For Decoration.

C. MANUFACTURES IN CEMENT AND ARTIFICIAL STONE.

D. Manufactures in Marbles, Granites, Porphyries, Alabaster, Spar, etc., for Useful or Ornamental Purposes.
  1. For Construction and external Decoration.
  2. For internal Decoration (not Furniture), as Chimney-pieces, &c.
  3. For articles of Furniture, as Tables, &c.
  4. For purposes of mere Ornament.

E. Inlaid Work in Stone, Marble, and other Mineral Substances.

F. Ornamental Work in Plaster, Composition, Scagliola, Imitation Marble, &c.

G. Combinations of Iron and other Metals with Glass and other Substances for various Useful Purposes.
  1. For Architectural purposes.
  2. For Miscellaneous purposes.

XXVIII. *Manufactures from Animal and Vegetable Substances, not being Woven, Felted, or included in other Sections.*

A. Manufactures from Caoutchouc.
  1. Impermeable Articles.
    Boots.
    Holdsworth's Life Preservers.
    Captain Smith's Life Preservers.
    Hydrostatic and Air Beds.
    Water and Air Cushions.
    Gas Bags.
    Printers' Blankets.
    Cloaks, Capes, Coats, Paletots, &c.
    Boots and Shoes, Over Shoes, or Goloshes.
    Fishing and Deck Boots.
    Ship Sheets.
    Bellows.
    Air-pump Valves for Steam Engines.
    Sponge Baths and Bags.
    Prepared Water and Air proof Textures of every description.
  2. Elastic Articles.
    Railway and other Carriage Springs and Buffers.
    Valve Canvas.
    Knee Caps.
    Surgical Bottles.
    Pump Buckets and Valves.
    Bands and Rings for Letters and Packages.
    Writing Tablets.
    Trouser Straps.
    Gussets for Boots.
    Vest Backs.
    Washers for Flange and Socket Joints.
    Driving Bands for Machinery.
    Railway Felt.
    Wheel Tires
    E. Smith's Torsion Springs for Window-blinds and Shades.
    Door Springs.
    Dr. Bell's Sewer and Sink Valves.
    Hodge's Projectile and Lifting Straps.
    Air-pump Valves.
    Elastic Webbing.
    Cricket Gloves and Balls.
    Stoppers for Decanters, Bottles, Jars, and other vessels.
  3. Articles in Caoutchouc—Moulded, Embossed, Coloured, and Printed.
    Bas-reliefs.
    Bags.
    Maps, printed on Caoutchouc.
    Sheets, in Colour.
    Embossed and Printed Ornaments.
    Garters, Bracelets, &c., Embossed, Coloured, or Printed.
    Bottles, Embossed and in Colours.
    Embossed Sheets for Seats and other Purposes.
    Vulcanized Articles combined with Metal—such as Decanter Stoppers, Inkstands, Cocks and Taps for Fluids, Hinges, Locks and Bolts, Wheel Tires, Plugs for Cisterns, Linings of Vessels, &c.

B. Manufactures from Gutta Percha.
  1. For Waterproofing Purposes.
  2. For Agricultural Uses, as Tubing for Manure, &c.
  3. For Maritime Purposes, as Speaking Trumpets, Life Buoys, Life Boats, Cords, Tiller Ropes, &c.
  4. Decorative Uses, as Ornamental Mouldings, Brackets, Medallions, Picture Frames, &c.
  5. Surgical, Electrical, and Chemical Uses, as Dissolved Gutta Percha for Wounds, Stethoscopes, Splints, Ear Trumpets, &c., Carboys, Funnels, Acid Vessels, Covering of Telegraph Wire, Insulating Stools, &c.
  6. Domestic and Miscellaneous Uses, as Soles for Shoes, Linings of Cisterns, Conveyance of Water and Gas, Hearing Apparatus, &c.

C. Manufactures from Ivory, Tortoiseshell, Shells, Bone, Horn, Bristles, and Vegetable Ivory.

D. General Manufactures from Wood (not being Furniture).
  1. Turnery.
  2. Carving, &c.
  3. Coopers' Work of all kinds.
  4. Basket and Wicker work.
  5. Miscellaneous Wood work.

E. Manufactures from Straw, Grass, and other similar Materials.

F. Miscellaneous Manufactures from Animal and Vegetable Substances.

XXIX. *Miscellaneous Manufactures and Small Wares.*

A. Perfumery and Soap.

B. Articles for Personal Use, as Writing Desks, Dressing Cases, Workboxes, when not exhibited in connexion with Precious Metals (XXIII.), and Travelling Gear generally.

C. Artificial Flowers.

D. Candles, and other means of giving Light.

E. Confectionary of all Kinds.

F. Beads and Toys, when not of Hardware, Fans, etc.

G. Umbrellas, Parasols, Walking-sticks, etc.

H. Fishing Tackle of all kinds, Archery.

I. Games of all kinds.

J. Taxidermy.

K. Other Miscellaneous Manufactures.

FINE ARTS.

(*So far as they come within the limitations of the Exhibition.*)

XXX. *Sculpture, Models, and Plastic Art.*

A. Sculpture as a Fine Art.
  1. In Metals simple, as Gold, Silver, Copper, Iron, Zinc, Lead, &c.
  2. In Metals compound, as Bronze, Electrum, &c.
  3. In Minerals simple, as Marble, Stones, Gems, Clay, &c.
  4. In elaborate Mineral Materials, as Glass, Porcelain, &c.
  5. In Woods and other Vegetable Substances.
  6. In Animal Substances, as Ivory, Bone, Shells, Shell Cameos.

B. Works in Die-sinking, Intaglios.
  1. Coins, Medals, and Models of a Medallic character in any material.
  2. Impressions struck from Dies for ornamental purposes.
  3. Gems, either in Cameo or in Intaglio, Shell Cameos.
  4. Seals, &c.

C. Architectural Decorations.
  1. Integral, in Relief, Colour, &c.
  2. Adventitious, as Stained Glass, Tapestry, &c.

D. Mosaics and Inlaid Works.
  1. In Stone. 4. In Wood.
  2. In Tiles 5. In Metal.
  3. In Vitrified Materials.

E. Enamels.
  1. On Metals. 2. On China. 3. On Glass.

F. Materials and Processes applicable to the Fine Arts generally, including Fine Art Printing, Printing in Colour, etc. etc.
  1. Encaustic Painting and Fresco.
  2. Ornamental Printing, Chromo-typography, Gold-Illuminated Typography, Typography combined or uncombined with Embossing.
  3. Lithography, Black, Chromo-lithography, Gold-Illuminated Lithography, Lithography combined or uncombined with Embossing.
  4. Zincography, or other modes of Printing.

G. Models.
  1. In Architecture. 2. Topography. 3. Anatomy.

LYON PLAYFAIR.

Appendix B.

INSTRUCTIONS FROM THE COUNCIL OF CHAIRMEN TO THE JURIES.

1. In accordance with the decisions of the Royal Commissioners, the Council of Chairmen have met and agreed to the following Instructions as a guide to the Juries.

2. *Working of Juries.*—In regard to the working of the Juries, the Council of Chairmen think it advisable to leave much to the discretion and gradual experience of each Jury; but upon the following points the decisions of the Royal Commissioners are precise, and it will be desirable that the practice of the Juries should be uniform.

3. The Juries will, at their first meeting on Monday, consider the course to be followed in the examination of the subjects confided to them, and arrange generally the time and places for their respective meetings.

4. *Deputy-Chairmen.*—The first duty of each Jury will be to elect a Deputy-Chairman, who will assist the Chairman, and fill his place in the Jury, or at the Council, in his absence.

5. *Reporters.*—A Member of the Jury will be appointed to draw up a Report upon the class of subjects submitted to it. It will be advisable that this appointment should be made as soon as the eligibility and willingness of some Member to undertake that duty can be ascertained. As the Reports will probably be published, they should be drawn up with the care necessary to describe the State of Industry of all Nations, as shown in this Exhibition, and in such a manner as may best form a permanent record of the Exhibition itself.

6. *Sub-Committees.*—The Royal Commissioners have given their sanction to Juries acting in matters of detail by Sub-Committees. How far it may be convenient in each case to adopt this system, and to depute to a Sub-Committee, or to individual Members, the investigation of particular objects, is left to the judgment of each Jury; but it must be borne in mind that no Award can be made but by a majority of the Jury.

7. *Evidence and Associates.*—When a Jury may wish to call in the aid of persons of technical knowledge to aid their judgment, they may do so in conformity with the 20th Article of the General Decisions.

8. Jurors of another Class, when knowledge of that Class is required to guide the Jury, may be called in if a majority of the Jury should decide to do so.

9. In both the above cases, however, the persons to be consulted do not possess Notes, and only remain associated with the Jury as long as the special occasion for which they were called requires their presence.

10. *Juries to carry on their Investigations without delay.*—The Juries are expected to carry on their investigation with as little intermission, and to come to their decision with as little delay as possible.

11. *Mode of making Awards.*—When a Jury has decided upon its Awards, those Awards will be submitted to a Meeting of all the Juries of the same group for confirmation, and for the investigation of any Decision that may be disputed.

12. The Awards will then be submitted to the Council of Chairmen, to secure uniformity of action, and a compliance with the Rules now laid down, or which may hereafter be sanctioned by the Council.

13. The Awards will become final as soon as the Council of Chairmen shall have reported that they are in conformity to those Rules.

14. *Secresy.*—All the Considerations, Discussions, and Decisions of *each* Jury and of the Council of Chairmen, are to be considered as strictly confidential, and on no account to be divulged until the Award has become final.

15. *Medals to be awarded without reference to Nationality.*—The Medals will be awarded for excellence only, without reference to countries, the Exhibition being considered as a whole, and not as consisting of the produce of different nations.

16. *Individual competition to be avoided.*—In making the Awards, the Juries will bear in mind that the Royal Commissioners desire that the different Medals should indicate different kinds of merit, and not degrees in the same kind of merit.

17. *Two Medals only to be awarded.*—The Juries will only have to award the medium size and large Medal. The small Medal will not be given by the Juries, the Commission having withdrawn it as a Prize Medal at the request of the Council of Chairmen.

18. *Conditions for the award of the Medals.*—The medium size (or as it is proposed to be called the "Prize Medal") will be awarded by the Juries in conformity with the decisions laid down in the paper issued by the Royal Commissioners, with the general indications contained in these directions.

19. The Great Medal can be finally awarded only by the Council of Chairmen, upon recommendations made to that body by the allied Juries referred to in Decision 9.

20. Each Jury must obtain the sanction of its own group of Juries to its recommendation of the Great Medal, before the Council of Chairmen can take the award into consideration. The grounds, on which this recommendation is made must be fully stated. The Great Medal will only be given for very pre-eminent and indisputable merit. It is impossible, until the Juries have acquired a knowledge of the articles exhibited, to define the proportion of the Great to the Prize Medal; but the Council of Chairmen have to announce their intention of making the proportion a very small one.

21. The Chairmen of the groups of Prizes have had under their consideration the various conditions which it will be advisable to adopt in the award of Prizes in the various classes into which the Exhibition is divided. They do not intend that these conditions should be compulsory on the Juries, as it is probable that they may require modification in particular cases, but they may be useful as indications to show the general grounds on which awards may be made.

Group A.

Medals are to be awarded for novelty in the mode of obtaining, applying, and adapting Raw Materials and Produce, skill and excellence in known modes of obtaining, applying, or adapting them; comparative excellence in the quality obtained, combined with utility. The value of the instructiveness of any Series exhibited.

Group B.

The Sub-Committee of the Chairmen of this Group, for certain reasons set forth in their Report (see Report), strongly urge that if novelty of invention (as far as regards Machinery) be not altogether excluded, the greatest caution should be used, and the most jealous scrutiny employed by Jurors before any Prize whatever be awarded under such claims for merit.

Class V.—*Machines for Direct Use.*

Fitness of the work for the object sought to be obtained (which combines almost every merit of Machinery), economy in first cost, durability, economy of maintenance, excellency of workmanship.

Class Va.—*Carriages.*

Successful application of any new Material, with elegance of design and excellence of workmanship, strength and lightness, reasonable cheapness.

Note.—These qualities will apply almost exclusively to Carriages of luxury.

For the Public Service.

Lightness, sufficient solidity for safety, durability, cheapness.

Class VI.—*Manufacturing Machines and Tools.*

Fitness of the Machinery for the objects sought, economy in the first cost, durability, and excellence of workmanship; economy in production, and perfection in articles manufactured; saving in time, and quantity produced; economy of maintenance.

Class VII.—*Civil Engineering, Architectural and Building Contrivances.*

Science and skill in Design to obtain the object sought with the greatest economy; fitness in the application of Materials, success in the work in which the Model or Drawing is exhibited; perfection of workmanship in the Model or Drawing exhibited.

Class VIII.—*Naval Architecture and Military Engineering; Ordnance, Armour, and Accoutrements.*

Merits of combination in the Models or Drawings relating to Military or Naval Engineering; advantages obtained by experiments in carrying out the means proposed either by Models or Drawings. Improvements in Arms, Apparatus, or any articles belonging to Military and Naval Service or Architecture, to Rigging or other branches of Seamanship, to Accoutrements or Equipments of Troops, their fitness and efficacy; economy in production.

Class IX.

In this Class actual trial has been found generally necessary for the safe award of Prizes; Field Instruments being tried on the land, and Yard Implements being also set to work, and the results exhibited in Numerical Tables.

Class X.—*Philosophical Instruments.*

Novelty of inventions, or novelty in the whole or part of the instruments; ingenuity of construction; new application of old principles; application of new principles; improved beauty of form; increased durability, and more extensive application.

Class Xa.—*Musical Instruments.*

Novelty of invention, novel application of old inventions, improvement of mechanical action. Tone, perfection of workmanship, beauty of design combined with general excellence, increased felicity of action, cheapness combined with durability.

Class Xb.—*Horology.*

Ascertained or probable accuracy and certainty of performance, whether time-keeping, discharging of striking parts, or registering; stability, strength and durability, simplicity and economy of construction, goodness of execution. High finish to be considered subordinate to the scientific objects.

Class Xc.—*Surgical Instruments.*

For instruments which possess novelty of a useful character, and giving evidence of originality and inventive power, ingenuity in the application, extension, or modification of principles already known, or for new combinations, mechanical skill, including cheapness, finish, and other qualities of mechanical execution.

Group C.—*Manufactures. Textile Fabrics.*

In this, those articles will be rewarded which fulfil in the highest degree the conditions specified in the sectional list, namely, increased usefulness, such as permanency in dyes, improved forms and arrangements in articles of utility, &c.; superior quality, or superior skill in workmanship; new use of known materials; use of new materials; new combinations of materials; beauty of design in form or colour, or both, with reference to utility; cheapness relatively to excellence of production.

Group D.—*Metallic, Vitreous, and Ceramic Manufacture.*

Important inventions and discoveries, or regularity combined with excellence of design; novel application of known discoveries; great utility combined with economy and beauty; excellence of workmanship and quality.

Group E.—*Miscellaneous.*

Novelty of material in application, excellency of design, material, workmanship, and cheapness.

Group F.—*Fine Arts.*

Originality and excellence of design and importance of the work, combined with great merit of execution; merit in execution, combined with application to useful purposes.

Appendix C.

MINUTE OF ROYAL COMMISSION ON THE AWARD OF THE COUNCIL MEDAL.

"With reference to the awards of the Council Medal, the Commissioners think it proper to recapitulate the terms of those Decisions, and to explain with somewhat greater minuteness the exact meaning which they intended to attach to them.

"The 107th of the published Decisions of the Commissioners is as follows:—

" 'It is the intention of the Commissioners to reward
" 'excellence in whatever form it is presented, and not to
" 'give inducements to the distinctions of a merely indi-
" 'vidual competition. Although the Commissioners have
" 'determined on having three Medals of different sizes
" 'and designs, they do not propose to instruct the Juries to
" 'award them as first, second, and third in degree for the
" 'same class of subjects. They do not wish to trammel the
" 'Juries by any precise limitation; but they consider
" 'that the Juries will rather view the three kinds of
" 'Medals as a means of appreciating and distinguishing
" 'the respective characters of the subjects to be rewarded,
" 'and not of making distinctive marks in the same
" 'Class of Articles exhibited.'

"And the 21st Article of the Decisions regarding Juries is this:—

" 'The three classes of Medals are intended to distinguish
" 'the respective characters of subjects, and not as first,
" 'second, and third in degree for the same class of subjects.'

"The important features in these Decisions, and that which distinguishes the mode of granting Medals on the present occasion from that usually adopted in the Exhibitions of Foreign Countries, is the announcement that the Medals are not to be awarded 'as first, second, or third in degree for the same class of subjects.' It is obvious, therefore, that in the case of manufactured Articles mere excellence of manufacture, being in other words a mere difference in degree between subjects included in the same class, cannot be rewarded with a Council Medal without a deviation from the principle of this decision. If, however, there is any novelty of invention or adaptation, or any peculiarity in the mode of manufacture, which can also be taken into account, and of which the importance and value shall be judged sufficient, the Council Medal may properly be given.

"Thus, for example, if a piece of Linen be exhibited of such remarkable excellence as to be at once and by unanimous consent recognised as greatly superior to any other piece of Linen in the whole Exhibition, yet if the ordinary processes only have been employed in its production, and if it be not distinguished by any originality in the design applied to it, it ought not to have a Council Medal, however great may have been the care and labour bestowed upon it. But if, on the other hand, a piece of Linen of very decided excellence should be produced by a new method, exhibiting advantages not hitherto attained, it would be quite within the spirit of the Decision in question that such method should be rewarded with a Council Medal.

"Or again, if a sample of Sugar of extraordinary fineness should be exhibited, if such fineness were the result only of the application of the ordinary processes, with more than ordinary care and skill, it ought not to have the Council Medal; but if a new chemical agent, or a new process had been employed with advantage in its production, the process by which it was produced, if sufficiently important, would be eligible to receive it.

"It is not, however, intended to limit the granting of the Council Medal to cases of production by a new process: such a rule would, of course, not apply where the question of Fine Art was involved. In judging of works of pure art, the Medal will, of course, be given to those cases where the most remarkable and pre-eminent genius has been displayed; and in cases where design is applied to an article of Manufacture, it may sometimes happen that it will be of sufficient originality and importance to justify the grant of a Council Medal as an acknowledgment of the taste displayed.

"Thus, for instance, a piece of Porcelain or a piece of Tapestry, though they could not receive the Council Medal for the mere excellence of the workmanship, might properly receive it for a very extraordinary and original merit of the design applied to them. And, in like manner, though a Council Medal ought not to be given to a piece of Furniture, of which the principal merit was that it was well made, it might be awarded to it if there were so much beauty in the design as to entitle it to great distinction as a Work of Art.

"The Commissioners must, however, limit themselves by observing that they would not recognise beauty of design as a sufficient title to a Council Medal unless applied to an object of some importance. Very great merit might be found in the carving of an umbrella or a pipe, yet it might be thought improper to reward such merit with a Council Medal, on account of the comparative insignificance of the subject.

"The last observation naturally leads the Commissioners to offer some remarks upon another point on which it is possible that doubts may arise; namely, whether the fact of an Exhibitor having incurred great expense in the preparation of an Article for exhibition should entitle him to a Council Medal: as, for instance, in the case of the Exhibitors of valuable Raw products, of specimens of Manufactured Goods remarkable only for the size of the specimens, of very precious Jewels, or of collections of the productions of particular districts. In these cases, the Commissioners are decidedly of opinion that the mere fact of a large outlay of money ought not to be regarded as entitling an Exhibitor to receive a Council Medal, though care should, of course, be taken, that his zealous co-operation in promoting the objects of the Exhibition, be properly noticed in the Report of the Jury of his Class.

"In the foregoing remarks, the Commissioners have repeatedly spoken of rewarding inventions and new processes. They think it right, therefore, to guard themselves against being supposed to throw upon the Juries the duty of discovering whether each particular object which they mark for reward is actually the invention of the party claiming the merit of it. They can conceive that, in many cases, such an investigation would, under the circumstances, be impossible. In Machinery, particularly, they presume that the Juries will reward an important Machine without undertaking to pronounce whether the novelties exhibited in its construction have been originated by the Exhibitor, or have been borrowed or adapted by him from some one else. The test of invention will be satisfied if the Machine be rewarded for its importance and ingenuity, and not for the mere excellence of workmanship.

"As the Commissioners have referred to the claims of invention, it would appear to be desirable to fix some date beyond which invention should cease to be a claim for the Council Medal. It has not been made a condition in the admission of Articles to the Exhibition that they should be new; but it would be obviously difficult and inexpedient to discuss claims of invention made many years since. It appears to the Commissioners that, as most European States consider from fourteen to fifteen years a proper period for limiting by patents the use of an invention to the discoverer before it becomes the property of the public, this period would form a limit, beyond which the claims of invention should not be admitted.

"In communicating these remarks to the Council of Chairmen, the Royal Commissioners must again repeat that they are only anxious to obviate the danger of their published Decisions being misunderstood. The responsibility of giving effect to those Decisions must rest with the Council of Chairmen, in whom the control of the separate Juries, and more particularly the duty of regulating the distribution of the Council Medal, has been specially vested; and the Royal Commissioners would strongly impress upon them the responsibility under which they lie of exercising that control with care and firmness, according to the opinions which they may personally entertain of the merits of the several cases brought before them."

Appendix D.

DEPARTMENT OF JURIES.

Dr. Lyon Playfair, F.R.S., Special Commissioner in Charge of the Department of Juries.

DEPUTIES.

John Wilson, F.R.S.E., late Principal of the Royal Agricultural College—for Group A.—*Raw Materials.*
Col. J. A. Lloyd, F.R.S., Special Commissioner—for Group B.—*Machinery.*
George Wallis—for Group C.—*Textile Manufactures.*
Captain Boscawen Ibbetson, F.R.S.—for Group D.—*Metallic and Fibrous Manufactures.*
Sir Stafford Northcote, Bart., Secretary to the Royal Commission—for Groups E. & F.—*Miscellaneous Manufactures and Fine Arts.*
Lieutenant Edward Ward, R.E., Secretary to the Department of Juries.
Lieutenant Crossman, R.E., } Assistant Secretaries to Group B.
Lieutenant Ducane, R.E., }
George Wright, Assistant Secretary to Groups E. and F.
Major Boyd, Interpreter.

COUNCIL OF CHAIRMEN.

A.—*Raw Materials.*

I. Sir Henry De La Beche, C.B., F.R.S.
II. J. Dumas.
III. Edward de Lode.
IV. Professor Owen, F.R.S.

B.—*Machinery.*

V. Rev. E. Moseley, M.A., F.R.S.
Va. Earl Jersey.
VI. Gen. Poncelet.
VII. I. K. Brunel, F.R.S.
VIII. Baron Charles Dupin.
IX. Philip Pusey, M.P., F.R.S.
X. Sir David Brewster, F.R.S.
Xa. Sir Henry Bishop.
Xb. E. B. Denison, M.A.
Xc. J. H. Green.

C.—*Textile Fabrics.*

XI. Sir James Anderson.
XII. Professor Herrman.
XIII. G. T. Kemp.
XIV. Count Von Harrach.
XV. Herr Von Hoegaerden.
XVI. Hon. Col. Anson.
XVII. M. M. Van de Weyer.
XVIII. Henry Tucker.
XIX. Professor Bolley, of Switzerland.
XX. Wm. Felkin.

D.—*Metallic, Vitreous, and Ceramic Manufactures.*

XXI. Lord Wharncliffe.
XXII. Hon. Horace Greeley.
XXIII. Duc de Luynes.
XXIV. Lord de Mauley.
XXV. Duke of Argyll.

E.—*Miscellaneous Manufactures.*

XXVI. Professor Roesner.
XXVII. Signor Benedetto Pistrucci.
XXVIII. Senor Don Joaquin Alfonso.
XXIX. Viscount Canning.

F.—*Fine Arts.*

XXX. Herr Von Viebahn.

LIST OF JURORS AND ASSOCIATE JURORS.

I. Mining, Quarrying, Metallurgical Operations, and Mineral Products.

Sir Henry De la Beche, C.B., F.R.S., *Chairman*, 28 Jermyn Street, Piccadilly; Director-General of the Geological Survey of the United Kingdom, &c.

A. Dufrenoy, *Deputy Chairman* and *Recorder*, France; Member of the Institute of France, Inspector-General of Mines, &c.

M. Faraday, F.R.S., Royal Institution, Albemarle Street; Professor of Chemistry to the Royal Institution.

Jules Henri Geirnaert, Belgium; Engineer-in-Chief of the Corps of Miners.

W. E. Logan, F.R.S., 42 Sackville Street; Director of the Geological Survey of Canada.

Ferdinand Schreiber, Zollverein; Mining Engineer.

Richard Taylor, F.G.S., Truro; Mineral Surveyor to the Duchy of Cornwall.

Professor Peter Tunner, Austria; President of Imperial Mining School, Leoben, Styria.

ASSOCIATE.

Gabriel Kamensky,[*] Russia; Councillor of the Administration of Finances.

[*] Juror in Class XXV.

II.—Chemical and Pharmaceutical Processes and Products generally.

J. Dumas, *Chairman*, France; former Minister of Agriculture and Commerce, Member of Institute, &c.

Thomas Graham, F.R.S., *Deputy Chairman* and *Reporter*, 4 Gordon Square; Professor of Chemistry, University College.

Jacob Bell, M.P., 15 Langham Place; Pharmaceutist.

Michele Galeani, H.D., Sicily; Doctor of Medicine.

George Gossleth, Austria; Chemical Manufacturer.

John Mercer, F.C.S., Oakenshaw, near Accrington, Lancashire; Calico Printer.

H. L. Pattinson, F.C.S., 10 Grey Street, Newcastle-on-Tyne; Chemical Manufacturer.

Dr. Varrentrapp, Zollverein; Professor of Chemistry.

ASSOCIATES.

Thomas Anderson, M.D., F.R.A.S., Edinburgh; Chemist to the Highland and Agricultural Society of Scotland.

——— *Balard*,[*] France; Member of the Institute, &c. &c.

L. L. Bonaparte, France; Member of the National Assembly.

William Linton, 7 Lodge Place, St. John's Wood; Artist.

A. Payen,[†] France; Member of the Institute, Professor at the Conservatory of Arts and Sciences, Member of the Central Jury, &c.

Eugene Peligot,[‡] France; Professor at the Conservatory of Arts and Sciences, Member of the Central Jury.

John Percy, M.D., F.R.S., Museum of Practical Geology, London; Professor of Metallurgy.

J. Persoz,[§] France; Professor of Chemistry at Petersburg, Member of the Central Jury, &c.

[*] Juror in Class XXVIII.
[†] Juror in Class IV.
[‡] Juror in Class XXIV.
[§] Juror in Class XVIII.

III. Substances used as Food.

Edward de Lode, *Chairman*, Russia; Member of the Institute for the Administration of the Domains of the Empire.

Sir J. P. Boileau, Bart., F.R.S., *Deputy Chairman*, 20 Upper Brook Street.

Joseph D. Hooker, M.D., R.N., F.R.S., *Reporter*, Royal Gardens, Kew; Botanist.

Comte Herve de Kergolay, France; Secretary of the Central Jury, &c.

Dr. J. Lindley, F.R.S., 21 Regent Street; Professor of Botany, University College.

Ashbel Smith, United States; Planter.

No Associates in this Class.

IV.—Vegetable and Animal Substances chiefly used in Manufactures, as Implements, or for Ornament.

Professor Richard Owen, F.R.S., *Chairman and Joint Reporter*, College of Surgeons, Lincoln's Inn Fields; Curator to the College of Surgeons.

A. Payen, *Deputy Chairman*, France; Member of the Institute, Professor to the Museum of Arts and Sciences, Member of the Central Jury, &c.

Professor Edward Solly, *Joint Reporter*, F.R.S., 15 Tavistock Square; Lecturer on Chemistry at Addiscombe.

Judge E. S. Duncan, United States.

Dr. J. F. Royle, F.R.S., Heathfield Lodge, Acton; Professor of Materia Medica, King's College.

Ramon de la Sagra, Spain; Corresponding Member of National Institute of France.

N. Wallich, M.D., F.R.S., 5 Upper Gower Street, Bedford Square; formerly Curator of the Botanical Gardens, Calcutta.

F. Weyhe, Zollverein; Councillor of Home Economy.

ASSOCIATE.

George Peterson,[*] Russia; Member of the Scientific Committee for the Administration of the Domains of the Empire.

[*] Juror in Class XXVIII.

V. Machines for direct Use, including Carriages and Railway and Naval Mechanism.

Rev. Henry Moseley, M.A., F.R.S., *Chairman* and *Reporter*, Wandsworth; Inspector of Schools, and formerly Professor of Mechanics at King's College.

Colonel A. Morin, *Deputy Chairman*, France; Member of Institute and of Central Jury, and Director to Museum of Arts and Sciences.

Chevalier Adam de Burg, Austria; Director of Imperial Polytechnic Institute, Vice-President of Society of Arts and Manufactures, &c.

Luigi Cappelletto, Austria; Mechanical Engineer.

Professor Wilhelm Engerth, Austria.

W. Fairbairn, Manchester; Mechanical Engineer.

John Farey, 67 Upper Guildford Street, Russell Square; Consulting Engineer.

John Hick, Bolton-le-Moors; Mechanical Engineer.

H. Maudslay, 4 Cheltenham Place, Lambeth; Mechanical Engineer.

Robert McCarty, United States; Civil Engineer.

Robert Napier, Glasgow; Mechanical Engineer and Shipbuilder.

Charles de Rossius-Orban, Belgium; Vice-President of the Chamber of Commerce of Liege.

ASSOCIATES.

Professor Edward Cowper, King's College, Somerset House; Professor of Mechanics at King's College.

W. H. Hatcher, 22 Hawley Road, Camden Town; Engineer.

Va. Sub-Jury for Carriages.

The Earl of Jersey, *Chairman*, 38 Berkeley Square.

J. Holland, *Deputy Chairman* and *Reporter*, 254 Oxford Street; Coach Builder.

C. Arnoux, France; Engineer.

T. Hutton, Summer Hill, Dublin; Coach Builder.

O. McDaniel, United States.

Antoine Poncelet, Belgium; Engineer-in-Chief.

No Associates in this Class.

VI. Manufacturing Machines and Tools.

General J. V. Poncelet, *Chairman*, France; Member of Institute, late Director of Polytechnic School, &c.

Rev. R. Willis, F.R.S., *Deputy Chairman* and *Reporter*, Cambridge; Jacksonian Professor of Natural and Experimental Philosophy at Cambridge.

Luigi de Cristoforis, Vice-President of Chamber of Commerce, Milan; Member of the Scientific Institute of Bologna.

Professor Filippo Corridi, Tuscany; Director of the Technological Institute, Florence.

Benjamin Fothergill, Manchester; Mechanical Engineer.

Charles Gascoigne Maclea, Leeds; Mechanical Engineer.

Guilherme Kopke, Portugal; Mechanical Engineer.

John Penn, Greenwich; Mechanical Engineer.

George Rennie, F.R.S., Whitehall Place, Mechanical Engineer.

T. R. Sewell, Carrington, near Nottingham; Lace Manufacturer.

Samuel Webber, United States; Civil Engineer.

Professor W. Wedding, Zollverein; Member of the Board of Trade and Commerce at Berlin.

ASSOCIATES.

A. Barclay, Brewery, Park Street, Southwark; Brewer.

Robt. Davison, 33 Mark Lane; Civil Engineer.

— *Dolfousse*, France.

J. Mercer,* *F.C.S.*, Oakenshaw, near Accrington, Lancashire; Calico Printer.

A. Payen,† France; Member of the Institute.

Dr. Varentrapp,‡ Zollverein, Professor of Chemistry.

* Juror in Class II. † Juror in Class IV. ‡ Juror in Class II.

VII. Civil Engineering, Architectural and Building Contrivances.

I. K. Brunel, F.R.S., *Chairman* and *Reporter*, Duke Street, Westminster; Civil Engineer.

Charles Combes, *Deputy Chairman*, France; Member of Institute and of Central Jury.

Dr. Neil Arnott, F.R.S., Bedford Square; Doctor of Medicine.

F. W. Conrad, Holland; Engineer, Chairman of Royal Institute of Engineers at Delft.

J. M. Rendel, F.R.S., 8 Great George Street, Westminster; Civil Engineer.

Count A. E. de Rosen, Sweden and Norway; Swedish Royal Navy.

Dr. J. V. C. Smith, United States; Doctor of Medicine.

William Tite, F.R.S., 17 St. Helen's Place, Bishopsgate; Architect.

No Associates in this Class.

VIII. Naval Architecture and Military Engineering; Ordnance, Armour, and Accoutrements.

Baron Charles Dupin, *Chairman* and *Reporter*, France; Member of Institute and President of Central Jury, &c.

Major-General Sir John Burgoyne, K.C.B., *Deputy Chairman*, 87 Pall Mall; Inspector General of Fortifications.

Lieut.-Col. J. N. Colquhoun, Royal Arsenal, Woolwich.

Charles Lesoinne, Belgium; Member of the Chamber of Representatives, late Merchant.

Major Jean L. Micheels, France.

Sir Baldwin Walker, K.C.B., 66 Westbourne Terrace; Surveyor-General of the Navy.

A. Whitney, United States; Merchant.

Isaac Watts, Somerset House; Assistant Surveyor-General of the Navy.

ASSOCIATES.

Capt. Beechey, R.N., Board of Trade.

Lieut. A. S. Creyke, R.E., 23 Belgrave Square.

Col. L. A. Hall, R.E., Ordnance Map Office, Southampton; Director of Ordnance Survey.

Capt. Henry James, R.E., 34 Ladbroke Square, Notting Hill; Ordnance Survey.

George Lovell, 12 Ely Place, Holborn; Inspector of Small Arms.

Col. A. Morin,* France; Member of the Institute, &c.

Capt. William Yolland, R.E., Ordnance Map Office, Southampton; Ordnance Survey.

* Juror in Class V.

Note.—A. F. Creuze, F.R.S., of Lloyd's, attended the meetings of Jury VIII. as Member, until serious illness prevented his attendance, when at his desire he was replaced.

IX. Agricultural and Horticultural Machines and Implements.

P. Pusey, M.P., F.R.S., *Chairman* and *Reporter*, Pusey, near Farringdon.

Col. B. Challoner, 11 Charles Street, Berkeley Square.

B. T. Brandreth Gibbs, Half-Moon Street, Piccadilly.

A. Hammond, Westacre, Swaffham, Norfolk.

Bethmann Hollweg, Zollverein.

B. P. Johnson, United States; Secretary New York Agricultural Society.

Josh. Locke, M.P., F.R.S., 6 Chester Terrace, Regent's Park.

C. M. Lampson, United States.

Professor Hlübeck, Austria.*

W. Miles, M.P., Leigh Court, near Bristol.

E. Moll, France; Professor of Agriculture at Conservatory of Arts and Manufactures.

Baron Edouard Mertens d'Ostin, Belgium.

C. H. Rau, Zollverein; Professor of Political Economy.

J. V. Shelley, Maresfield Park, Sussex.

H. S. Thompson, Moat Hall, near York.

* Chevalier Charles de Kleyle, Proxy for Professor Hlübeck.

ASSOCIATE.

Sir Joseph Paxton, 36 Gloucester Place, Portman Square.

X. Philosophical Instruments and Processes depending upon their Use; Musical, Horological, and Surgical Instruments.

Sir David Brewster, F.R.S., *Chairman* and *Reporter*, St. Andrew's, Fifeshire, N.B.; Principal of the University, St. Andrew's.

Professor Daniel Colladon, Switzerland.

E. B. Denison, 42 Queen Anne Street.

J. Glaisher, F.R.S., *Reporter*, 13 Dartmouth Terrace, Lewisham; Observer in Greenwich Observatory.

Sir John Herschel, Bart., F.R.S., 32 Harley Street; Master of the Mint.

Professor Hetsch, Denmark.

E. R. Leslie, R.A., United States; Artist.

L. Mathieu, France; Member of Bureau of Longitude, of Institute, and of Central Jury.

W. H. Miller, F.R.S., Scroope Terrace, Cambridge; Professor of Mineralogy.

Richard Potter, A.M., University College, London, Professor of Natural Philosophy.

Professor Schubarth, Zollverein; Professor of Chemistry and Natural Philosophy.

Baron Armand Seguier, France; Member of Institute, &c.

ASSOCIATES.

J. S. Bowerbank, 3 Highbury Grove.

Rev. W. S. Kingsley, Sidney College, Cambridge; Fellow of Sidney College.

Lambert A. J. Quetelet,* Belgium; Secretary to the Royal Academy at Brussels,

Lord Wrottesley, 34 St. James's Place.

* Juror in Class XXX.

Sub-Jury *A.* for Musical Instruments.

Sir H. R. Bishop, *Chairman* and *Reporter*, 13 Cambridge Street, Hyde Park, Professor of Music at Oxford.

Sigismund Thalberg, *Deputy Chairman*, Austria; Professor of Music.

W. Sterndale Bennett, 15 Russell Place, Fitzroy Square, Professor at the Royal Academy of Music.

Hector Berlioz, France.

J. Robert Black, United States; Physician.

Chevalier Neukomm, Zollverein.

Cipriani Potter, 9 Baker Street, Portman Square; Principal of Royal Academy of Music.

Dr. Schafhautl, Zollverein; Professor of Geology, Mining, and Metallurgy.

Sir George Smart, St. Anne's, Chertsey; Organist and Composer of the Chapel Royal.

Henry Wylde, 65 Westbourne Terrace; Doctor of Music, and Professor at the Royal Academy of Music.

ASSOCIATES.

Rev. W. Cazalet, Tenterden Street, Hanover Square; Superintendent of the Royal Academy of Music.

James Stewart, 22 Brecknock Crescent, Camden Town; Pianoforte Manufacturer.

William Telford, Dublin; Organ Builder.

Sub-Jury *B.* for Horology.

E. B. Denison,* *Chairman* and *Reporter*, 42 Queen Anne Street.

Baron Armand Seguier,* *Deputy-Chairman*, France.

Professor Daniel Colladon,* Switzerland.

E. J. Lawrence, 44 Chancery Lane; Barrister.

* Jurors in Class X.

Sub-Jury *C.* for Surgical Instruments.

J. H. Green, F.R.S., *Chairman* and *Reporter*, Hadley, Middlesex.

Dr. Thomas Chadbourne, United States.

James Philp, 67 St. James's Street; Surgical Instrument Maker.

Dr. Roux, France.

Dr. Lallemand, France.

W. Lawrence, F. R. S., Whitehall Place; Surgeon to Bartholomew's Hospital.

XI. Cotton.

Sir James Anderson, Lord Provost of Glasgow, *Chairman*, Glasgow; Cotton Manufacturer.

Philip Ellisen, *Deputy-Chairman*, Zollverein; Merchant.

Thomas Ashton, *Reporter*, Hyde, near Manchester; Cotton Spinner.

Charles Buschek, Austria; Vice-President of the Austrian Committee.

Col. R. E. Coxe, United States; Planter.

W. Gray, Mayor of Bolton, Wheatfield, Bolton; Cotton Spinner.

George Jackson, Corporation Road, Carlisle; Cotton Spinner.

Paul Kirchofer, Switzerland.

Aug. Mimerel, France; President of General Council of Manufacturers.

J. Aspinal Turner, Manchester, Cotton Spinner.

ASSOCIATES.

Thomas Coath, 7 Bread Street, Cheapside; Linen and Manchester Merchant.

Robert Johnson, 95 Watling Street, City, Warehouseman.

John Pittman, 11 Bow Lane, Cheapside; Merchant.

XII. Woollen and Worsted.

Dr. Von Hermann, *Chairman*, Zollverein; Privy Councillor in Finance Department.

Henry Forbes, J. P., *Deputy Chairman*, Bradford; Merchant.

Samuel Addington, *Reporter*, Stroud; Woollen Merchant.

Henry Brett, Huddersfield; Ditto.

C. C. Carl,* Zollverein; Manufacturer.

John Cooper, J.P., Leeds; Woollen Merchant and Manufacturer.

George Lawton, Mecklehurst, near Ashton-under-Lyne; Flannel Manufacturer.

Thomas Marling, Stroud; retired Manufacturer.

J. Randoing, France; Member of Central Jury, &c.; Member of the Legislative Assembly of France.

Laon Samoiloff, Russia; President of the Council of Manufacturers at Moscow.

Philipp Scholler,† Austria.

Armand Simonis, Belgium; Merchant; President of the Chamber of Commerce, Verviers.

ASSOCIATES.

John Barnes, Leeds; Salesman.

Joseph Bateson, Leeds; Merchant.

Thomas Dewhurst, Bradford; Worsted Spinner.

Benjamin Harrison, Bradford; Worsted Manufacturer.

Henry Jennins, Leeds; Merchant.

Henry Kelsall, Rochdale; Flannel Manufacturer.

Darnton Lupton, Leeds; Woollen Merchant.

Emilius Preller, Bradford; Yarn Merchant.

George Tetley, Bradford; Merchant.

* F. Lucius, Proxy for M. Carl.

† Charles Offermann, Proxy for M. Scholler.

XIII. Silk and Velvet.

George Tawke Kemp, *Chairman*, 35 Spital Square; Silk Manufacturer.

Arles-Dufour, *Deputy-Chairman*, France; Member of Central Jury.

Thomas Winkworth, *Reporter*, Gresham Club, King William Street, City; formerly Silk Manufacturer.

Samuel Courtauld, 2 Carey Lane, Cheapside; Crape Manufacturer.

Lieut.-Col. Henry Daniell, Turkey; Coldstream Guards.

Thomas Jeffcoat, Coventry; Ribbon Manufacturer.

Henri Mahler, Switzerland.

Antonio Radice, Austria; Vice-President of Chamber of Commerce, Verona.

J. Vertu, Sardinia.

Charles Warwick, 132 Cheapside; Silk Merchant.

No Associates in this Class.

XIV. Manufactures from Flax and Hemp.

Count Franz Ernst Van Harrach, *Chairman*, Austria; Chamberlain of His Imperial Majesty, President of Bohemian Society of Arts and Manufactures, Prague.

Charles Tee, *Deputy-Chairman*, Pindar Oak, Barnsley; Manufacturer.

William Charley, *Joint Reporter*, Seymour Hill, Belfast; Bleacher.

Grenier Lefevre, *Joint Reporter*, Belgium; Member of Senate, President of Chamber of Commerce, Ghent.

— Legentil, France; President of the Chamber of Commerce of Paris, and of Central Jury, &c.

John McMaster, Guildford, Banbridge, Ireland; Manufacturer.

John Moir, Dundee; Ditto.

Carl Noback, N. Germany; German Commissioner.

Alexander Scherer, Russia; of the Ministry of Finance.

John Wilkinson, J. P., Leeds; Flax Spinner.

No Associates in this Class.

XV. Mixed Fabrics, including Shawls, but exclusive of Worsted Goods (Class XII.)

Charles Van Hoegaerden, *Chairman*, Belgium; Merchant, Member of Chamber of Commerce, Brussels.

John R. Lavanchy, *Deputy Chairman*, 6 New Burlington Street; Silk Mercer.

W. Clabburn, Norwich; Manufacturer.

Maxime Gaussen, France; Member of Central Jury.

David Kemp, Glasgow; Shawl Merchant.

N. Kingsbury, United States; Manufacturer.

John Morgan, Greenlaw, Paisley; Ditto.

William Prinsep, *Reporter*, 30 Gloucester Gardens.

Titus Salt, J.P., Bradford; Ditto.

Frederick Schwann, Huddersfield; Merchant.

John H. Swift, United States; Merchant.

Sir Gardner Wilkinson, Turkey.

ASSOCIATES.

F. Bernoville,* France; Spinner and Manufacturer.

George Hairs, 31 Milk Street, Shawl Manufacturer.

* Juror in Class XX.

XVI. Leather, including Saddlery and Harness, Skins, Furs, Feathers, and Hair.

Hon. Col. George Anson, *Chairman*, 52 Hill Street, Berkeley Square.

Charles Nottbeck, *Deputy-Chairman*, Russia; attached to the Ministry of Imperial Domains.

J. A. Nicholay, *Reporter*, 82 Oxford Street; Furrier.

J. B. Bevington, *Joint Reporter*, Neckinger Mills, Bermondsey; Leather Manufacturer.

J. S. Cunningham, United States.

J. F. Fauler, France.

John Foster, 16 Wigmore Street, Cavendish Square; Florist and Feather Manufacturer.

J. W. Newman, Walsall; Saddler and Harness Manufacturer.

Hector Roessler, Zollverein; Counsellor of Commerce.

Edward Zohrab, Turkey; Turkish Commissioner.

ASSOCIATE.

George Kidd, 257 Oxford Street; Saddler and Harness Maker.

XVII. Paper and Stationery, Printing and Bookbinding.

Sylvain Van de Weyer, *Chairman*, Belgium; Ambassador Extraordinary and Plenipotentiary to H. M. the King of the Belgians.

Thomas de la Rue, *Deputy Chairman* and *Joint Reporter*, 110 Bunhill Row; Ornamental Stationery Manufacturer.

C. Whittingham, *Reporter*, Chiswick, and Took's Court, Chancery Lane; Printer.

A. Firmin Didot, *Joint Reporter*, France; Member of Central Jury, &c.

Professor Hülsse, Zollverein; Director of the Royal Polytechnic Academy at Dresden

Viscount Mahon, F.R.S., 41 Grosvenor Place.

Henry Stevens, Barnet, Vermont, United States; Residing at Morley's Hotel, Strand.

C. Venables, Plomer Hill House, Wycombe; Retired Paper Maker.

ASSOCIATE.

George Turner, United States.

XVIII. Woven, Spun, Felted, and Laid Fabrics, when shown as specimens of Printing or Dyeing.

Henry Tucker, _Chairman_, 30 Gresham Street; Silk Manufacturer.

J. Persoz, _Deputy-Chairman_, France; Professor of Chemistry at Paris; Member of Central Jury.

Edmund Potter, _Reporter_, Manchester; Calico Printer.

J. M. Beebe, United States.

E. E. Chevreul, France; Member of Institute, Professor and Director to Museum of Natural History.

John Hargreaves, Accrington, Lancashire; Calico Printer.

Alexander Harvey, Glasgow; Dyer.

Henry Pahud,* Switzerland; Merchant.

C. Swaisland, Crayford, Kent; Printer.

Dr. Wilhelm Schwarz, Austria; Board of Trade, Vienna.

* Charles Bovet, Proxy for Mr. Pahud.

ASSOCIATES.

— _Marnas_, Lyons, France.

Samuel Smith, Bradford.

XIX. Tapestry, including Carpets and Floor-cloths, Lace and Embroidery, Fancy and Industrial Works.

Dr. Pompeius Bolley, _Chairman_, Switzerland; Commissioner.

Peter Graham, _Deputy Chairman_, 37 Oxford Street; Carpet Manufacturer.

Richard Birkin, _Reporter_, Nottingham; Lace Manufacturer.

D. Biddle, 81 Oxford Street; Laceman.

— Falk,* Zollverein; Manufacturer.

Antony Fessler, Switzerland.

— Lamel,† France; Inspector of Manufactures; Member of Central Jury.

Robert Lindsay, Belfast; Sewed and Embroidered Muslin Manufacturer.

Thomas Simcox Lea, J. P., Astley Hall, Stourport.

Francois A. Washer, Belgium; Merchant at Brussels.

* Philipp Elliesn, Merchant, Proxy for M. Falk.
† Felix Aubray, Merchant, Proxy for M. Lamel.

No Associates in this Class.

XX. Articles of Clothing for immediate Personal or Domestic Use.

William Felkin, Mayor of Nottingham, _Chairman_, The Park, Nottingham; Lace Manufacturer.

Philippe Walther, _Deputy Chairman_, Switzerland.

T. Christy, _Reporter_, 35 Gracechurch Street, Beaver and Silk Hat Manufacturer.

T. Brown, 40 Wood Street; Straw Hat Manufacturer.

F. Bernoville, France.

Elliott Cresson, United States.

— Hulsse,* Zollverein.

E. Smith, 60 Old Broad Street, City; Tailor.

* E. Blank, Merchant, Proxy for M. Hûlsse.

ASSOCIATES.

_E. Blank,_* 10 Trump Street, Cheapside; Merchant.

Robert Dixon Box, 187 Regent Street; Boot and Shoe Maker.

William Burchett, 29 Cheapside; Boot and Shoe Maker.

Alexander Cumming, 104 Fore Street, City; Warehouseman.

Seymour Haden, 62 Sloane Street, Chelsea; Surgeon.

Samuel Hodgkinson, 43 Threadneedle Street, City; Hosier and Glover.

William Maclaren, 55 Cornhill; Boot and Shoe Maker.

John Baptiste Soldi, Southwark.

* Also Proxy for M. Hûlsse.

XXI. Cutlery and Edge Tools.

Lord Wharncliffe, _Chairman_ and _Reporter_, 28 Lower Brook Street.

Joseph B. Durham, _Deputy Chairman_, 456 Oxford Street; Cutler.

C. Karmarsch,* Zollverein; Director of the Polytechnic Institution.

Nubar Bey, Egypt.

Alderman Charles Peace, Sheffield; late Cutlery and Edge-tool Manufacturer.

J. Leplay, France; Engineer-in-Chief of Mining School and Professor of Metallurgy, Paris.

* Dr. Schafhautl, Professor of Metallurgy, Proxy for M. Karmarsch.

ASSOCIATES.

Thos. Hethrington Henry, F.R.S., 18 Lincoln's Inn Fields; Analytical Chemist.

_Thos. De la Rue,_* 110 Bunhill Row; Ornamental Stationery Manufacturer.

James Ragg, Sheffield; Scissor Manufacturer.

C. Venables,† Plomer Hill House, High Wycombe; Paper Manufacturer.

* Juror in Class XVII. † Juror in Class XVII.

XXII. Iron and General Hardware.

Hon. Horace Greeley, _Chairman_, United States; Editor.

W. Bird, _Deputy Chairman_, 5 Martin's Lane, Cannon Street City; Iron Merchant.

W. Dyce, _Reporter_, 2 Fitzroy Square.

Arthur Adams, Walsall; Hardware Merchant.

— Auer, Austria.

G. Goldenberg, France; Manufacturer; Member of Central Jury, &c.

Don Manuel Heredia, Spain; Merchant.

E. Stirling Howard, Sheffield; Grate Manufacturer.

George Shaw, Cannon Street, Birmingham; Patent Agent.

Ferdinand Spitaels, Belgium; Member of Senate, Vice-President of Chamber of Commerce, Charleroix.

Dr. F. Steinbeis, Zollverein; Member of the Board of Trade and Commerce.

Henry Van Wart, Birmingham; Merchant.

ASSOCIATES.

_Sir H. R. Bishop,_* 13 Cambridge Street, Hyde Park; Professor of Music at Oxford.

Professor A. W. Hofmann,† _Ph. D., F.R.S., F.C.S._, Zollverein; Professor of Chemistry.

Chevalier Neukomm,‡ Zollverein; 9 Carlton Terrace.

Richard Redgrave,§ _R.A._, 18 Hyde Park Gate, South, Kensington Gore; Artist.

Warren de la Rue,‖ _Ph. D. F.R.S., F.R.A.S. F.C.S._, 7 St. Mary's Road, Canonbury, Islington; Manufacturer of Ornamental Stationery.

Dr. Schafhautl,¶ Zollverein; Professor of Geology, Mining, and Metallurgy.

M. Wyon,** _R.A._, Her Majesty's Mint; Medalist.

* Juror in Class X.a. † Juror in Class XXIX. ‡ Juror in Class X.a.
§ Juror in Class XXX. ‖ Juror in Class XXIX. ¶ Juror in Class X.a.
** Juror in Class XXX.

XXIII. Working in Precious Metals, and in their Imitations; Jewellery, and all Articles of Virtu and Luxury, not included in the other Classes.

Albert Duc de Luynes, _Chairman_ and _Reporter_, France; Member of Institute, &c.

Henry Hope, M.P., _Deputy Chairman_, Piccadilly.

Don Francisco Eloiza, Spain; Colonel of Artillery.

James Garrard, Goldsmiths' Hall; Prime Warden of Goldsmiths' Company.

John Gray, 5 Billiter Square, City; Silversmith and Plater.

L. Grüner, Zollverein; Architect.

Charles Sallandrouze de Lamornaix, France; Commissioner General of Government; Member of Council of Manufactures and of Central Jury, &c.

Earl Lovelace, Turkey.

Westley Richards, Birmingham; formerly Plater and Jeweller, Chairman of the Birmingham Exhibition in 1849.

Robert Younge, Sheffield.

ASSOCIATES.

William Thomas Brande, Royal Mint; Professor of Chemistry, Royal Institution.

N.F. Le Dagre, France; Judge of the Tribunal of Commerce of the Seine, and Member of the Chamber of Commerce at Paris.

Thoms Vasey, Monmouth Court, Whitcomb Street; Setter of Diamonds.

Percival Norton Johnson, 57 Hatton Garden; Metallurgical Chymist.

George Mathey, 57 Hatton Garden; Metallurgical Chymist.

XXIV. Glass.

Lord De Mauley, F.R.S., _Chairman_ and _Reporter_, 21 St. James' Place.

E. H. Baldock, M.P., _Deputy Chairman_, 5 Hyde Park Place.

R. L. Chance, Glass Works, Birmingham; Glass Manufacturer.

L. C. Duncan, United States; Barrister.

Jules Frison,* Belgium; Merchant, Member of Chamber of Commerce at Charleroix.

Robert Orbard, 2 Crescent, Blackfriars; Glass Manufacturer.

Eugene Peligot, France; Professor at Museum of Arts and Sciences; Member of the Central Jury.

Dr. G. Scheeler, Zollverein; Mining Councillor.

* Professor Jules Chandelon, Proxy for M. Frison.

ASSOCIATES.

Geo. Bontemps, at Messrs. Chance and Co.'s, Birmingham; Glass Manufacturer.

Sir David Brewster,* Principal of the University of St. Andrews.

Joseph Chater, 24 St. Dunstan's Hill, Tower Street; Window Glass Dealer.

Alfred B. Daniell, 18 Wigmore Street; Flint Glass Dealer.

William Mortlock, 18 Regent Street; Flint Glass Dealer.

Philip Palmer, 118 St. Martin's Lane; Window Glass Dealer.

James Powell, 16 Temple Street, Whitefriars; Flint Glass Manufacturer.

Andrew Ross, 2 Featherstone Buildings, Holborn; Optician.

Wm. Swinburne, 93 Upper Thames Street, City; Plate and Crown Glass Manufacturer.

Chas. Winston, 3 Harcourt Buildings, Temple; Barrister.

Thos. Wood, 19 Greek Street, Soho; Plate Glass Silverer.

Ernest Zuccani, Brick Lane, Spitalfields; Looking Glass Manufacturer.

* Juror in Class X.

XXV. Ceramic Manufacture, China, Porcelain, Earthenware, &c.

Duke of Argyll, *Chairman* and *Reporter*, Stafford House, St. James's, and Roseneath.

Chas. Baring Wall, Esq., M.P., F.R.S., *Deputy Chairman*, 44 Berkeley Square.

E. Ebelmen, France; Director of the National Manufactures, Sèvres; Member of the Central Jury, &c.

Gabriel Kamensky; Russia; Councillor of the Administration of Finances, and Commissioner in London.

W. Mortlock, 18 Regent Street, Waterloo Place, China Manufacturer.

F. Odernheimer, Zollverein; Director of the Board of Trade and Commerce, Wiesbaden.

Augusto Pinto Basto, Portugal.

John A. Wise, Clayton Hall, Newcastle-under-Lyme, Staffordshire.

ASSOCIATES.

E. H. Baldock,* *M.P.*, 5 Hyde Park Place.

Thos. Hethrington Henry, *F.R.S.*, 18 Lincoln's Inn Fields; Analytical Chemist.

* Juror in Class XXIV.

XXVI. Decorative Furniture and Upholstery, including Paper-hangings, Papier Maché and Japanned Goods.

Professor Carl Roesner, *Chairman* and *Reporter*, Austria; President of the Imperial Academy of Fine Arts.

Lord Ashburton, *Deputy Chairman*, 82 Piccadilly;

John Lewis Aubert, 20 Lower Road Islington, Paper Stainer.

Charles de Beyne, Russia; Architect.

François Coppens, Belgium; Architect.

J. G. Crace, 14 Wigmore Street, Cavendish Square; House Decorator.

Charles Crocco, Sardinia; Manufacturer.

John Jackson, 49 Rathbone Place; Manufacturer of Composition and Papier Maché Ornaments.

W. Meyer, North Germany.

Natalis Rondot, France; late of the Embassy to China, Member of Central Jury, Delegate of Chamber of Commerce of Lyons and Paris.

Edward Snell, 27 Albemarle Street; Upholsterer and Cabinet-maker.

John Webb, 8 Old Bond Street; Upholsterer &c.

ASSOCIATES.

Lieut-Colonel Charles A. J. Demanet; Colonel of Engineers.

L. Gruner,* 12 Fitzroy Square; Architect.

Chev. Lencisa, Sardinia; Commissioner to the Exhibition for H. M. the King of Sardinia.

—— *Wolowski*,† France; Professor to Museum of Arts and Sciences, Member of the Central Jury, and of the Legislative Assembly of France.

* Juror in Class XXIII. † Juror in Class XXIX.

XXVII. Manufactures in Mineral Substances, used for Building or Decoration, as in Marble, Slate, Porphyries, Cements, Artificial Stones, &c.

Benedetto Pistrucci, *Chairman*, Italy; Her Majesty's Chief Medalist.

Lord Sudeley, *Deputy Chairman*, 35 Dover Street.

Professor D. T. Ansted, F.R.S., *Reporter*, 17 Manchester Street, Manchester Square; Professor of Geology, King's College.

Bernardo di Bernardis, Austria; Architect.

George Godwin, F.R.S., 24 Alexander Square, Brompton; Architect.

Sir Charles Lemon, Bart., F.R.S., M.P., 46 Charles Street, Berkeley Square.

Emmanuel Psycha, Greece; Civil Engineer, and late Professor of Physical Sciences.

Viscount Hericart de Thury, France; Member of Institute.

ASSOCIATES.

F. Barker, 71 Lower Grosvenor Street.

Thos. Hethrington Henry, *F.R.S.*, 18 Lincoln's Inn Fields; Analytical Chemist.

G. Lowe, *C.E.*, *F.R.S.*, 39 Finsbury Circus; Engineer to Chartered Gas Company.

XXVIII. Manufactures from Animal and Vegetable Substances, not being Woven or Felted, or included in other Sections.

Don Joaquin Alfonso, *Chairman*, Spain; Director of the Conservatory of Arts, Madrid.

J. E. Gray, F.R.S., P.B.S., *Deputy-Chairman*, British Museum; Keeper of the Zoological Department, British Museum.

Dr. E. Lankester, F.R.S., *Reporter*, 22 Old Burlington Street; Secretary to the Ray Society.

Rev. Gorham D. Abbott, United States; Spingler Institute, New York, City.

— Balard, France; Member of Institute.

T. J. Miller, 7 Millbank Street; Merchant.

George Peterson, Russia; Member of the Scientific Committee for the Administration of the Domains of the Empire.

T. A. Wise, M.D., 9 Princes Gate, Hyde Park; Hon. E.I.C.

ASSOCIATES.

Natalis Rondot,* France; late of the Embassy to China, &c.

* Juror in Class XXVI.

XXIX. Miscellaneous Manufactures and Small Wares.

Viscount Canning, *Chairman*, 10 Grosvenor Square.

— Wolowski, *Deputy-Chairman*, France; Professor to Museum of Arts and Sciences, Member of the Central Jury and of the Legislative Assembly of France.

Warren De La Rue,† Ph. D., F.R.S., F.R.A.S., F.C.S., *Reporter*, 7 St. Mary's Road, Canonbury, Islington; Manufacturer of Ornamental Stationery.

Arthur Henfry, F.L.S., 17 Manchester Street, Gray's Inn Road; Vice-President of the Botanical Society.

Prof. A. W. Hofmann, Ph. D., F.R.S., F.C.S., *Joint Reporter*, Zollverein; Professor of Chemistry.

John Joseph Mechi, 4 Leadenhall Street; Maker of Dressing-cases and Cutlery.

Otto Schumann, Austria; Member of the Council of the Chairmen of Commerce of Vienna.

W. R. Smith, United States; Mineralogist.

ASSOCIATES.

D. W. Mitchell, 11 Hanover Square; Secretary to the Zoological Society.

Professor Richard Owen,* *F.R.S.*, College of Surgeons, Lincoln's Inn Fields; President of the College of Surgeons.

Natalis, Rondot,† France; late of the Embassy to France, &c.

* Juror in Class IV. † Juror in Class XXVI.

XXX. SCULPTURE, MODELS, AND PLASTIC ART.

G. VON VIEBAHN, *Chairman*, Zollverein; Privy Councillor in the Department of Commerce at Berlin.

LORD COLBORNE, *Deputy-Chairman*, 10 Hill Street, Berkeley Square.

ANTONIO PANIZZI, *Reporter*, Tuscany; British Museum; Keeper of the Printed Books at the British Museum.

C. R. COCKERELL, R.A., Bank of England; Architect.

J. GIBSON, 7 Tilney Street, Park Lane; Sculptor.

LORD HOLLAND, Tuscany; Minister at the Court of Turin.

COUNT LEON DE LABORDE, France; Member of Institute, &c.

GENERAL GEORGE MANLEY, 19 Rutland Gate; formerly Adjutant-General in Rome.

C. T. NEWTON, British Museum; Assistant in the Antiquarian Department of the British Museum.

A. W. PUGIN, St. Augustine, West Cliff, Ramsgate; Architect.

LAMBERT A. J. QUETELET, Belgium; Secretary of the Academy of Fine Arts, and President of the Circle-Artistique, Brussels.

RICHARD REDGRAVE, R. A., 18 Hyde Park Gate South, Kensington Gore; Artist.

Y. D. C. SUERMONDT, Holland; Late Master of the Mint at Utrecht.

DR. C. WAAGEN, Zollverein; Director of the Museum of Fine Arts at Berlin.

W. WYON, R.A., Her Majesty's Mint; Medallist.

No Associates in this Class.

APPENDIX E.

LIST OF JURORS AND ASSOCIATE JURORS ALSO EXHIBITORS.

NAME.	ADDRESS.	Exhibit Excluded.		REMARKS.
		Class.	No.	
CLASS I.				
Richard Taylor	Truro	I.	434 & 451	
CLASS II.				
H. L. Pattinson	10 Grey Street, Newcastle-on-Tyne.	II.	12 & 18	
CLASS IV.				
Ramon de la Sagra	Spain	. .	157	Honourable Mention, Class IV.
N. Wallich	5 Upper Gower Street, Bedford Square.	Indian Collection.		Prize Medal, Class II.
CLASS V.				
W. Fairbairn	Manchester	V. & VI.	26 & 200	Council Medal, Class VI.
H. Maudslay	Lambeth	V. & VI.	38 & 228	
C. de Roessius Orban	Belgium	. .	372	Prize Medal, Class I.
Professor E. Cowper.	King's College	VI.	134	
CLASS VA.				
C. Arnoux	France	. .	1542	
T. Hutton	Dublin	V.	884	
CLASS VI.				
G. Rennie	Whitehall Place.	V. & VII.	52 & 98	
T. R. Sewell	Carrington	VI.	92	
CLASS VIII.				
Lieut.-Col. Colquhoun	Woolwich	III.	13	
CLASS IX.				
B. T. B. Gibbs	Piccadilly	III.	104	
CLASS XC.				
James Philp	67 St. James' Street	X.	641	
CLASS XI.				
Sir J. Anderson	Glasgow	XI.	7	
Robert Johnson	Watling Street, City	XI.	55	
CLASS XII.				
Henry Brett	Huddersfield.	XII.	20	
John Cooper	Leeds	XII.	42	
George Lawton	Mecklehurst	XII.	6	
J. Randoing	France	. .	973	
Phillip Scholler	Austria	. .	227	
A. Simonis.	Belgium	. .	194	
Joseph Bateson	Leeds	XII.	39	
Henry Kelsall	Rochdale	XII.	486	
Darnton Lupton	Leeds	XII.	33	
Emilius Preller	Bradford	IV.	91	
CLASS XIII.				
G. T. Kemp	24 Spital Square	XIII.	18	
Samuel Courtauld	2 Carey Lane, Cheapside	XIII.	34	
J. Vertu	Sardinia	. .	28	
CLASS XIV.				
Count F. Von Harrach	Austria	. .	285	
Charles Tee	Barnsley	XIV.	37	Prize Medal, Class XV.
John Moir	Dundee	XIV.	46	

NAME.	ADDRESS.	Exhibit Excluded.		REMARKS.
		Class.	No.	
Class XV.				
W. Clabburn	Norwich	XV.	284	
John Morgan	Paisley	XV.	299	
Titus Salt	Bradford	XII.	139	Prize Medal, Class XII.
F. Schwann	Huddersfield.	XII. & XV.	115	
Sir G. Wilkinson	. . . .	XXX.	319	
George Hairs	Milk Street, London	XV.	277	
Class XVI.				
J. A. Nicholay	Oxford Street	XVI.	301	
J. B. Bevington	Bermondsey	XVI.	1	Honourable Mention, Class IV.
John Foster	16 Wigmore Street, Cavendish Square.	XXIX.	74	Prize Medal, Class XXIX.
Class XVII.				
Thomas de la Rue	110 Bunhill Row	XVII.	76	Prize Medal, Class VI.
A. F. Didot	France	. .	212	
Class XVIII.				
Henry Tucker	30 Gresham Street	XVIII.	2	
Edmund Potter	Manchester	XVIII.	30	
John Hargreaves.	Accrington	XVIII.	3, 9, & 38	
Class XIX.				
Peter Graham.	37 Oxford Street	XIX.	330	
Richard Birkin	Nottingham	XIX.	20	
D. Biddle	81 Oxford Street	XIX.	1	
F. A. Washer	Belgium	. .	318	
Class XX.				
T. Christy	Gracechurch Street.	XX.	35	
F. Bernoville	France	. .	1548	
Class XXI.				
J. B. Durham.	456 Oxford Street	XXI.	46	Prize Medal, Class XXIII.
Class XXII.				
G. Goldenberg	France	. .	851	
Class XXIII.				
John Gray	Billiter Square	XXIII.	101	
Westley Richards	Birmingham	VIII.	240	Prize Medal, Class VIII.
Class XXIV.				
R. L. Chance	Birmingham	XXIV.	22 & 60	Council Medal, Class X.
Jules Frison	Belgium	. .	392	
E. Luccani	Spitalfields	XXX.	348	Prize Medal, Class XXII.
Class XXVI.				
J. G. Crace	Wigmore Street, Cavendish Square.	XXVI.	530	Prize Medal, Class XIX.
Charles Crocco	Sardinia	. .	50	
John Jackson	49 Rathbone Place	XXVI.	5	
W. Meyer	Mecklenburg Schwerin	. .	6	Honourable Mention, Class IV.
Edward Snell	27 Albemarle Street	XXVI.	170	
John Webb	8 Old Bond Street	XXVI.	171	
Lieut.-Colonel Demanet.	Belgium	. .	178	
Class XXIX.				
W. De La Rue	110 Bunhill Row	XVII.	76	Prize Medal, Class VI.
Class XXX.				
J. Gibson	Tilney Street, Park Lane	XXX.	64 & 80	
W. Wyon, R. A.	Mint	XXX.	234	

ANSWER OF HIS ROYAL HIGHNESS PRINCE ALBERT TO LORD CANNING'S REPORT.

MY LORD,

THE Royal Commissioners are much indebted to your Lordship, and to the distinguished gentlemen of this and other nations, who have acted on the Juries intrusted with the award of the Prizes in the recent Exhibition, for the zeal with which they have undertaken, and the ability with which they have fulfilled, the task which has been allotted to them. The Commissioners are sensible that the services of these gentlemen have, in many instances, been rendered at great inconvenience to themselves, and at the sacrifice of very valuable time, and of important avocations. It is with pride and pleasure, that they have noticed in the lists of those who have performed this service to the Exhibition, the names of men of every nation of the most exalted rank, and of the most eminent reputations in statesmanship, in science, in literature, in manufactures, in commerce, and in the fine arts; of men in every respect well calculated not only to form a correct technical judgment upon the merits of the articles submitted to their inspection, but also to maintain the high character which the Commissioners have uniformly striven to impart to the Exhibition.

In no department of the vast undertaking, which has just been brought to a happy close, were greater difficulties to have been apprehended than in that in which your Lordship and your eminent Colleagues have given your assistance. On this, the first occasion on which the productions of the different nations of the globe have ever been brought together for the purpose of comparing their several merits, not only were prejudices and jealousies to have been expected to interfere with the decisions, but the nature of the case presented many difficulties of a formidable character, to the formation of a judgment which should appear satisfactory to all. The names of the Jurors, indeed, when once made known, were of themselves a sufficient guarantee for that impartiality which was essential to the fulfilment of their task; and from all that has come to the knowledge of the Royal Commissioners during the progress of their labours, they are fully satisfied that every award has been made with the most careful consideration, after the most ample and laborious investigation, and upon grounds most strictly honourable, just, and candid.

But although the high character of the Jurors would have fully justified the Commissioners in intrusting them with the award of the prizes without fettering their discretion with any instructions whatever, had nothing more than an impartial decision been required, there were difficulties of a very peculiar nature inherent to the task, which seemed to render necessary the adoption of some regulations that might, at first sight, appear to have been somewhat arbitrary in their character. The differences in the wants of various nations having necessarily impressed their several manufactures with different characteristics, it would seem to be almost impossible for those who have been in the habit of judging the productions of their own country by one standard, to enter fully into merits which can only be properly appreciated by another standard, since the very points which in the one case appear to be excellencies, may in the other, not unnaturally, be taken as defects. This consideration and a knowledge of the evils which were to be apprehended from any accidentally erroneous decision, in a matter so intimately connected with the commercial interests of every nation, induced the Royal Commissioners to lay down, for the guidance of the Juries, those principles to which your Lordship has referred.

It would, perhaps, have been more interesting to the public had the Commissioners instructed the Juries to follow the practice which has usually prevailed in the Exhibitions of individual nations, and to grant Medals of different degrees, to mark the gradations of excellence among the Exhibitors; but they feel that they have adopted the safer course, and that which was upon the whole most in accordance with the feelings of the majority of the Exhibitors, in directing that no distinction should be made between their merits, if their productions came up to the standard requisite to entitle them to a Prize, but that all should, without exception, take the same rank and receive the same Medal.

The Commissioners, however, considered it right to place at the disposal of the Council of Chairmen a peculiar or "Council" Medal, in the cases to which your Lordship has referred. Important discoveries in many branches of science and of manufactures have in this Exhibition been brought under the notice of the public; and it seems just that those who have rendered services of this kind to the world, should receive a special mark of acknowledgment on an occasion which has rendered so conspicuous the advantages which the many have derived from the discoveries of the few.

The grant of the Council Medal for beauty of design, and for excellence in the fine arts, as applied to manufactures, though made upon a somewhat different principle, is also compatible with the views of the Commissioners, since in the cases in which it has been given it does not mark any greater comparative excellence of manufacture, or assign to one producer a higher place than is accorded to others, but is to be regarded as a testimony to the genius which can clothe the articles required for the use of daily life with beauty that can please the eye, and instruct and elevate the mind. Valuable as this Exhibition has proved in many respects, it appears to the Commissioners that there is no direction in which its effects will be more sensibly and immediately perceived than in the improvement which it may be expected to produce in taste, and the impulse it has given to the arts of design; and a special acknowledgment is justly due to those who have afforded the best examples of art, whether pure or applied, and led the way in this interesting career of improvement.

It now remains for the Commissioners once more to return to your Lordship and your Colleagues their cordial thanks; and they must not omit to include in these acknowledgments those gentlemen who have in various ways assisted you in your labours, particularly those who have acted with you as Associates or Experts, for the purpose of assisting your judgment in matters requiring very minute and special knowledge of particular subjects; and the Commission are well aware that these gentlemen have frequently been of the greatest service. In the hope that the Jurors and Associates might desire to possess a lasting memorial of the Exhibition, a Special Medal has been struck in commemoration of their important services.

It is the intention of the Commissioners to publish not only the names of those to whom the Juries have awarded Prizes, but also the valuable Reports which they have prepared on the state of science, art, and manufactures, in the several branches of the Exhibition with which the Juries have been conversant. The Royal Commissioners fully appreciate the zeal and talent displayed by those Jurors who have accepted the laborious office of Reporters to the Juries; and they doubt not that their Reports will form most interesting records of this Exhibition, and will afford important materials for ascertaining the progress of human industry, at any future time, when another review of its productions, like the present, may be determined on.

It now becomes my pleasing duty on behalf of the Royal Commissioners, to deliver my most sincere acknowledgments and thanks for the hearty co-operation and support which the Exhibition has constantly received from Foreign Countries. The Foreign Commissioners, who have left their own countries to superintend the illustration of their respective national industries at the Exhibition, have ever shown that desire to aid the general arrangements which alone has rendered possible the success of the undertaking.

To the Society of Arts, which, by its exhibitions of works of national industry prepared the way for this international Exhibition, the Royal Commission and the public feel that their acknowledgments are especially due, and the Commission have to thank that body for having carried out the preliminary arrangements to an extent which justified me, as their President, in the application which I made to the Crown for the issue of a Royal Commission.

The Commission have also to acknowledge the valuable services afforded by the eminent scientific and professional men who, on the Sectional Committees, aided most materially in founding a scientific basis on which to rear the Exhibition.

To the Local Commissioners and members of Local Committees, but more especially to those who have undertaken the onerous duties of Secretaries, our best acknowledgments are also due. Without their zealous aid it would have been impossible to have obtained an efficient representation of the industrial products of their respective localities.

And finally, we cannot forget that all the labours of those thus officially connected with the Exhibition would have been in vain, had it not been for the hearty goodwill and assistance of the whole body of Exhibitors, both Foreign and British. The zeal which they have displayed in affording a worthy illustration of the state of the industry of the nations to which they belong, can only be equalled by the successful efforts of their industrial skill. The Commission have always had support and encouragement from them during the progress of the undertaking, and they cannot forget how cheerfully they submitted to regulations essential for their general good, although sometimes producing personal inconvenience to themselves. If the Exhibition be successful in aiding the healthy progress of manufactures, we trust that their efforts will meet with a due reward.

In now taking leave of all those who have so materially aided us in their respective characters of Jurors and Associates, Foreign and Local Commissioners, Members and Secretaries of Local and Sectional Committees, Members of the Society of Arts, and Exhibitors, I cannot refrain from remarking with heartfelt pleasure, the singular harmony which has prevailed amongst the eminent men representing so many national interests—a harmony which cannot end with the event which produced it. Let us receive it as an auspicious omen for the future; and while we return our humble and hearty thanks to Almighty God for the blessing He has vouchsafed to our labours, let us all earnestly pray that that Divine Providence which has so benignantly watched over and shielded this illustration of Nature's productions, conceived by human intellect, and fashioned by human skill, may still protect us, and may grant that the interchange of knowledge, resulting from the meeting of enlightened people in friendly rivalry, may be dispersed far and wide over distant lands; and thus, by showing our mutual dependence upon each other, be a happy means of promoting unity among nations, and peace and goodwill among the various races of mankind.

ALBERT.

LIST OF JURY AWARDS.

GENERAL COUNCIL MEDALS.

His Royal Highness Prince Albert	For the original conception and successful prosecution of the idea of the Great Exhibition of 1851, Joint Medal with that granted for the Model Lodging House in Class VII.
Chamber of Commerce, Lyons	For the Collection which it exhibits, in which is shown the general progress made through their exertions in the Silk Manufactures of Lyons.
East India Company, The Honourable	For the very valuable and extensive collection illustrating the Natural Resources and Manufactures of India.
Egypt, H.H. The Viceroy of	For the very valuable and extensive collection, illustrating the Manufactures and Natural Resources of Egypt.
French Minister of War	For the part taken by him in exhibiting the valuable collection of Raw Products from Algeria.
Spain, The Government of	For the valuable and extensive collection of Raw Products, showing the Natural Resources of Spain.
Tunis, The Bey of	For the very valuable and extensive collection illustrating the Manufactures and Natural Resources of Tunis.
Turkey, The Government of	For the valuable and extensive collection of Raw Products, showing the Natural Resources of Turkey.

CLASS I.

[*The Catalogue Numbers refer to the corresponding Numbers in the Official Descriptive and Illustrated Catalogue.*]

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	51	Berard and Co.	Process for washing and purifying coals.
United Kingdom	65	Brockedon, W.	Cumberland lead, condensed in blocks.
France	1214	Estivant Brothers	Brass of superior quality produced by a novel process.
Prussia	6	Güttler, W.	Treatment of arsenical ores, and the extraction of gold from them.
Austria	424	Kleist, Baron Von	Iron of superior quality and manufacture.
Prussia	649 & 677	Krupp, Fried	Cast steel of superior and novel quality.
United Kingdom	480	Pattinson, H. L.	Process of separating silver from lead by crystallization.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	430	Abercarn and Gwythen Collieries Company. (Awarded to Ebenezer Rogers.)	Process for blasting, &c.
United States	344	Adirondac Manufacturing Company, New York.	Steel and iron.
Belgium	368	Amand, Joseph	Quality of iron.
Nova Scotia	2	Archibald, C. D.	Cast iron.
United Kingdom	53	Bagnall and Jesson (Outside, West).	Section sample of coal from South Staffordshire thick seam.
——	411	Bagnall, J. and Sons	Rod iron.
France	1071	Baudry, A. T.	Quality of steel.
United Kingdom	424	Bickford, Smith, and Davey	Safety fuse.
——	411	Bird, W. and Co.	Collection illustrating the iron trade.
——	427	Blackwell, S.	Collection of iron ores, with descriptive catalogue.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	83	Bowling Iron Company, The (Bradford) (Cl. XXII.)	Quality of iron.
——	509	Buccleuch, The Duke of	Apparatus for condensing the fumes of lead-works.
——	494	Byers, J.	The manufacture of lead.
Belgium	377	Chaudoir, C. and H.	Brass and brass tubes.
United Kingdom	115	Cocker, Samuel and Son (Sheffield) (Cl. XXII.)	Quality of steel.
France	1564	Colin, J. R.	Polished granite and serpentine.
Belgium	376	Delloye-Matthieu, C.	Iron, sheet iron, and steel.
Russia	21 & 120	Demidoff, Messrs.	Iron and copper.
France	162	Dervillé and Co.	Marbles from the Pyrenees.
——	476	Deyeux, —	Crucibles.
United Kingdom	412	Ebbw Vale Company, The	Collection of manufactured iron models, &c.
Austria	409 410 & 425	Egger, Ferdinand, Count von	Iron and steel.
Canada	5	Ferrier, Hon. J.	Quality of iron.
Austria	420	Fischer, Anton	Steel and iron; iron wire.
France	229	Gallicher and Co.	Quality of iron (known as Berry iron).
——	230	Gandillot and Co.	Iron tubes.
Bavaria	95	Gienanth Brothers	Iron and steel.
South Australia	3	Graham and Hallett	Specimens of copper from the mines of Burra Burra.
United Kingdom	210	Greaves, J. W.	Specimens of slates, &c., from Festiniog.
France	531	Groult and Co.	Copper tubes, &c.
——	532	Gueuvin Bouchon, and Co.	Millstones.
United Kingdom	85	Hird, Dawson, and Hardy (Low Moor Company). (Cl. XXII.)	Quality of iron.
——	472	Hosking, R.	Reversing apparatus for stamping.
Prussia	632	Huth and Co.	Steel.
India	–	Indian Iron and Steel Company	Wootz steel and manufacture.
United Kingdom	109	Johnson, Cammell, and Co. (Cl. XXII.)	Quality of steel.
——	477	Johnson and Matthey	Collection, metallurgic.
Grand Duchy of Hesse	6	Jonghaus and Venator	Geological maps.
Prussia	3	Königshütte, Royal Iron Foundry at	Cadmium.
Sweden and Norway	34	Kongsberg Silver Works	Silver ores, illustrative.
Prussia	321	Landau, S.	Lava millstones of Andernach.
——	447	Lehrkind, Falkenroth, and Co.	Steel.
Spain	21	Lenense Asturian Company	Iron and steel.
United Kingdom	20	MacDonald, Major C.	Collection of turquoises.
Prussia	2	Malapane, The Royal Iron Foundry at	Zinc.
——	850	Mansfeld, The combined Mining Works of.	Copper and copper smelting.
France	627	Méhu, J. M. F.	Apparatus for raising miners and materials.
United Kingdom	84	Meinig, C.	Collection of grindstones, hones, &c.
Van Diemen's Land	–	Milligan, J.	Series of rocks and minerals.
United Kingdom	418	Mills, R.	Plan for opening and closing doors in mines.
Belgium	366	Moncheur, F. and A.	Quality of iron.
Canada	10	Montreal Mining Company	Copper manufacture.
United States	44	Morris, Jones, and Co.	Plate iron.
Sweden and Norway	6	Motala Iron and Engine Works	Iron, quality of.
Belgium	24	Mueseler, M. L.	Safety lamps.
Nassau	1	Nassau, The Government Engineers of Mines of	Collection of mineral produce and metallurgy of Nassau.
United Kingdom	199	Naylor, Vickers, and Co. (Cl. XXII.).	Quality of steel.
Switzerland	1	Neuhaus and Blösch	Fine iron wire.
United States	166	New Jersey Exploring and Mining Company.	Zinc ores, iron (Franklinite) ores, smelting process, &c.
United Kingdom	273	Northumberland and Durham Coal Trade.	Collection exhibited.
Belgium	7	Nouvelle-Montagne Zinc Mining Company, The	Zinc smelting and manufacture.
Nova Scotia	–	Nova Scotia, Central Committee in	Collection of mineral products.
Belgium	372	Orban, J. M., and Son	Sheet iron.
United Kingdom	485	Oxland, R.	The separation of wolfram and tin.
Belgium	6	Pommeroeul Smelting Company, The	Quality of iron.
Russia	20	Ponomareff, Madame (Iron Works of Khamounitsky).	Sheet and other iron.
France	1680	Poulet, J. F.	Spun lead.
Belgium	371	Remacle and Pérard	Sheet iron.
Prussia	452	Rochatz, C., and Co.	Zinc and its preparations.
——	11	Ruffer and Co.	Zinc and zinc plates.
Russia	1 to 19	Russia, Imperial Manufactories	Iron and copper.
Austria	417	Schwarzenberg, Prince.	Iron and steel.
United Kingdom	411	Selby and Johns.	Iron tubes and enamelled iron.
——	484	Sopwith, T.	Illustrations of lead manufacture, &c.
Belgium	8	St. Hubert, Ed. de	Millstones.
Prussia	318	Stolberg, Eschweiler Mining Company in	Lead and zinc.
Austria	411	Töpper, Andreas	Sheet and bar iron.
United States	167	Trenton Iron Company	Iron of fine quality, ores, &c.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	190	Turton and Sons (Cl. xxii.)	Quality of steel.
Tuscany	2 to 11	Tuscany, Royal Mines of	Illustrative mineral and metallurgic series.
—	1	Tuscany, Royal Technological Institute of	Mercury ores.
Austria	423	Wöllersdorf Tin Plate Works.	Sheet iron, for tin plates.
—	408	Vienna, Depôt of Imperial Mines at.	Iron and steel (cast) and cinnabar.
—	405	Zois, Widow, Carl	Quality of iron and steel.

HONOURABLE MENTION.

France	1051	Alluaud, —, sen.	China clays (Limoges).
Austria	415	Andrassy, Count G.	Rod iron.
United Kingdom	462	Arthur, J.	Apparatus for pumps, &c.
South Australia	2	Barossa Range Mining Company, The	Copper ores.
United Kingdom	41	Barrow, Richard (Outside, West)	Block of coal (Derbyshire).
—	415	Beecroft, Butler, and Co.	Iron and steel.
—	417	Biddulph, J.	Tin plates.
Prussia	453	Böing, Röhr, and Leffsky	Iron and steel.
Algeria	20	Bona Mines and Iron Works Company	Iron and steel.
Belgium	399	Boucher, T.	Refractory clay.
Austria	414	Bouquoi, Count (Kallich Foundry.).	Iron.
Portugal	1295	Bracal Mine	Samples of lead ore.
United Kingdom	47	Brymbo Company, The (Outside, West).	Block of coal (North Wales).
—	495	Burr, T. W. and G.	Specimens of lead ore.
—	400	Butterley Iron Company	Coal and ironstone.
France	448	Chapot and Selon	Lithographic stones.
Canada	12	Chaudière Mining Company	Native gold.
Belgium	119	Cockerill, J.	Model of a lifting machine for miners.
—	5	Collette-Doucet, F. J.	Grindstones, &c.
Spain	29	Cordova, The Province of	Marbles.
United Kingdom	402	Crutwell, Allies, and Co.	Iron ores.
United States	191	Darling, W.	Iron ores, &c.
Portugal	120 to 231	De Figueiredo, J.	Marbles.
Belgium	14	De Gaiffier d'Hestroy, The Baron	Porcelain clay.
Portugal	110 & 111	Déjeant, —	Lithographic stones.
Prussia	432	Dickert, Thomas	Maps.
Van Diemen's Land	–	Douglas River Coal Company	Coal.
Prussia	449	Dressler, J. H., sen.	Iron ore.
Belgium	494	Dupierry, jun.	Whetstones.
France	1597	Eloffe, —	Collection of specimens (geological and mineral)
Belgium	10	Fallon-Piron, J. B.	Namur marble.
—	15	Ferrare, F. and L., De	Plastic clay.
United States	469	Feuchtwanger, Dr. L.	Collection of minerals, fossils, and fresh-water shells.
Austria	421	Fischer, Berth.	Cast steel.
Switzerland	47	Fischer, J. C.	Steel in bars.
United Kingdom	48	Fitzwilliam, The Earl (Outside, West)	Section of coal-beds (Barnsley).
Austria	412	Fürstenberg, Prince	Specimens of iron.
France	226	Gaillard, —, sen.	French millstones (burrs).
United Kingdom	488	Garland, T.	Arsenic from tin ores.
Spain	23	Giró, J.	Iron.
Prussia	592	Graff, P.	Cobalt and ores.
Sardinia	1	Grange, F.	Spathic iron ores.
Greece	–	Greek Government	Steatite.
United Kingdom	506	Grey, J.	Zinc and zinc ores.
Belgium	1	Guillaume, J. A.	Whetstones.
Sweden and Norway	16	Guldsmed-shyttan, The Mines of	Argentiferous lead.
Prussia	454	Hambloch, J.	Iron ore.
Trinidad	–	Harris, Lord	Series of minerals.
United Kingdom	22	Haywood, J. (Outside, West)	Collection of grindstones.
—	23	Highley, S., jun.	Collection of sulphur, &c.
—	29	Howard, T.	Collection of building stones.
Austria	428	Hüber, F.	Iron and steel wire.
United Kingdom	487	Jordan, C.	Metals and alloys, specimens of.
—	91	King and Co.	Stourbridge clays.
Austria	5	Kochmeister, Friedrich	Nickel and cobalt.
Belgium	3	Lamberty, C.	Whetstones.
—	25	Lamberty Brothers	Whetstones.
France	1710	Lapeyrière, C.	Quality of iron.
—	290	Larivière, C.	Angers slates.
United Kingdom	125	Lee, Dr. J.	Samples of sand.
United States	322	Lee, W.	Iron ore.
Austria	16	Lobkowitz, Prince Ferdinand von	Garnets.
Canada	1	Logan, W. E.	Manganese and iron ores.
Prussia	324 & 326	Lohe and Stahlberg, Royal Forges at	Steel.
Nassau	2	Lossen, M.	Iron, &c.
Spain	31	Madrid, The Royal Library of	Marbles.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Prussia	438	Mannheimer, Wolff	Amber.
Belgium	396	Marchin, Communal Commission of	Quartzose conglomerate.
Canada	4	Marmora Iron Company	Iron, &c.
France	1344	Marx and Co.	Lithographic stones.
Prussia	316	Meinerzhagen, and Kreuser Brothers	Lead ores, &c., from the mines of the Count Julius of Lippe, and Messrs. Kreuser Brothers.
Austria	1	Miesbach, A.	Lignites.
Greece	15	Milo, —	Specimens of steatite.
United Kingdom	426	Monkland Iron and Steel Company, Glasgow.	Coal, ores, clays, &c.
Belgium	9	Morimont, J. B.	Millstones.
United States	202	Morrell, Stewart, and Co.	Sheet iron.
United Kingdom	46	Nesbit, J. C.	Phosphatic fossils, &c.
——	34	Oakeley, E. (Outside, West)	Block of coal from North Wales.
Belgium	4	Offergeld, P. J.	Whetstones.
Prussia	62	Ohle, E. F., Heirs of	Lead tubes, &c.
Belgium	2	Otte, C. J.	Whetstones.
United Kingdom	36	Paine, J. M.	Phosphatic fossils, &c.
Portugal	–	Palmella, The Duke of.	Marbles.
New Granada	–	Paris E.	Emeralds.
Russia	23	Pashkoff, Michael	Copper.
——	24	Pashkoff, Alexander	Copper.
Belgium	395	Pastor, B., and Co.	Fire-clays and bricks.
United States	74	Peale, C. W.	Anthracite.
Belgium	18	Pérard and Mineur	Iron.
United Kingdom	101	Phillips, W.	China clays.
——	500	Phillips, Smith, and Co.	Iron and tin plates.
Sardinia	3	Pianello, D.	Slates.
Russia	15	Poland, Imperial Mines of.	Cadmium.
Portugal,	112	Portugal Royal Tobacco Contractors	Lithographic stones.
Austria	400	Radmeister Community	Iron.
Sweden and Norway	2	Rettig, C. A.	Iron ores, &c.
France	1448	Roger, —, jun.	French burrs (La Ferté).
United States	314	Rousseau, A. J.	Iron ores.
——	416	Ruggles, G. H.	Sheets of mica.
Spain	32	Saragossa, The Province of	Marbles.
Austria	429	Schell, Carl	Iron wire.
——	15	Schönborn, Erwein, Count von	Garnets.
Prussia	303	Schropp and Simon	Maps.
China	–	Shanghae, Her Majesty's Consul at	Collection illustrative of porcelain manufacture.
Portugal	991 to 1014	Silva, Da, Manuel Antonio	Samples of shot.
India	–	Singapore, Local Committee of	Tin ores.
United Kingdom	410	Solly and Co.	Iron and steel.
——	469	St. Austell Local Committee	Series illustrating tin.
——	473	Swansea Committee	Specimens of copper.
Austria	4	Szumrák, J. F.	Cobalt ores, &c.
United Kingdom	434	Taylor, R.	Model of mining machinery.
Belgium	394	Temsonnet, G., and Dartet	Fire-clays.
United Kingdom	14	Tennant, J.	Collection of minerals, &c.
Prussia	40	Tessler, D. F.	Amber.
United Kingdom	24	Thistlethwayte, H. F.	Collection of precious stones.
Belgium	12	Tombelle-Lomba, E.	Porcelain clay.
France	1508	Touaillon, C. (Representative of M. Thell, Gérant de la Société meulière d'Epernon.)	Millstones.
Sweden and Norway	36	Treschow,— (Tritzoe, Laurvig, Norway).	Iron bars (quality).
United Kingdom	468	Truro Local Committee	Series illustrating tin.
Sweden and Norway	9	Tunaberg Cobalt Works	Cobalt, &c.
Austria	13	Volderauer, Georg	Arsenic, &c.
Prussia	446	Vorster, C. D.	Iron and steel.
United Kingdom	431	Wales, J.	Model of coal-mine, &c.
United States	408	Ward, W. and J. W.	Copper ore.
United Kingdom	230	Warlich's Patent Fuel Company	Patent fuel.
Canada	2	Wilson, Dr. J.	Magnetic iron ores, &c.
United Kingdom	416	Wingerworth Iron Company	Iron and steel.
Wurtemburg	1	Zeller, F.	Millstones.
Sardinia	2	Zolesi, S.	Slates.

CLASS II.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	1620	Guimet, J. B.	Artificial ultramarine.
Tuscany	24	Larderel, Count F. de	Boracic acid, and method of preparing it.
United Kingdom	441	Longmaid, W. (Cl. I.)	Process for treating copper pyrites with common salt.
France	1682	Prat and Agard	Salts of potash, and other products of sea-water.

PRIZE MEDAL.

France	1049	Avignon, The Chamber of Commerce of.	Garancine.
United Kingdom	45	Barnes, J. B.	Valerianates.
Austria	9	Batka, Wenzel	Metallic preparations, &c.
Prussia	312	Bischof and Rhodius	White lead.
Netherlands	1	Bleekrode, Professor S., and Enthoven, K.	Oxide of zinc.
United Kingdom	48	Blundell, Spence, and Co.	Painters' colours.
France	1092	Bobée (Widow) and Lemire	Acetic acid and acetates.
Sardinia	12	Bonjean, J.	Ergotine.
France	376	Bouxwiller Mining Company, The	Prussiate of potass, alum, &c.
United Kingdom	27	Bramwell, T. and Co.	Prussiate of potass.
Austria	20	Brosche, F. X.	Succinic acid, and oxides of chromium and uranium.
United Kingdom	57	Brown, F.	Oxide of zinc.
——	7	Brown and Co.	Salts of ammonia.
Grand Duchy of Hesse	1	Büchner, W.	Ultramarine.
United Kingdom	34	Bullock, J. L.	Rare organic products.
——	85	Burt, S. J.	Cantharadine.
Belgium	37	Cappellemans, Deby, and Co.	Pink salt, &c.
France	793	Cerceuil, L. F.	Dyed flocks.
Prussia	12	Cochius, E. E.	Prussiate of potass.
France	802	Colville, Mlle. Anna	Colours for porcelain painting.
——	1156	Conrad, W.	Chemical preparations.
Tuscany	22	Corridi, G.	Santonine and other chemicals.
France	462	Cournerie and Co.	Iodine, &c.
——	807	Courtial, —.	Ultramarine.
Prussia	458	Curtius, J.	Ultramarine.
United Kingdom	63	Dauptain, Gorton, and Co.	Ultramarine.
——	111	Davenport, J. T.	Chemical products.
——	62	Davy, Mackmurdo, and Co.	Glycerine, and various salts.
France	109	De Cavaillon	Salts of ammonia.
United Kingdom	8	Dentith, W., and Co.	Salts and colouring matters, and oxide of zinc.
France	169	Drouin and Brossier	Printers' colours, &c.
Sardinia	13	Dufour, L.	Quinine.
France	1229	Fouché-Lepelletier	Chemical products.
Bavaria	12	Gademann, H.	Ultramarine.
United Kingdom	92	Godfrey and Cooke	Pharmaceutical products.
——	10	Hähnel and Ellis	Sulphate of copper.
Austria	26	Heinzen Brothers	Cudbear and archil.
United Kingdom	24	Hemingway, A. and W.	Salts of iron.
Austria	30	Herbert, F. P., Baron von.	White lead.
Prussia	683	Herrmann, O.	Glacial phosphoric acid, &c.
United Kingdom	23	Hills, F. C.	Sal ammoniac
——	41	Hopkin and Williams	Chemical products.
——	11	Howards and Kent	Alkaloids, and other preparations.
——	13	Hurlet and Campsie Alum Company	Alum and prussiates.
——	86	Huskisson, J. W. and H.	Chemical products.
Wurtemburg	4	Jobst, F.	Quinine.
United Kingdom	90	Kent, J. H.	Dried pharmaceutical herbs.
France	555	Kuhlmann Brothers	Chemical products.
Prussia	13	Kunheim, Dr. Louis	Pink salt, and oxide of uranium.
United Kingdom	9	Kurtz, Clement Augustus	Colouring matters.
France	580	Lefebre, T. and Co.	White lead.
——	308	Leroux, —.	Salicine.
Prussia	875	Leverkuss, C.	Ultramarine.
United Kingdom	107	MacFarlan, J. F. and Co.	Chemical products.
Prussia	464	Mathes and Weber	Chemicals, &c.
United Kingdom	14	May and Baker	Chemicals; mercurial preparations.
France	916	Meissonier, Charles	Chemical products.
——	925	Ménier and Co.	Pharmaceutical extracts.
——	640	Michel, A.	Extracts; colouring woods.
United Kingdom	17	Moberley, W.	Alum.
France	325	Moreau, A.	Products of distilled bitumen.
United Kingdom	106	Morson, T. and Son	Organic products.
Prussia	323	Pauli, Otto	Phosphorus, &c.
United Kingdom	1	Pontifex and Wood	Tartaric and citric acids, and other chemicals.
United States	262	Powers and Wightman.	Chemicals.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Tuscany	25	Ridolfi, Prof. M..	Artists colours for encaustic painting.
Nassau	7	Röhr, F.	Ultramarine.
Russia	28	Sanin, —	Salts of lead, &c.
Saxony	10	Saxon China (Meissen) Manufactory, The Royal	Fine ultramarine.
Mecklenburgh-Strelitz	3	Scharenberg, A..	Red lakes.
Russia	27	Schlippe, C.	Prussiates; alum, &c.
United Kingdom	9	Schmersahl, Auguste Edward.	Ultramarine.
——	61	Scott, L.	Oxide of zinc.
Wurtemburg	6	Siegle, H..	Red lakes.
United Kingdom	94	Smith, T. and H.	Aloine and cantharadine.
France	1020	Sorel, —	Oxide of zinc.
United Kingdom	31	Spencer, J. A.	Chemical products.
——	93	Squire, P..	Chemical and pharmaceutical products.
Prussia	460	Stohmann and Wüstenfeld	Chemical preparations.
United Kingdom	119	Sturge, J. and E.	Red phosphorus.
Belgium	26	Vieille Montagne Zinc Mining Company.	Oxide of zinc.
Austria	19	Wagenmann, Seybel, and Co.	Chloride of potassium.
United Kingdom	–	Wallich, Dr. N.	For specimens of woods furnishing substances used in pharmacy.
——	89	Ward, J.	Iodine, &c.
——	32	Watt, W.	Iodine, &c.
——	103	Watts, J.	Chemical and pharmaceutical products.
Prussia	684	Weiss, J. H.	Red lakes.
——	461	Wesenfeld and Co.	Sulphate of soda.
——	334	Wiesmann, A. and Co..	Products of distilled schist.
United Kingdom	6	Wilson, J. and Son	Alum.
——	28	Winsor and Newton	Artists' colours.
——	7B	Young, J.	Stannate of soda; mineral oil; paraffine from coals, &c.
Frankfort-on-Maine	3	Zimmer, C.	Quinidine.
France	1536	Zuber, J. and Co.	Ultramarine.

HONOURABLE MENTION.

Sardinia	7	Albani Brothers.	Chemical products.
France	1541	Anthelme, —	Alum.
Prussia	826	Augustin, H. F. L.	Acetate of lead.
Austria	34	Bigaglia, Pietro	White lead.
Prussia	313	Bleibtreu, L..	Alum, &c.
Belgium	42	Brasseur, E.	White lead.
Austria	21	Braun, G. J.	Stannate of soda.
France	438	Brière, A.	Arsenical preparations.
Russia	29	Brusghin, Alexander	Prussiate of potash.
United Kingdom	4	Buckley, J. The Trustees of the late.	Copperas.
——	3	Button, C.	Collection of chemicals.
Sardinia	11	Calloud, F.	Phloridzin.
United Kingdom	26	Clifford, G.	Process for restoring parchment deeds injured by fire.
——	228	Cobbold, E. (Cl. i.)	Peat products.
France	1153	Coignet and Son.	Phosphorus.
——	801	Collas, M. A. C..	Coal tar.
United Kingdom	15	Cook, T. A.	Carbonate of soda.
——	118	Copney, W.	Single crystals of salts.
France	1180	Delignou, V.	Oil of schists.
Prussia	7	Dubois, C. A.	Samples of cinnabar.
United Kingdom	58	Ellam, Jones, and Co.	Various pigments.
——	227	Evans, G. (Cl. i.)	Peat products.
Belgium	38	Floreffe, Société de	Chemical products.
United Kingdom	55	Fowler, J. P.	Benzoic acid.
——	44	Fox and Barrington	Various chemicals.
France	1245	Gautier-Bouchard	Various colours.
United Kingdom	75	Hayes, P., and Co.	Resin oils.
Austria	32	Herbert, Ignaz, Baron von	Red lead.
Prussia	465	Hesse, Electoral Blue Colour Works of, Schwarzenfels.	Cobalt and smalts, ultramarine.
United Kingdom	60	Johnson, J. R.	Extracts, madder, &c.
——	102	Keating, T.	Matico, and other drugs.
Austria	27	Kinzelberger and Co.	Various colours.
——	24	Kutzer and Lehrer	Ultramarine, &c.
France	581	Lefèvre, sen..	Oxide of zinc.
United Kingdom	16	Lindsay, G.	Copperas.
Prussia	8	Lucas, Moritz	Samples of cinnabar.
France	317	Maire and Co.	Vinegar.
Prussia	327	Marquart, Dr. L. C.	Bisulphide of carbon, &c.
United Kingdom	68	Marshall, J.	Lichens.
——	2	Melincrythan Chemical Company	Acetate of lead.
United Kingdom	1	Miller, T. (Fine Art Court) (Cl. xxx.)	Various pigments.
Tuscany	26	Mussini, Professor C.	Lake colours and varnish.
Hesse, Grand Duchy of	8	Oehler, K.	Tar oil.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	225 & 485	Oxland, Robert (Cl. I.)	Peat products.
——	113	Oyler, S.	Specimens of lint.
——	33	Picciotto, M. H.	Purified gum.
——	121	Pinto, Perez, and Co.	Acetate of lead.
Netherlands	2	Poortman and Visser	White lead.
United Kingdom	108	Pound, M.	Bail, a new astringent drug.
——	7	Reeves and Sons (Fine Art Court) (Cl. XXX.)	Various pigments.
——	6	Robertson and Co. (Fine Art Court) (Cl. XXX.)	Various pigments.
——	240	Rogers, J. (Cl. I.)	Peat products.
France	1452	Rosselet, C. P. H.	Chemical preparation for restoring gold and silver embroideries.
United Kingdom	3	Rowney and Co. (Fine Art Court) (Cl. XXX.)	Various pigments.
——	59	Russell and Robertson	Chromate of lead.
Sardinia	10	Saluce, M.	Pharmaceutical collection.
Spain	242	Sauto, Ambrosio	Collection of pharmaceutical preparations.
Bavaria	14	Sattler, W.	Various lakes.
——	15	Schruck and Uhlich	Ultramarine.
Austria	23	Setzer, Johann	Cadmium yellow, and ultramarine.
United Kingdom	7	Spence and Dixon	Alum.
——	20	Stevenson, W.	Carbonate and bicarbonate of soda.
Netherlands	3	Stratingh and Co.	White lead.
United Kingdom	7	Tennants, Clow, and Co.	Various salts.
——	21	Tulloch, A. T., Capt.	Materials used in the manufacture of gunpowder, &c.
Austria	18	Weber, G. D.	Cream of tartar.
United States	43	Wetherell and Brother	Various salts.
United Kingdom	47	Wood and Bedford	Lichens.

CLASS III.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United States	524	Borden, Gail, jun.	The preparation called "meat biscuit."
France	1576	Darblay, —, jun.	The Gruaux and household flour, of very fine quality, obtained by his novel and economical process.
——	667	Grar, N., and Co.	The sugar obtained from beet-root by the barytic process.
United Kingdom	105	Lawson, Peter, and Son	Their admirably displayed, very complete, instructive, and scientifically arranged collection of the vegetable products of Scotland.
France	1348	Masson, E.	Dried vegetables prepared by his new and economical process.
——	1485	Serret, Hamoir, Duquesne, and Co.	Beet-root sugar, procured by a method, the result of which is to save valuable substances previously lost in the manufacture, and consequently to reduce materially the price of the sugar itself.

PRIZE MEDAL.

United Kingdom	107	Albert, H. R. H. Prince	Sample of beans and winter oats.
Ceylon	–	Albrecht, Greenhill, and Co.	A very fine series of cinnamon.
India	–	Aska Sugar Factory, Madras Presidency.	Ganjam sugar.
United Kingdom	143	Assam Company	Assortment of teas.
India	–	Astagram Sugar Company	Different kinds of sugar.
British Guiana	36	Anderson, G., and Co.	Sugar.
Spain	139B	Avilés, The Borough of	A Montanches ham.
Russia	29	Baguer, —	Wheat (Arnaout) from the Government of Saratoff.
Cape of Good Hope	46	Bam, J. A.	Soft wheat.
United States	246	Barnes, W.	Maple sugar.
United Kingdom	116	Batty and Feast	Pickes.
Switzerland	52	Baup, H.	Meats preserved by simple desiccation.
France	1073	Bazin, —, sen.	A new variety of wheat, and an important collection of agricultural produce.
United States	103	Bell, T.	Soft wheat from Genessee.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	39	Benson, W.	A fine selected series of varieties of American and other tobacco, raw and manufactured.
Sardinia	18	Blondel, Gaston, and Co.	Rice.
United Kingdom	162	Buck, Peter, and Son	Oatmeal and wheat-flour.
France	1126	Cabanes and Rambié	Flour (thirds).
Lübeck	2	Carstens, D. H.	Excellent preserved meats.
France	121	Chevet, —, jun.	Preserved meats and vegetables.
United Kingdom	159	Chitty, Edward	Flour (best whites).
Canada	35	Christie, D.	White wheat.
Cape of Good Hope	54	Clarence, R.	Dried fruits.
Belgium	81	Claus and Caron	Cane sugar.
United Kingdom	56	Clemens, J.	Malaga raisins and Jordan almonds.
——	49	Cohen and Orr	Havannah cigars (Ugues Brand).
——	11	Copland, Barnes, and Co.	Preserved meats and vegetables.
Russia	37	Cossacks on the estates Petroffskaja and Novo-Spasskaja (Azof Sea).	Wheat, black and blue-eared, called Boolgarka.
France	465	Crespel-Delisse, T.	Beet sugar.
Portugal	412 to 416	Da Fonseça Vaz, Pinto	Dried fruits.
France	153	Damainville, —	Artificial honeycomb.
United States	245	Dean, L.	Maple sugar.
Van Diemen's Land	–	Deane, Dray, and Deane	White wheat.
Spain	–	De Arrieta, Jose Joaquin	Sugar from Havannah, prepared by the vacuum process in the plantation itself.
France	47	De Beauvoys, Ch.	A hive on the plan of Huber.
Spain	126B	De Cabañas and Cabazal	Cigars of Havannah (Cabanas).
France	365	De Sandoval and Co.	Chocolate.
Spain	173A	De Zulueta, J.	Sugar from Havannah.
United States	273	Dill and Mulchahey	Cavendish tobacco.
——	363	Duffield, C.	Ham.
India	–	East India Company, The Hon.	A collection of rices, teas, spices, and cigars.
Spain	176	Enriquez, J. N.	Cane sugar from Velez, Malaga.
Russia	60	Ershoff, Lieut.-General	Fine samples of millets (*Panicum miliaceum et Italicum*).
Tunis	–	Etteib-Mohsen	A collection of varieties of dates.
Egypt	–	Egypt, H. H. the Viceroy of	Soft white wheat.
United Kingdom	54	Faulkner, R. and C.	Preserved fruits.
France	505	Féry, A.	Rice, from the Landes of Bordeaux.
——	209	Feyeux, N. D. M.	A series of fécules, and similar substances.
Canada	–	Fisher, Arthur	Maple sugar.
United Kingdom	55	Fortnum, Mason, and Co.	A fine collection of dried fruits.
——	31	Fry, Joseph Storrs, and Son	Series illustrating the manufacture of cocoa and chocolate.
——	12	Gamble, J. H.	Preserved meats.
Sardinia	9	Garassini, P.	Vino di Arancio.
Portugal	403 418 to 420	Gomes, J. L.	Dried figs.
Spain	126A	Gonzalez-Alverá, Buenaventura	Cigars of Havannah (Râmas).
United States	284	Grant, J. H.	Cavendish tobacco.
Grenada	1	Grose, H.	Nutmegs.
France	1262	Guihery, Deslandelles, and Co.	Preserved meat and vegetables.
South Australia	5	Hallet, R., and Sons	Wheat (white soft); wheat flour.
Labuan	2	Hammond, W. P., and Co.	Sugar and tea from Siam, and spices.
South Australia	9	Heath and Burrows	Wheat (white soft).
United States	114	Hecker and Brother	Genessee flour.
——	172c	Heriot, E. T.	Carolina rice.
United Kingdom	7	Hills and Underwood	Malt vinegar.
France	1277	Jeanti, Prevost, Perraud, and Co.	Beet sugar.
United Kingdom	42	Jonas, E., and Brothers	English cigars, manufactured from Havannah tobacco.
——	43	Jones, B. and Co.	A collection of Havannah cigars, representing the state of the English market.
Canada	41	Jones, D.	White peas.
Austria	68	Jordan and Barber	Gruaux and common flour.
United Kingdom	150	Kidd and Podger	Flour.
United States	84	Kirtland, B. B.	A collection of maize, thirty-four varieties.
Russia	32	Koucheleff, Count	A collection of corn and hops.
United Kingdom	40	Lambert and Butler	English cigars, manufactured from Havannah tobacco.
Jersey and Guernsey	2	Le Couteur, Colonel	A series of wheats.
Algeria	33	Lepelletier	Soft wheat.
Canada	40	Limoges, D.	White peas.
United Kingdom	44	Lundy Foot and Co.	Snuff.
India	–	MacClelland, Dr.	Isinglass, from the *Polynemus plebeius*.
Borneo	–	MacHenty, —	Coffee.
United Kingdom	114	MacKillican, James	White wheat.
Van Diemen's Land	–	MacPherson and Francis	Wheat.
France	1337	Magnin, J. V.	Macaroni, vermicelli, and hard wheat of Auvergne.
——	1339	Maille and Segond	Wine vinegar aromatized.
United Kingdom	79	Maund, B.	Hybrid wheats.
Spain	66	Medina del Campo, The Mayor of	Wheat.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Van Diemen's Land	53, 54, & 55	Milligan, A. M.	Biscuits.
United Kingdom	291	Milton, J. (Cl. IX.)	Improved cottage hive.
——	34	Monteiro, L. A.	Chocolate.
——	139	Moore, Edward Duke	Preserved milk and cream.
New South Wales	7	Newcastle, N. S. W., Fresh Meat Preserving Company.	Preserved boiled mutton.
United States	83	New York State Agricultural Society.	Collection of wheats.
United Kingdom	62	Paine, J. M.	Golding's hops.
Tuscany	29	Paoletti, F.	Macaroni, vermicelli, &c.
United Kingdom	[illegible]	Payne, H.	Revitt wheat.
France	343	Perron, E.	Chocolate.
Portugal	1203 to 1207	Portugal Royal Tobacco and Snuff Company.	Cigars and snuff.
Trinidad	–	Purdie, W.	Nutmegs, cloves, black pepper, and cigars; cocoa, prepared for the Spanish market.
United States	128	Raymond and Schuyler	Flour (thirds).
United Kingdom	74	Raynbird, Hugh.	Hybrid wheat.
Canada	–	Reinhardt, G.	Ham.
United Kingdom	52	Richardson Brothers	Roll tobacco and snuff.
——	59	Richardson, Timothy, and Sons	For Golding's hops, grown by Mr. Phillips, of Offham, in Mid Kent.
Austria	57	Richter, Anton, and Co.	Beet sugar.
China	–	Ripley, P. W.	A large assortment of teas of the finest quality.
United Kingdom	15	Ritchie and M'Call	Preserved meat.
Canada	126	Robb, J.	Biscuits.
United States	265	Robinson, P.	Cavendish tobacco.
Russia	66	Roussanoff, —	Wheat flour.
France	1457	Rousseau Brothers	Beet sugar.
United States	200	Schooley and Hough	Ham (Cincinnati).
Russia	52	Selivanoff, —	Oats, grown from English seed.
——	42	Shabelsky, Colonel	Wheat (hard Odessa).
Canada	48	Simpson, J. and Co.	Wheat flour.
——	64	Smith, B.	Hops.
United Kingdom	28	Snowden, R.	Coffee prepared by his process of separating the tough membrane from between the folds of the seed or berry.
Russia	76	Spiglazoff, Alexis	Russian cigarettes, from Russian-grown tobacco.
Canada	51	Squair, R.	Oatmeal.
Grand Duchy of Hesse	81	Stein and Schröder	Hops.
Turkey	–	Sublime Porte, The.	Hard wheat, and a very fine collection of Turkish tobacco; also honey.
United Kingdom	53	Travers and Co.	A collection of spices.
France	1046	Turpin, F. A.	Chocolate.
Spain	72	Valencia, The Province of.	Samples of rice.
France	1520	Vézon Brothers	Gluten, granulated.
United Kingdom	117	Vickers, James (Cl. IV.)	Russian isinglass.
Austria	62	Vienna, The Privileged Steam Flour Mill Company.	Flour.
France	738	Watrelot-Delespaul, —	Chocolate.
Canada	38	Watts, R. M.	Polish oats.
United Kingdom	72	Webb, Richard	Talavera wheat.
Mauritius	3	Webb Brothers and Co.	Sugar.
Prussia	695	Wittekop and Co.	Macaroni, vermicelli, &c.

HONOURABLE MENTION.

Canada	67	Bales, J.	Maple sugar.
United Kingdom	38	Benham, W. A.	Cocoa.
Belgium	78	Blyckaerts, G.	Very fine potato-flour.
United Kingdom	41	Bremner and Till	An assortment of fine unmanufactured tobacco.
United States	–	Bridge, John	Oil-cake.
New South Wales	2	Briears, J.	Spiced beef hams.
United Kingdom	16	Brocchieri, P.	Blood, preparation of, for alimentary purposes.
Prussia	687	Brumme and Co.	Beet sugar.
Canada	–	Bucke, R.	Arrowroot.
United Kingdom	68	Burn, R.	Oil-cake (cotton seed).
France	789	Camus, M.	Sardines.
Spain	112	Carabé, Manuel	Olives.
India	–	Carew and Co.	Loaf sugar from Rohilcund.
Prussia	468	Carstanjen, A. F. Sons	Cigars.
Spain	105	Casalo, J. R.	Dried raisins.
France	1558	Chailloux, Lepage, and Pochon	Honey.
Algeria	16	Chapel, —.	Canna arrowroot.
France	1149	Choquart, C.	Chocolate.
Prussia	15	Christiani, C. H.	Beer (for ships' use).
France	456	Cloet, C.	Fine pearl barley, vermicelli, and similar preparations.
——	1570	Courtin Raoult	Wine vinegars.
United Kingdom	92	Croughton, W. P.	Golden-pod beans.
Portugal	441	Da Fonte Boa, Viscount	Black olives, small, and of great excellence.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
British Guiana	12	Davison, W. (Demerara)	Plantain meal.
Canada	65	Dawes, Thomas, and Sons.	Hops.
Spain	100	De Alvear, J.	Dried plums.
Belgium	63	Degryse, Louis	Hops from Poperinghe.
Portugal	401 B	De Loulé, Marquis	Cyperus esculentus.
——	593	De Mattos, J. B.	Honey.
Belgium	64	Dequidt, Widow L.	Hops from Poperinghe.
Switzerland	71	Destraz, L.	A straw beehive.
United Kingdom	119	Dewar, T.	Preparations of mustard.
Spain	106	Enriquez, J.	Dried figs.
Greece	14	Eubœa, The Bishop of.	Honey (Rhodomeli).
Canada	59	Fisher, J.	Seeds of cameline.
——	127	Fletcher, J.	Capillaire, and raspberry vinegar.
New Brunswick	–	Fraser, W. J.	Preserved salmon.
Cape of Good Hope	–	Fredrichson, J. F.	Wheat flour.
United Kingdom	102	Gibson, C.	Barley grown at Pitlochry (600 feet above the sea).
Canada	133	Gillespie and Co.	Wood vinegar.
France	521	Gillet, A.	Sardines.
United Kingdom	63	Golding, R.	Golding's hops.
Bermuda	1	Gray, B. C. T., and Son	Arrowroot.
France	246	Gremailly, —.	Galantine de perdreaux.
——	530	Groult, jun.	Collection of fécules.
Russia	79	Hirshmann, Hirshendorf, and Ravitch.	Beet-root sugar.
Nova Scotia	–	Holliday, Tristram	Preserved salmon.
New Zealand	39	Hooper and Co.	Malt.
United States	342	Hotchkiss, W.	Wheat.
Ceylon	–	Hunasgiru, The Estate of.	Coffee.
Canada	62	Jeffries, G.	Clover seed.
Egypt	90, 91 & 92	Ilham Pasha, H. H.	Petit mais, samples of.
Cape of Good Hope	52	Joubert, J. G.	Honey.
United Kingdom	95	Juson, W.	Wheat flour.
Russia	31	Karnovitch, E.	Rape-seed.
Ceylon	–	Kirklees, The Estate of	Coffee.
United Kingdom	5	Kitchener, W. C.	Honey.
Russia	63	Khokholkoff and Gregorjeff	Dried green peas.
——	35	Klepatsky, —.	Wheat (hard).
France	1640	Laugier, —.	Honey.
Algeria	32	Lava and Co.	Flour (thirds).
France	297	Leblanc, A.	Flour (household).
United States	530	Lee, James, and Co.	Oil-cake.
France	303	Lemolt, A. F.	Cho'ca (a mixture of coffee and chocolate).
——	591	Lervilles, J.	Chicory.
Canada	73	Levey, J.	Tobacco for cigar-making.
Van Diemen's Land	297	Lipscombe, F.	A ham.
Austria	58	Lobkowitz, Ferdinand, Prince von	Beet sugar.
France	1334	Mabire, —, jun.	Wheat (English and Russian).
United Kingdom	153	MacCann, J.	Oatmeal.
Canada	61	MacGinn, T.	Timothy-grass seed.
St. Helena	3	Magnus, S.	Coffee.
Spain	133	Manso, R.	Pimientos de Vico (Logroño), or sweet capsicums.
France	922	Martin de Lignac	Consolidated milk.
New Zealand	–	Martin, Hugh	Barley.
France	925	Menier and Co.	Chocolate.
Spain	180	Molina, A.	Honey from El Moral de Calatrava.
United States	8	Mooklar and Chiles	Cavendish tobacco.
India	–	Morris, Captain	Coffee.
United Kingdom	–	Mortlock, Miss	Honey.
Cape of Good Hope	36	Moss, N.	Cigars.
South Australia	4	Moses, H. E. and M.	Australian wheat and flour; preserved meats.
Grand Duchy of Hesse	11	Müller, J. P.	Cigars.
Russia	75	Mustapha Idaroff	Turkish tobacco, from the Caucasian provinces.
Austria	56	Neuwall Brothers, Chevaliers de	Beet sugar.
Russia	338	Nikita Vsevolodowitch Vsevolojsky	Caviare.
Spain	107	Olmo, José	Dried peaches.
United States	104	Oswego Starch Factory	Fecula of maize.
Russia	54	Ounkovsky, —	Oats.
United States	305	Oyler and Anderson	Cavendish tobacco.
United Kingdom	22	Payne and Son	A collection of sauces and condiments.
France	948	Pellier Brothers.	Sardines.
——	950	Peneau, J.	Sardines, and roast mutton (preserved).
Hamburgh	5	Peterson, John	Rape cake.
United Kingdom	66	Peterson, T.	Collection of oil cakes.
Denmark	1	Puggaard, H., and Co.	Barley.
Malta	4	Pulis, G.	Fine white wheat.
Russia	49	Ratshinsky, —	Smolensko grits, from buckwheat.
New Zealand	–	Renwick, Thomas	Barley.
France	1686	Rigault, —, jun.	Wine vinegars.
Austria	55	Robert and Co.	Beet sugar.
Russia	47	Ropp, Baron.	Barley.
France	994	Rouchier, F., and Son	Preserved "petits pois."

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United Kingdom	47	Sales, Pollard, and Co.	English-made Yara cigars.
——	144	Saunders and Gatchell	Chicory.
——	70	Sheppard, A.	Wheat, malt, and barley, samples of
Russia	69	Sorokin, Catherine	Chicory.
United Kingdom	138	St. Etienne, Madame D.	Spinach, preserved by drying.
——	112	Sutton, J., and Sons	Naked barley.
——	77	Taylor, John, and Son	Malt.
United States	528	Thomas, James	Cavendish tobacco.
——	268	Thomas and Co.	Cavendish tobacco.
Austria	60	Tlumacz Beet-root Sugar Manufactory	Beet sugar.
Van Diemen's Land	47	Tooth, E.	Malt.
Canada	52	Trenholme, E.	Buckwheat, and its flour.
United Kingdom	71	Truro Local Committee, The.	Samples of corn from Cornwall.
Greece	13	Tsitzimbakos, A.	Honey (Hymettus).
Netherlands	69	Van der Linden, A.	Cigars.
Belgium	65	Van Meries, Madame	Hops from Poperinghe.
——	82	Vercauteren, J. L.	Linseed oil cake.
——	91	Vercruysse, H. and D.	Rape cake.
France	1528	Violette, J. H. M.	Biscuits.
Prussia	332	Wahl, F.	Potato sago.
Van Diemen's Land	51	Walker, J.	Fine flour.
United Kingdom	21	Warriner, G.	Osmazone.
Prussia	20	Weill, C.	Preserved larks and fruits.
United Kingdom	32	White, G. B.	English chocolate.
United States	397	White, M.	Muscovado sugar.
Russia	51	Zilfoogar-Beck Iskander-Beck Ogli	Paddy, called Chaltik.

CLASS IV.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	106	Belfast Flax Improvement Society, The Royal	The persevering and successful efforts to improve the quality of the fibre of flax, as illustrated by the series of specimens exhibited.
France	245	Graux, Jean Louis (de Mauchamp)	The origination of a new and valuable quality of wool, giving to the variety of Merino the best quality for combing, and possessing increased strength, brilliancy, and fineness of fibre.
——	247	Grenet, L. F.	A new and improved mode of obtaining a pure, inodorous, and colourless gelatine from the refuse parts of animals, and valuable and diversified modes of applying the materials, as illustrated in the collection exhibited.
United Kingdom	48	Mercer, John (Cl. xviii.)	The process of modifying the fibre of cotton by the action of caustic alkali, whereby its physical and chemical properties are altered and improved in a most remarkable manner.
France	1404	Popelin-Ducarre	The novel and economical mode of preparing vegetable charcoal from the small branches of trees, and from annual plants.

PRIZE MEDAL.

Egypt	–	Abdul, Hamid	Collection of raw produce.
United Kingdom	49	Adams, John.	Flax.
France	1050	Alcan and Limet	Silk.
India	–	Almeida, Messrs. (Singapore).	Collection of Lingoa woods.
Portugal	5.0	Angola, The Governor of (1850).	Tacula wood.
India	–	Arbuthnot, Messrs.	Indigo.
Russia	99	Ardamatsky Brothers	Flax.
France	8	Arduin and Chancel	Silk.
——	3	Averseng, Delorme, and Co.	Palm fibre.
Cape of Good Hope	30a	Bazley, T.	Cotton.
France	1076	Beauvais, C.	Silk.
British Guiana	74, 76	Bee, J. F.	Cotton and woods.
France	1078	Belleville Brothers	Starch, &c.
United Kingdom	130	Berger, S. (Cl. iii.)	Rice starch.
France	61	Besnard, Richoux, and Genest	Hemp, &c.
United Kingdom	21	Bethell, J.	Preserved wood.
Austria	95	Birnbaum, Jacob	Hemp.
India	–	Bishop, T. (Tanjore)	Fixed oils.
Belgium	87	Bissé, Louis-Emile	Oils.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
British Guiana	71, 72	Blair, D.	Cotton.
India	–	Blundell, Mr.	Collection of woods.
United States	37	Bond, S.	Cotton.
France	1104	Boucherie, J. A.	Wood, preserved.
———	1105	Boudon, L.	Silk.
British Guiana	–	British Guiana, The Royal Agricultural and Commercial Society of	Colonial produce.
France	782	Bronno-Bronski, Major Count de.	Silk.
Turkey	–	Broussa, Ecole de Siriciculture, de	Silk.
New Zealand	16	Brown, W.	Kauri gum.
Van Diemen's Land	107	Brownrigg, —	Woods.
Prussia	45 & 46	Brünneck, von O.	Wool.
United Kingdom	77	Burch, W.	Collection of dye substances.
———	68	Burn, R. (Cl. III.)	Cotton-seed oil.
———	7	Burnett, Sir W.	Preserved woods.
Cape of Good Hope	60	Busk, C. J.	Red ebony wood.
India	–	Butterworth, Hon. Lieut.-Col.	Colonial produce.
Spain	152	Calderon, J.	Hemp, flax, and silk.
———	242A	Canales, J.	Essential oils.
Cape of Good Hope	–	Cape of Good Hope, The Agricultural Society of	Cape produce.
Sardinia	27	Casissa and Sons	Silk.
France	107	Castelle, H.	Gelatines.
———	114	Champanhet-Sargeas, J.	Silk.
Algeria	17	Chuffart	Cottons.
Cape of Good Hope	13	Clarence, R.	Sheep's-tail oil.
United Kingdom	105	Claussen, P.	Flax and flax cotton, process of preparing it.
India	–	Cleghorn, Dr.	Gamboge.
———	–	Cockburn, Messrs. (Moorshedabad)	Starch.
United States	–	Cockerill, —	Wool.
———	301	Colegate, W. and Co.	Starch.
South Australia	–	Colonization Assurance Corporation, per W. B. P. Wood.	Collection of raw produce.
France	801	Collas, M. A. C.	Essential oils, &c.
United Kingdom	117	Colman, J. and J. (Cl. III.)	Starch.
Algeria	22	Curtet, jun.	Collection of oils.
United Kingdom	126	Curtis Brothers, and Co.	Tanning substances.
India	–	Cutch, H. H. The Rajah of	Raw produce.
Belgium	98	David and De Boe	Flax.
France	1613	De Géminy	Cotton oil.
Algeria	38	De Montigny, G.	Dyes.
Van Diemen's Land	–	Denison, Sir W. T.	Collection of raw produce.
Belgium	104	Desmedt and Co.	Flax.
France	697	De Tillancourt	Silk.
United Kingdom	81	Dorrien, C.	Wool.
Spain	215	Dotres and Co.	Silk.
France	169	Droüin and Brossier	Silk.
Tuscany	82	Ducci, A.	Walnut-wood veneers.
France	177	Dumortier, L.	Flax.
Mauritius	2	Dupont, E.	Silk.
Algeria	23	Dupré de St. Maur	Cotton and madder.
France	189	Duval, A.	Silk.
India	–	Elliot, W. (Vizagapatam).	Cattimundoo (resin).
Austria	22	Engelmann, S.	Starch gum.
Russia	106	Esthonia, Government of	Flax.
United States	188	Ewing, J. H.	Wool.
Prussia	95	Fabian, C. G.	Pine-needle fibre and oil.
United Kingdom	135	Fauntleroy, R. and Sons	Collection of woods and ivory.
Austria	90	Figdor, Isaac, and Sons	Wools.
Russia	103	Filemonoff, Kosma	Hemp.
India	–	Fischer, G. T. (Salem).	Indigo obtained from "Wrightia," and cotton.
Van Diemen's Land	82-89	Fowler (Maria Island).	Woods.
Tuscany	43	Franceschini, G.	Silk.
Prussia	27	Frankenfelde, The Royal Flock at	Wool.
British Guiana	31, 32	Garnett, H. T.	Starch, cassava.
France	846	Gibelin and Son.	Silk.
Belgium	105	Gilta, J. L.	Hemp.
France	1249	Girod (de l'Ain) le Général	Wool.
India	–	Godfrey, Messrs. (Ghazeepore)	Oil of roses.
Prussia	803	Graff, W.	Wool.
Austria	73	Gratz, Steiermark Silkworm Breeding Association at	Silkworms, breed of.
France	784	Guérin-Méneville and Robert	Silk.
India	–	Gwalior, H.H. The Maharaja Rao Scindia, of	Fixed oil.
Van Diemen's Land	103	Hadden, Capt., W. C.	Woods.
Prussia	690	Haller, J. C.	Wheat starch.
India	–	Hammond, W. P. and Co.	Collection of Siam produce.
United States	172B	Hampton, W.	Cotton.
Algeria	28	Hardy, A.	Cotton and cochineal.
France	866	Haro, E. F.	Essential oils, &c.
Trinidad	–	Harris, Lord (Governor)	Produce of Trinidad.
United Kingdom	6	Harrison, R. and J.	Collection of woods.

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Labuan	–	Hentig	Borneo cotton.
Spain	230	Hernandez, J.	Wool.
United States	559	Hicks, George	"Tillandsia usnoides."
United Kingdom	28	Hillas, F.	Purified oils.
United States	316	Holmes, G. L.	Cotton.
United Kingdom	14	Holtzapffel and Co.	Collection of woods for turning.
Van Diemen's Land	111 to 120	Hood, R. V.	Woods.
United States	156	Hotchkiss, H. G. and L. B.	Oil of peppermint.
India	–	Huffnagle, Dr. (Calcutta)	Series of lacs, &c.
British Guiana	74 A & B	Hughes, P.	Cotton.
France	881	Hugues, jun.	Essential oil.
India	–	Hunter, Dr. (Madras)	Vegetable fibre and woods.
Austria	89	Hunyady von Ketheley, Count Joseph	Wools.
United Kingdom	40	Hutchinson and Co.	Vegetable fibres.
Sardinia	26	Jacquet, H. and Co.	Silk.
Tuscany	–	Jaeger, W. and Co.	Silk.
France	1273	Jame, Bianchi, and Duseigneur	Silk.
India	–	Jardine, D. (Calcutta)	Silk.
——	–	Jenkins, Major F.	Assam produce.
——	–	Jennings, C. R.	Silk.
——	–	Jeypore, H. H. the Rajah of	Attar of roses.
United States	172A	Jones, J. R.	Cotton.
——	172	Jones, J. V.	Cotton.
United Kingdom	128	Jones, O. and Co. (Cl. III.)	Starch from rice.
India	–	Joradah Factory, Proprietors of	Indigo.
France	552	Joubert-Bonnaire and Co.	Hemp.
Russia	101	Karnovitch, E.	Flax.
——	117	Kaufmann, A.	Woods.
India	–	Kerr, W.	Gutta percha.
——	–	Key, Professor J. (Madras)	Fixed oils.
United States	500	Kimber, A. M., and Co.	Wool.
United Kingdom	2	King, Emma	Anatomised plants.
India	–	Kishingurh, H. H. the Rajah of	Fixed oils.
——	–	Kotah, H. H. the Rajah of	Collection of raw produce.
Russia	340	Koudriaffzeff Jadenoffsky, Basile	Horsehair.
——	100	Krasheneneckoff	Hemp.
Prussia	29	Küpfer	Wool.
France	559	Lailler, E. H.	Flax.
——	286	Lainé-Laroche, and Max-Richard	Hemp.
United States	330	Lak, D.	Cotton.
France	1292	Lepeyre and Dolbeau	Silk.
Austria	92	Larisch-Mönnich, Count H.	Wools.
France	905	Lazare and Lacroix	Dye colours.
Portugal	497 to 500	Leal, F. M. C.	Collection of oils, fixed and volatile.
France	576	Leclerc Brothers	Hemp and flax.
——	1312	Fefevre, Elizée	Wool.
Tuscany	47	Lepori, T.	Silk.
Cape of Good Hope	–	Lindenberg, J.	Vegetable wax.
Russia	83	Lisinsk Forest Institution	Birch oil, turpentine, &c.
Portugal	553 to 578	Loulé, Marquis de	Collection of woods.
Prussia	24	Lübbert, E.	Wool.
——	42	Lüttwitz, Baron von	Flax and wool.
New South Wales	–	MacArthur, Col.	Collection of wools.
India	–	Mackenzie Brothers (Bengal)	Silk.
United States	172B	Macleod, W. W.	Cotton.
India	–	MacNair, Messrs.	Indigo.
——	–	MacNair, W. (Surdah)	Silk.
Van Diemen's Land	–	MacNaughten	Woods.
Spain	186	Madrid, The Cabinet Botanical Garden of	Collection of Cuba woods.
Cape of Good Hope	11	Manuel, C.	Cotton.
Spain	234	Manilla, The Economical Society of	Fibrous substances and woods.
United Kingdom	114	Markwick M.	"Spongio-piline" fabric.
Spain	156	Martinez, P.	Hemp.
United States	371	Maryland, The State of	Collection of produce.
Turkey	–	Mighirditz Djezairglou	Silk.
Algeria	37	Mercurin, H. J.	Oils.
France	1356	Méro, C. D.	Essential oils.
United States	164	Merriweather, J. B.	Cotton.
Prussia	557	Mevissen, G.	Flax.
Van Diemen's Land	–	Milligan, J.	Collection of raw produce.
United Kingdom	85	Milner, R.	Collection of Irish wools.
Austria	91	Mittrowsky, Count Anton von	Wools.
France	647	Molines, L.	Silk.
Spain	202	Montfort, F.	Silk.
Canada	80	Montreal Central Commission	Collection of woods.
Algeria	39	Morin	Cotton and silk.
New South Wales	15	Moses, Son, and Davis	Tallow.
France	932	Mottet, C.	Dyes.
Turkey	–	Morgue and Co.	Silk.

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Spain	199	Murcia, The Province of	Silkworm gut and madder.
United States	178	Nailor, J.	Cotton.
Wurtemburg	11	Nördlinger, Prof.	Collection of woods.
Prussia	39	Nordmann, G. L.	Wool.
Turkey	–	Nouri Moustapha, Pasha	Silk.
United States	104	Oswego Starch Factory	Starch.
British Guiana	–	Outridge, J.	Collection of woods.
Ceylon	–	Parlett, O'Halloran, and Co.	Oils.
Turkey	–	Paulaky, J. (Broussa)	Silk.
Algeria	42	Pelissier, C.	Cottons.
Bavaria	36	Pelleuz, Brentano, and Co.	Silk.
United States	201	Perkins and Brown	Wool.
Ceylon	–	Pieris, T. A.	Collection of oils and gums.
United States	32	Pope, J.	Cotton.
United Kingdom	106	Preston, J. and Co.	Flax.
Netherlands	12	Prins, C. C.	Potato starch.
Austria	84	Querini, Giovanni	Silk.
France	1080	Rambouillet, National Sheepfold of	Wool.
Tuscany	48	Ravagli, P.	Silk.
United Kingdom	116	Rea, E.	Collection of resins.
Canada	75	Reed and Meakins	Hard woods.
United Kingdom	84	Rebow, J. Gurdon	Wool.
France	1426	Regard Brothers	Silk.
Spain	207	Rey and Co.	Silk.
France	354	Richer, F.	Wool.
Russia	138	Rier, Peter	Silk.
Spain	163	Ripalda, Count	Hemp.
France	362	Rouxel, F.	Flax.
——	1464	Russ and Co.	Silk.
——	363	Ruez, L.	Starches.
Prussia	34	Rüfin, Alfred	Flax.
India	–	Sainte, Messrs. (Calcutta)	Cocoa-nut oil.
Spain	34	Saragossa, The Agricultural Board of	Collection of produce.
United Kingdom	9	Saunders, W. W.	Collection of woods.
St. Domingo	–	Schomburgk, Sir R.	Collection of produce.
Austria	95A	Schönberg Yarn Spinning-mill	Hemp.
Netherlands	13	Schöneveld and Westerbaan	Starch.
Tuscany	37	Scoti Brothers	Silk.
Turkey	–	Scott, —, (Shemlan, Mount Lebanon)	Silk.
United Kingdom	19	Scott, E. and Co.	Collection of woods.
United States	172F & 320D	Seabrook, W.	Cottons.
Russia	135	Semenoff, J. and Faleyeff	Bristles, &c.
British Guiana	33 to 35	Shier, D.	Starch (cassava).
Tunis	–	Sidi Mahmoud Benyad	Collection of native produce.
India	–	Smith, Captain (Assam)	Munjeet.
United Kingdom	68	Smith and Son	Lichen and cudbear.
India	–	Speede, Messrs.	Starch.
France	382	Steinbach, J. J.	Starches.
Austria	103	Steinböck, A.	Samples of oil.
France	1495	St. Ubery	Collection of woods, &c.
British Guiana	–	Stutchbury, J. S.	Woods and oil.
New Zealand	–	Tao Nui	Collection of woods and flax.
Austria	657	Tandler, Stefan	Wood fibre.
France	1031	Teissier du Cros, L. and E.	Silk.
United States	241	Thomson, Rev. Z.	Woods.
United Kingdom	121	Tucker, R. G. (Cl. III.)	British gum.
India	–	Tulloch, Lieut.-Colonel (Commissary-General of Madras).	Fixed oils, and collection of woods.
Tuscany	–	Tuscany, Royal Technological Institute of	Collection of woods.
Austria	96	Ullersdorf, Flax Retting Establishment.	Flax, &c.
Spain	209	Valencia, The Agricultural Board of	Collection of raw produce.
Belgium	107	Vanbogaert, J. B.	Flax and hemp.
British Guiana	73	Van der Gon Netscher, A. D.	Cotton.
Belgium	489	Van Geeteruyen, C.	Starch.
——	103	Van Riet, P. J.	Hemp.
——	114	Van Wiele, J. B.	Flax.
——	113	Verbeeck, P. J.	Flax.
——	102	Verhelst, F.	Hemp.
Prussia	333	Werth, A., and Co.	Potato starch.
Austria	87A	Verza Brothers	Silks.
France	1528	Violette, J. H. M.	Charcoal.
India	–	Vizianagram, H. H. The Rajah of	Fixed oils.
Russia	109	Volkhonsky, Prince	Hemp and starch.
Ceylon	–	Watson, — (Surdah)	Silk.
India	–	Weber, L. (Java)	Vegetable fibre.
Prussia	331	Welcker, A. C.	Potato starch.
Western Africa	1	Weston, W.	Oils, &c.
United Kingdom	106	White, —	Flax.
Van Diemen's Land	91-93	Whitesides, —, (Hobart Town)	Collection of woods.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
India	–	Wight, Dr.	Collection of various specimens of cotton and woods.
United Kingdom	47	Wood and Bedford. (Cl. II.).	Lichens and dyes.
—	42	Wright, L. W. and Co.	Flax, and China-grass.
China	–	Yun Kee (of Shanghae)	Silk.
Tuscany	49	Zavagli, P.	Silk.

HONOURABLE MENTION.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Russia	94	Abdourza-Maram Ogli.	Native cotton.
—	131	Abramoff, J.	Cashmere hair.
France	749	Affourtit, G. L.	Silk.
Van Diemen's Land	–	Akers, Lieut., R.E.	Woods.
United Kingdom	96	H. R. H. Prince Albert	Cashmere wool.
Spain	151	Alcaide, M. G.	Cochineal.
Algeria	47	Algiers, Commission of Woods and Forests.	Corks.
—	58	Algiers, Delegate of	Vegetable fibres.
France	1538	Alléon, H.	Albumen from eggs.
Canada	100	Allon, J.	Tanning substances.
Portugal	462 to 464	Almeida, Praenca	Olive oils.
—	473 to 477	Almeida, Silva, and Co.	Olive oil.
Spain	164	Almeria, The Province of.	Olive oil.
China	–	Astell and Co.	Silk.
France	12	Augan, M.	Gum.
Russia	86	Babaieff Arakel	Madder.
—	96	Babarikin, M.	Flax.
Austria	45A	Bachrich, J.	Amadou.
France	17	Bahuet, A.	Silk.
Bahamas	–	Baines, F., and Co., (Nassau).	Collection of woods and sponges.
India	–	Balfour, Major (Madras)	Collection of woods.
France	410	Barral, C.	Silk.
—	41	Barrès Brothers	Silk.
Canada	70	Bastien, M.	Flax.
Portugal	458, 495A 509, 509A	Batalha, F. R.	Gum copal, oils, and orchilla.
Prussia	471	Becker, F. A., Sapp, and Co.	Amadou.
United States	176	Bell, E. B.	Woods.
Algeria	6	Benes, Miss M.	Cottons.
France	760	Bénouville, Madame	Silk.
—	1548	Bernoville, Larsonnier, and Chenest.	Wool.
Spain	152A	Berenguer, J. B.	Cochineal.
Rome	6	Beretta, Daniele	Silk.
United Kingdom	1	Bevington and Son (Cl. XVI.).	Tanning substances.
Russia	248	Bezroukavnikoff Sokoloff, A.	Prepared horsehair.
Austria	143	Bienert, D. and Son	Wood.
Belgium	93	Bihet, H.	Glue.
United States	131	Blakeslee, J.	Wool.
France	1091	Bleuze, H.	Starch.
United Kingdom	60	Blyth, Hamilton, and Blyth	Feathers.
Algeria	9	Borde, J.	Oils.
France	376	Bouxwiller Mining Company, The	Glue.
—	429	Bonnal, V. and Co	Silk.
Belgium	73	Bocken, H. and Co.	Starch.
Rome	38	Bolgain	Silk.
Prussia	38	Bolzani, A., M.	Silk.
Sardinia	45	Borzone, J.	Silk.
France	774	Bonasse, Lebel, and Co.	Gelatine.
Austria	–	Bozzoni Brothers	Silk.
China	–	Braine, Charles Joseph.	Silk.
United Kingdom	134	Breadalbane, Marquis of	Woods.
Portugal	620	Bretes, M. F.	White wax.
United Kingdom	23	Brotherton and Co.	Oils.
—	123	Brown and Polson (Cl. III).	Starch.
United States	4	Brown, P. A.	Wool.
France	38	Bruneaux and Son	Wool.
Prussia	559	Brünger, A.	Flax.
Canada	128	Brunsden and Shipton	Starch.
British Guiana	–	Buchanan, A.	Woods.
Trinidad	–	Burnett, T. Y. C.	Cedrela wood.
Prussia	827	Burre and Küster	Starch.
Van Diemen's Land	22	Button, T.	Tanning substances.
France	81	Cabrit and Roux	Silk.
United Kingdom	65	Cahn, D. (Cl. XVII.)	Animal black.
Sardinia	22	Calvi, J.	Oils and linseed cake.
France	1136	Carrière, F.	Silk.
New Zealand	25	Caradus, J.	Flax.
Tuscany	50	Casuccini, C. F.	Silk.
United Kingdom	46	Cator, Nelson, and Co.	Flax and hemp.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Netherlands	30	Catz and Co.	Horsehair.
Cape of Good Hope	–	Cawood, J.	Elephants' tusks.
Rome	9	Cento, The Chamber of Commerce of	Flax.
New Brunswick	–	Chalmers, J..	Vegetable wax.
India	–	Chapman, J. E.	Collection of woods.
France	794	Champoiseau, N.	Silk.
United Kingdom	179	Cheeseborough, W. (Cl. XII. & XV.)	Collection of wools.
Russia	114	Clarke, Morgan, and Co.	Flax.
United Kingdom	22	Classon, J.	Woods.
Belgium	85	Claude, Louis	Oil.
France	1153	Coignet and Son	Gelatines.
New Zealand	3	Collinson, Rev. J.	Flax.
India	–	Colvin, J. R..	Woods.
France	1156	Conrad, W.	Oils.
United Kingdom	70	Cooney, C	Starch.
Russia	118	Cootais, Government of	Woods.
India	–	Coplestone, F. (Mangalore),	Oils.
Spain	165	Cordova, Province of	Oils.
United Kingdom	136	Cross, S.	Woods.
France	470	Darras, P.	Silk.
——	1169	Darvieu, Valmale, and Co.	Silk.
Tuscany	46	Davitti, L.	Silk.
United Kingdom	118	Dawson and Morris.	Gelatine and glue.
New South Wales	2	Day, J. and W.	Woods.
Belgium	92	Debbaudt-Delacroix	Cabbage oil.
Portugal	469 & 470	De Farrobo, Count.	Olive oil.
Algiers	34	De Lutzow	Saffron.
France	1178	Deleuze, A.	Silk.
——	142	Dellattre and Son	Wool.
Cape of Good Hope	50	De Pass, A.	Guano.
France	1466	De Ruolz.	Oils.
——	496	D'Enfert Brothers	Gelatines.
Portugal	478 & 479	D'Albuquerque, Mello, J.	Olive oil.
France	757	De Barthelats, L.	Silk.
Spain	231	Delgado, D.	Hair (rabbits).
Tuscany	38	Della Ripa, L.	Silk.
Belgium	86	De Mevius, C.	Silk.
——	111	De Potter, A.	Silk.
——	112	De Coninck, A.	Silk.
——	90	Degraeve-Delforterie	Flax.
Netherlands	9	De Haan, A..	Rape oil.
Spain	157	De la Sagra, R.	Textile fibres from Cuba.
——	161	De Las Heras, P.	Flax.
Portugal	483 & 484	De Linhares, Count	Olive oil.
Portugal	460, 461, & 466	De Catheiros Menezes, J. L.	Olive oil.
——	465	De Maudo	Olive oil.
——	617	De Carvalho, M. L.	White wax.
United Kingdom	138	Dillon, Viscount	Woods.
Van Diemen's Land	19	Dixon, J..	Flax.
United States	139	Dix, E. R.	Flax, hemp, and guano.
Russia	95	Djidjivadze, Prince Niko	Native cotton.
Spain	172	Diez de Ribera, A.	Hemp and oil.
United Kingdom	32	Dodge, Mrs. Catherine	Silk.
Belgium	68	Docquir and Parys	Potato starch.
United Kingdom	125	Dufaville, W.	Gelatine.
British Guiana	–	Duggin, T. B.	Resin and woods.
Cape of Good Hope	47	Dumbleton, H.	Woods.
France	150	Dussol	Silk.
United States	21	Dominick, G.	Lard oil.
Prussia	32	Eckardstein, Baron.	Wools.
Canada	74	Egan, J.	Woods.
Tunis	137	Elhage Aly Elmajboor.	Tanning substances.
United Kingdom	61	English's Patent Camphine Company, Hull.	Resins and oil of turpentine.
France	1214	Estivant Brothers	Glue.
United States	18	Emory, T.	Lard oil.
Prussia	330	Eipenschleid, L..	Potato starch.
Van Diemen's Land	105	Euston and Milligan	Woods.
India	–	Elliot, W. (Vizagapatam).	Collection of woods.
France	1217	Farjon, H.	Silk.
British Guiana	93 & 94	Faucet, T.	Woods.
Prussia	596	Fudikar, H.	Horsehair, &c.
British Guiana	163	Finlaison, W.	Cottons.
Spain	169	Fernandez, M.	Olive oil.
Portugal	510	Ferreira, M. B. jun.	Orchilla.
United States	469	Feuchtwanger, L.	Bleached shell-lac.
Portugal	535 453 481	Ficalho, Marquis de	Flax. Starch from Evora. Olive oil and wax.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Canada	78	Fisher, J.	Woods.
France	214	Fleury, J. F.	Turpentine.
Prussia	335	Flockenhaus and Co.	Wool.
Spain	241	Flores, Calderon, and Co.	Turpentine.
Switzerland	–	Fogliardi, T. B.	Silk.
New Zealand	–	Fox, W.	Woods.
United States	19	Frank, F.	Lard oil.
Van Diemen's Land	210	Freeman, Rev. E.	Woods.
New South Wales	18	Francis, W.	Woods.
Saxony	3	Gätzschmann, W.	Flax.
Russia	123	Gamaley, T.	Wool.
Portugal	–	Gonsalves, Genoveva	Dried ferns.
Sardinia	5	Girardi Brothers	Oils.
United Kingdom	15	Gillow and Co.	Woods.
Russia	130	Gigolo Shkhvili	Wool.
United Kingdom	141	Glass, G. M. (Cl. III.)	Gelatines.
Van Diemen's Land	–	Grant, J.	Wool.
Bermuda	1	Gray, —	Starch.
Canada	71	Grice, F.	Flax.
United States	537	Goddard, L.	Whalebone.
Russia	121	Gorigoretzk, Farm of	Wool and flax.
Sardinia	23	Guizo, M.	Wax.
South Australia	5	Hallet, R., and Sons	Olive oil.
Algeria	27	Haloche, —	Cottons.
India	–	Hamilton, R. N.	Volatile oil.
	–	Hannay, Major	Raw produce.
Belgium	94	Hansotte Delloye, H. G.	Glue.
United Kingdom	59	Heal and Sons	Feathers.
	80	Henderson, R.	Wool.
Canada	79	Henson, J.	Woods.
Bavaria	76	Hensteh, J.	Woods.
France	1624	Hervé Brothers	Gelatines.
Prussia	26	Hey	Wool.
Portugal	453 & 454	Holbeche, M.	Starch.
United States	208	Holbrook and Stanley	Lard oil.
Prussia	722	Hornig, C. E.	Flax.
India	208	Horsley, W. B. (Palamcottah)	Oils.
Spain	136, 226	Huelva, The Province of	Cochineal and wools.
	158	Huesca, The Province of	Flax and other fibres.
Van Diemen's Land	208	Hull, Hugh	Woods.
Society Islands	–	Hurtell, M.	Fibrous substances.
France	1272	Humbert and Co.	Gelatines.
Sardinia	38	Imperatori Brothers	Silk.
Russia	259	Ivanoff, P.	Prepared horsehair.
United Kingdom	99	Jennings, H. C. (Cl. II.)	Starch.
Canada	109	Jetu, C. A.	Fixed oils (porpoise).
United Kingdom	66	Jewesbury and Co.	Cochineal.
New Zealand	21	Johnson, J.	Woods.
Sweden and Norway	21	Johansson, J.	Flax.
Prussia	39	Kiszewski	Silk.
Russia	87	Kerim Raghim Ogli	Madder.
United States	253	Ketteridge, F. O.	Corn-husk fibre.
Russia	134	Koriakin and Mougikoff	Bristles.
Prussia	128	Kramsta, C. G. and Sons	Starch.
	19	Kruse, A. T.	Starch.
	552	Königs and Bücklers	Flax.
France	555	Kuhlmann Brothers	Prepared charcoal.
Russia	283	Ladighin, Madame	Feathers.
Tuscany	36	Lambruschini, R.	Silk.
Russia	145	Lapshin, John	Feathers.
France	900	Laporte and Son	Wool.
Portugal	467 & 468	Larcher, J.	Olive oil.
	134	Larkins, T. W.	Cotton (Sea Island).
Egypt	901	Laroque Brothers and Jacquemet	Wool.
France	220	Leal, R.	Silk.
Spain	570	Lebleis, H.	Starches.
France	1302	Leclercq, N.	Gelatines.
Belgium	88	Leclercq, F.	Flax.
Prussia	47	Lehmann, R.	Wool.
New South Wales	8	Learmonth, T.	Wool.
France	590	Lepaisant, L.,	Starch.
China	–	Lindsay	Silk.
United Kingdom	97	Lippert, D.	Collection of wools.
Van Diemen's Land	174	Lipscombe, F.	Flax.
Prussia	25	Lipski, J., von	Wool.
India	–	Loch, J.	Collection of raw produce.
United Kingdom	47	Long, J.	Woods, Irish.
	75	Long and Reynolds	Dyes.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	117	London Druggists (Cl. II.)	Gums and resins.
Prussia	336	Loosen, J. G.	Glue.
Canada	144	Mackay and Co.	Silk.
——	124	McFarlane, A.	Gelatines.
India	–	McDowell, —	Teak wood.
West Africa	–	McWilliam, Dr.	Oils.
United Kingdom	68	Marshall, J. (Cl. II.)	Dyes.
——	104	Marshall, E. S. (Cl. XXIII.)	Goldbeater's skin.
——	54	Mason, G.	Flax.
New Zealand	5	Macvay, J.	Tanning substances.
India	–	Mayne, D. (Cuddapah)	Collection of woods.
——	–	Maitland, Captain (Madras)	Collection of woods.
Cape of Good Hope	1	Maitland Mines	Coral.
Algeria	35	Maffre, E. F.	Oils.
France	322	Malingié, —	Wool.
Austria	102	Malvieux, C. T.	Rape oil.
Sardinia	15	Mancu, le Chevalier Simone	Oils.
Austria	77	Mattiuzzi, G. B.	Silk.
Russia	81	Marimanoff and Armakoona	Gelatines, &c.
India	–	Marquart, Captain	Woods.
Spain	144	Matesang, H.	Madder.
Sardinia	31	Mesina, S.	Olive oil.
United Kingdom	127	Miller, D. and W. (Cl. III.)	Starch.
New South Wales	19	Mitchell, Colonel Sir T.	Flax.
New Zealand	–	Mitford, G. M.	Kauri gum.
Russia	126	Mirza, Akhoondoff, Shah	Wool.
——	110	Milokroshetchnoi, K.	Flax.
United Kingdom	125A	Muller, F.	Gelatine and glue.
Van Diemen's Land	18	Murray, W.	Starch, &c.
Cape of Good Hope	44	Moravian Mission at Gnathendal	Woods.
Spain	150	Meron, E.	Cochineal.
Tuscany	45	Mordini, C. G.	Silk.
Spain	225	Montero, S.	Wools.
——	167	Montesinos, C. S.	Olive oil.
Mecklenburg-Schwerin	6	Meyer, M.	Charcoal.
India	–	Meppen, F. D. (Mysore)	Cottons.
France	1363	Mourgue and Bousquet	Silk.
——	933	Moussilac-Amand, —	Woods.
Van Diemen's Land	237	Moses, S.	Whalebone.
United Kingdom	137	Murray, Sir W.	Woods.
Russia	127	Narishkin, L. K.	Wool.
United Kingdom	20	Newton, C. H.	Woods (seasoned).
——	57	Nightingale, W. and C.	Feathers.
France	937	Nogarède, J. L.	Silk.
India	–	Ogilvie, Captain (Masulipatam)	Collection of woods.
Prussia	551	Ollerdissen, P.	Flax.
India	–	Onslow, A. P. (Ganjam)	Collection of woods.
Tuscany	31	Orsetti, C. T.	Oils.
Denmark	44	Owen, Joseph	Oils.
Tuscany	33	Pacini, D.	Oils.
Portugal	530, 531 & 532	Palmella, Duke de	Hemp.
Canada	76	Parisault, J.	Woods.
——	77	Parisault, F.	Woods.
United States	235	Parker and Brown	Wool.
France	1381	Paturle-Lupin, Seydoux, Sieber, and Co.	Wool.
Austria	94	Panna and Alexis	Wool.
United Kingdom	84	Paravagua and Casella (Cl. XXIII.)	Red coral.
Greece	12	Pavlides, B.	Sponges.
United Kingdom	132	Peet, T.	Cork.
United States	115	Pell, R. J.	Woods.
——	106	Peters, T. C.	Wool.
Tuscany	40	Petrucci, C.	Silk.
Russia	124	Philibert, L. and F.	Wool.
Algiers	43	Piglia, J.	Madder.
Portugal	471 & 472	Pinto, J. B.	Olive oil.
——	629	Pinto Basto, J. F.	Animal charcoal.
Tuscany	41	Pieri, Count G.	Silks.
France	960	Pitoux, V.	Gelatine.
British Guiana	102B	Pontifex, G.	Woods.
Canada	125	Prendergast, J.	Gums, &c.
France	1406	Pradier, J.	Silk.
Prussia	22	Prussian Royal Horse Depôt (Treptow on the Rega).	Wool.
United Kingdom	108	Puckridge, F.	Goldbeater's skin.
Malta	4	Pulis, G.	Cottons, silks.
Russia	144	Popoff, Alexander	Feathers, &c.
Van Diemen's Land	94	Quinn, —	Collection of woods.
France	1422	Raucher, L., jun.	Animal charcoal.
United States	–	Rayner, Eli	Cotton.
Barbadoes	–	Reade, A.	Samples of cotton.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Russia	139	Rebroff, A.	Silk.
Tuscany	69	Reffaelli, P., and Son	Specimens of coral.
France	1430	Reidon, E.	Silk.
India	–	Reynolds, Captain	Vegetable fibre.
United Kingdom	125	Reckitt and Son (Cl. III.)	Starch.
Cape of Good Hope	–	Reitz, Breda, and Co.	Wool.
France	987	Rivaud, G.	Wool.
New Zealand	4	Robertson, J.	Flax.
Russia	71	Roterman, C.	Starch.
Prussia	28	Rothschild, Baron S. Von	Wool.
Van Diemen's Land	293	Rout, W.	Wax.
France	1446	Roeck, L.	Silk.
——	1461	Royer, J. C. A.	Gelatines.
Prussia	337	Römer, C.	Oil.
Austria	98	Rotsch and Reichel.	Woods, teasles.
Tuscany	32	Ruschi Brothers.	Oils.
Russia	140	Rayko, N.	Silk.
United Kingdom	76	Sadler, I.	Cochineal.
France	1470	Sambuc, P.	Silk.
United Kingdom	21A	Samuels, D.	Woods.
Tuscany	51	Savi, Professor P.	Silk.
——	34	Saracini, Chevalier A.	Oils.
Prussia	443	Saucken, A. von.	Wool.
Portugal	538	Sa Nogueira, A.	Cotton.
Russia	128	Schloss Trikaten, N. N.	Wool.
Prussia	33	Schwerin, Count von	Wool.
Austria	72	Schola, A.	Silk.
Cape of Good Hope	37	Searight, J.	Guano.
Belgium	110	Seghers, B.	Animal charcoal, ivory-black, &c.
Austria	78	Senigaglia and Carminati	Silk.
——	81	Secchi, Francesco	Silk.
Spain	171	Seville, The Province of	Olive oil.
China	–	Shanghae, The Consul at	Vegetable wax.
United States	197	Sibley, S.	Wool.
Sardinia	25	Sinigaglia Brothers.	Silk.
New Zealand	14	Smith, J. A.	Orchilla weed.
Van Diemen's Land	295	Smith, Lieutenant	Gum (wattle-tree).
Netherlands	20	Smits, P.	Animal charcoal.
Saxony	1	Sommer, Charles	Flax.
Tunis	73, 75 150, 151	Solyman, Essaddy	Sponges.
United Kingdom	126	Shand and Muckart (Cl. III.).	Starch.
——	154	Stenhouse, A. (Cl. III.)	Starch.
South Australia	–	Stevens and Thompson	Wools.
Belgium	97	Strubbe and Baey	Tanning substances.
Austria	87	Steiner, G., and Sons	Silk.
Sweden	..	Sweden, H. M. the Queen of	Silk.
United Kingdom	119	Swinborne, T. C. and G.	Gelatine.
India	–	Tan Kim Seng	Fibre.
Cape of Good Hope	3	Thalwitzer, M.	Tanning bark.
Saxony	4	Thieme-Widtmarkter and Püschel	Sponges.
Prussia	23	Thaer, A. P.	Wool.
Persia	–	Thompson	Silk.
Bahamas	–	Thompson, J. T.	Hemp.
India	–	Thompson, Messrs. (Calcutta)	Vegetab'e fibres.
Russia	119	Tiflis, Government of	Woods.
United Kingdom	5A	Tilley, Lieutenant	Anatomised plants.
France	699	Tordeux	Charcoal, prepared.
United Kingdom	41	Trent, E. W.	Flax.
New Zealand	28	Tyrrell	Flax.
France	1498	Terasson de Montleau, J. A.	Wool.
Spain	210	Trenor, T.	Silk.
United States	494	Truesdale, Jacobs, and Co.	Cotton.
United Kingdom	122	Tucker, E. (Cl. III.)	Starch.
Bermuda	–	Tucker, R. and Co.	Coral and madrepores.
Prussia	21	Uechtritz, von L.	Starch.
Spain	98	Valgoma, F. A.	Flax.
——	142	Valladolid, Province of	Madder.
Cape of Good Hope	32	Van Breda, D. J.	Wool.
France	1519	Verdet and Co.	Silk.
——	1520	Vézon Brothers	Starch.
Spain	162	Villars, J. B.	Cotton.
——	–	Villars, Don	Rush.
France	1526	Vincent, J.	Silk.
Netherlands	15	Visser, Nolet, and Co.	Starch.
——	17	Visser, E. E.	Wax.
Russia	122	Vassal.	Wool.
Belgium	52	Vanden Abeele, L.	Flax.
——	84	Vanderstraeten, F.	Oil.
——	74	Van Bunnen, Madame C.	Starch.
Russia	30	Verdan and Co.	Starch.
Belgium	108	Verstraeten, E.	Animal charcoal.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Belgium	213	Vercruysse, F.	Flax, &c.
France	1048	Warmont, V. E.	Wool.
United Kingdom	120	Watt and Son	Glue.
Prussia	434	Wächter, J.	Scum of sugar.
Austria	93	Wallis, O., Count von	Wools.
Saxony	2	Watteyne, J.	Flax.
Prussia	31	Winkler, F.	Sponges.
New Zealand	34	Whytlaw and Son	Flax.
India	–	Wight, Dr. (Coimbatore.)	Collection of woods.
United Kingdom	124	Wotherspoon, R. (Cl. III.)	Sago starch.
Russia	129	Youzbash, Mahomet Khan	Wool.
——	72	Yurghenson	Starch.
——	108	Zakharoff, S.	Flax.
——	136	Zolotoreff, J.	Bristles.
Spain	168	Zayas, J.	Olive oil.

CLASS V.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	420	Appold, J. G.	A centrifugal pump, with curved vanes.
Belgium	119	Cockerill, J.	Pair of 140 horse power vibrating-cylinder engines, for river navigation; a locomotive engine; an oscillating-cylinder 3-horse power land engine; tubular boiler; a vertical-cylinder 16-horse power land engine. (The award is made for the whole.)
United Kingdom	512	Crampton, T. R.	Two passenger locomotive engines.
——	618	Dunn, T.	A railway traversing frame.
France	220	Fromont and Son	A double turbine.
United Kingdom	8	Penn, John, and Son	Two pair of compact marine engines, of light construction, for small vessels.

PRIZE MEDAL.

United Kingdom	510	Adams, W. B.	Light locomotive engine and double railway carriage.
——	44	Armstrong, W. G.	Hydraulic cranes.
——	1	Atherton, Charles	The application of an eccentric to working expansion valves.
——	643	Baines, W.	Railway switches and chairs.
——	412	Bank Quay Foundry Company (Warrington).	Great hydraulic press.
——	602	Barlow, W. H.	Wrought-iron permanent way.
——	646	Beecroft, Butler, and Co.	Railway wheels and axles.
France	761	Béranger, J., and Co.	Weighing machines.
United Kingdom	448	Cheavin, S.	Filtering pump.
France	1151	Clair, P.	A dynamometer and indicator; and a model in section of a locomotive.
United Kingdom	39	Clayton, Shuttleworth, and Co.	An 8-horse power vertical oscillating cylinder engine.
——	49	Collinge, C., and Co.	A 5-horse power direct-action steam-engine.
——	25	Crosskill, W.	Oscillating-cylinder direct-action steam-engine.
——	645	Cwm Avon Iron Company	Railway bars.
——	16	Davies, J. and G.	A patent revolving elliptic steam-engine, with an ingenious governor, equilibrium valves, and feed valves.
——	774	Davidson, J., and Co.	Scales and weighing machines.
——	772	Day and Millward	Weighing machines.
——	552	De Berge, C.	Railway buffers.
——	647	Derwent Iron Company	Large plates of rolled iron for sway-beams of engines and ship-building purposes, and a railway bar 66 feet long.
——	638	Ebbw Vale Company	Railway bars.
——	12	Edwards, T.	5-horse power direct-acting steam-engine.
France	830	Enfer, F.	Blowing machine.
United Kingdom	509	England, G., and Co.	Tank locomotive engine; traversing screw-jack.
Netherlands	76	Enthoven, K.	Iron crane for lifting and weighing.
France	507	Flaud, H. P.	5-horse power vertical-cylinder direct-acting high-pressure engine, for working at high velocities with high-pressure steam.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	406	Fourdrinier, E. N.	Safety cage for mines.
——	404	Fox, Henderson, and Co.	Derrick crane.
——	506	Great Western Railway Company (Swindon).	Passenger engine.
——	541	Haddan, J. C.	Papier-maché carriage.
——	536	Hawthorn, R. and W.	Locomotive passenger engine.
——	532	Henson, H. H.	Railway goods-waggon.
——	201	Hosking, R.	Treble-beat pump valve.
——	682	Jackson, P. R.	Railway tires; hydraulic press.
——	411	James and Co.	Weighing crane.
——	534	Kitson, Thompson, and Hewitson	Locomotive tank engine.
——	507	Lee, J.	Wheels, axles, and railway breaks.
France	1310	Letestu, —	Fire-engine.
United Kingdom	300	Lloyd, G.	Blowing machine.
Belgium	120	Marcinelle and Couillet Smelting Company.	Mine ventilator.
France	924	Mauzaize, J. N.	Friction-clutch.
United Kingdom	401	Merryweather, M.	Fire-engine.
——	539	McConnell, J. E.	Corrugated iron railway carriage.
——	434	M'Nicholl and Vernon.	Steam traversing crane.
——	649	Mersey Iron Company	Patent rolled iron for shipbuilding.
——	41	Nasmyth, J.	4-horse power direct-acting engine.
France	944	Parent, —	Scales.
United Kingdom	543	Patent Shaft and Axletree Company.	Railway carriage and other axles.
Canada	181	Perry, G., and Brothers	Fire-engine.
Prussia	473	Piepenstock and Co.	Disc wheels and hollow axles.
United Kingdom	784	Pooley, H., and Son	Weighing machines.
——	40	Pope, W., and Son	4-horse power oscillating-cylinder direct-acting steam-engine.
France	967	Pouyer (Quertier Fils)	Apparatus by which any number of movers may be connected or disconnected at pleasure.
United Kingdom	640	Ransomes and May	Water crane; patent compressed trenails and wedges for railways.
Austria	105	Schmid, H. D.	Weighing machine; parabolic governor for a steam-engine.
United Kingdom	410	Shand and Mason	Fire-engine.
——	46 & 203	Siemens, C. W.	Chronometric governor.
——	14	Simpson and Shipton	10-horse power reciprocating engine.
——	3	Smith, F. P.	A series of screw models, showing the progress of screw propulsion.
——	555	Spencer, J. and Son	Bailey's patent volute springs.
——	636	Thorneycroft, G. B., and Co.	Railway wheels and axles.
——	490	Thornton, Samuel	Hydraulic lifting jack.
——	6	Watt, James, and Co.	Pair of horizontal cylinder steam-engines for screw-propellers.
——	530	Williams, C. C.	Railway carriage.
——	637	Wordsell, G., and Co.	Railway axle, wheel-tire, and axle-box.
——	600	Young, C. D., and C.	Simultaneously-acting gates for railway crossings.

CLASS Va.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	802	Andrews, R.	A neat pony carriage.
France	59	Belvallette Brothers	A Stanhope or sporting phaeton, of excellent design, and well finished.
United Kingdom	811	Briggs, G. and Co.	A town chariot, admirably carried out as to good taste.
——	814	Browne, W.	A caned-car, very neat and well-finished. A curricle-car, made with Fuller's patent shafts, to be used occasionally with one horse.
United States	466	Childs, C.	A slide-top buggy or phaeton; enamelled leather of apron of very superior quality. The whole well got up and neatly finished.
United Kingdom	828	Davies, D.	A basterna brougham; a very good piece of work.
France	490	Dunaime, J. A.	A town "berlin," well formed, and got up in a superior manner.
United Kingdom	862	Hallmarke, Aldebert, and Hallmarke.	A green barouche; a very good carriage.
——	872	Holmes, H. and A.	A park phaeton, very neatly finished, and in good taste.
——	874	Hooper, G. N.	A green brougham, got up in the neatest manner, all in good taste and well done.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Belgium	118	Jones Brothers	A cab phaeton: a well-finished carriage.
United Kingdom	938	Peters and Sons	A park step-piece barouche, highly finished, and with good taste.
—	950	Robinson and Co.	A park phaeton, very neat, and an excellent piece of work.
—	956	Rock and Son	A patent dioropha, very ingenious as regards the shifting, and well shaped.
—	968	Silk and Brown	A full-sized park phaeton, elaborately finished; a very superior specimen of workmanship and art.
Belgium	122	Van Aken, P. and Son	A cabriolet chaise, neatly got up.
United Kingdom	997	Ward, J.	A bath chair, with patent noiseless wheels, the whole well shaped, well arranged, of excellent form, and well finished.
United States	361	Watson, G. W.	A sporting waggon, very neatly finished in all respects.
United Kingdom	996	Wyburn, Meller, and Turner	An elegant dress chariot, in all respects very highly finished.

CLASS VI.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	82	Barlow, A.	Jacquard looms with two cylinders, simultaneously raising and lowering the suspended wires.
France	1557	Cail and Co.	Vacuum apparatus, for the manufacture of sugar.
United Kingdom	40	Donisthorpe, G. E.	Double wool-combing machine.
—	130	Donkin, B. and Co.	Paper machinery.
United States	79	Dick, D.	Various engineers' tools and presses.
United Kingdom	200 & 403	Fairbairn, W. and Sons	Riveting machine and a corn-mill.
Prussia	52	Heckmann, C.	Vacuum apparatus, for the manufacture of sugar.
France	873	Hermann, G.	A set of chocolate machines.
United Kingdom	1	Hibbert, Platt, and Sons	A complete series of machines, employed in the cleaning, preparation, and spinning of cotton, showing the whole process, to the weaving inclusive.
—	218	Hick, B. and Son	Mill gearing, radial drills, engineers' machine tools, improved mandrils, portable forges.
—	75	Lawson, S. and Sons	Numerous machines employed for the preparation of flax.
—	10 & 46	Mason, J.	Woollen carding machine, also slubbing and roving frames.
France	228	Maudslay, Sons and Field	Coining press, acting by an eccentric.
	632	Mercier, A. and Co.	Machinery for carding and spinning wools.
United Kingdom	236	Nasmyth, J.	Steam hammer.
—	77	Parker, C. E. and C.	Power-loom for weaving sailcloth.
—	602	Pontifex and Wood	Vacuum apparatus for the manufacture of sugar, in copper and brass.
—	85	Reed, T. S. and Co.	New power-loom for weaving fringes without shuttles.
France	1438	Risler, G. A.	"Epurator," a machine for cleansing and preparing cotton for spinning.
United Kingdom	204	Sharp, Brothers and Co.	Large double lathe for railway wheels, slotting machine, and other engineers' machine tools, also a beautifully constructed ring and traveller throstle.
Prussia	476	Uhlhorn, H.	Coining press.
United Kingdom	201	Whitworth, J. and Co.	A large collection of engineers' machine tools of all kinds, screw stocks, standard gauges, and a knitting machine. Also his machine for measuring less than the millionth part of an inch.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	399	Acklin	Jacquard, employing paper instead of cards.
United Kingdom	448	Adorno, J. N.	Cigarette machine.
—	90	Ball, Dunnicliff, and Co.	Warp lace machine.
—	48	Berry, B. and Sons	Machinery for manufacturing worsted.
France	422	Berthelot, N.	Circular hosiery frames.
United Kingdom	400	Bessemer, H.	Centrifugal machine for refining sugar.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	406	Birch, J.	Machine for cutting sash and roof bars.
——	94	Birkin, R.	Bobbin-net lace machine, with Jacquard.
——	138	Black, J.	Paper-folding machine.
United States	551	Blodget, S. C.	Sewing machine.
France	428	Boland, A.	Kneading machine.
Prussia	53	Bonardel Brothers	Jacquard, and punching machine for Jacquard cards.
France	417	Borie Brothers	Machine for making hollow bricks.
——	15	Baranowski, J. J.	Machine for printing and numbering tickets.
United Kingdom	144	Brewer, C. and W.	Rollers of wire-cloth for paper-makers.
——	27	Calvert, F. A.	Wool burring and cotton-cleaning machinery and cylinders
——	135	Church and Goddard	Machine for cutting card boards, and printing and preparing railway tickets,
——	86	Claussen, P.	Circular hand-loom for hosiery.
——	78	Crawhall, J.	Machine for manufacturing hemp ropes.
——	35	Crichton, D.	New taking-up motion for a loom.
Tuscany	59	Cuyere, Mrs.	Weavers' reeds.
United Kingdom	80	Davenport, J. L.	Various machines for manufacturing silk.
——	226	Dalgety, A.	Small lathe, with self-adjusting chuck.
——	45	De Bergue, C.	Reeds made by machinery.
——	76	De la Rue and Co. (Cl. xvii.).	Envelope machine.
France	491	Dandoy-Mailliard, Lucq, and Co.	Rollers for spinning machinery.
Switzerland	61	Darier, H.	Press for cutting out watch-hands.
France	823	Dorey, J. F.	Machine for weaving improved healds.
United States	456	Earle, T. K. and Co.	Card clothing.
France	1607	Frey, jun.	Machine for making nails.
United Kingdom	84	Frost, J.	Improved silk machinery.
——	401	Furness, W.	Machines for tenoning, morticing, planing, and moulding wood.
Austria	109	Gamba, P. The Heirs of	Jacquard cylinder.
United Kingdom	208	Garforth, W. J. and J.	Steam-riveting machine.
Prussia	58	Hamann, A.	Turning lathe.
United Kingdom	102	Harding, Pullein, and Johnson	Machinery for making printing-types.
France	864	Harding-Cocker	Heckles.
United States	386	Hayden, W.	Drawing regulator for cotton.
United Kingdom	14	Higgins and Sons	Cotton machinery, and long line flax machine.
——	232	Holtzapffel and Co.	Amateur foot lathe, with overhead motion; slide rest and eccentric chucks, &c., for ornamental turning, with various apparatus and tools.
——	20	Hornby and Kenworthy	Sizing and dressing machine, and self-acting backing-off motion to a warping machine.
France	541	Huck	Apparatus for grinding and preparing alimentary substances.
——	269	Hue, J. B.	Press for manufacturing hooks and eyes, cutting and bending them at the same time.
United Kingdom	122	Ingram, H.	Applegath's vertical printing machine.
France	546	Jacquin, J. J.	Circular hosiery frames.
United Kingdom	212	Johnson, R. and Brothers.	Wire-drawing benches.
——	52	Judkins, C. T.	Heald machine and improved heald.
——	21	Kenworthy and Bullough	Stopping motion to a power loom.
——	604	Lawrence, J., sen.	Refrigerator, store cask, &c.
France	283	Lacroix and Son	Fulling machine for cloth.
Prussia	55	Leonhardt, J. E.	Type-founding machine.
United Kingdom	209	Lewis, F. and Sons	Wheel-cutting engine and roving spindle.
United States	447	Lowell Machine Shop	Self-acting lathe and power loom.
United Kingdom	454	Manlove, Alliott, and Seyrig	Centrifugal washing and drying machine.
——	206	Muir, W.	Small lathe and various tools.
France	330	Mareschal, J.	Machine for mincing meat.
——	645	Miroude Brothers	Card clothing.
United States	460	Morey, C.	Eastman's stone-cutting machines.
France	664	Nicolas, P.	Machine for engraving metal cylinders.
United Kingdom	158	Napier and Son	Letter-press printing machinery.
——	40	Perry, John	Wool-comb.
——	5	Preston, F.	Spindles and flyers.
——	456	Prosser and Hadley	Ornamental sawing machine.
——	74	Plummer, R.	Scutching, heckling, and other flax machines.
——	6	Parr, Curtis, and Madeley	Various machines for carding and spinning cotton; three self-acting mules; also various engineers' machine tools.
——	128	Rémond, A.	Envelope machine.
——	640	Ransomes and May (Cl. v.)	Leggatt's Queen press, with self-acting apparatus.
——	418	Robinsons and Russell.	Large steam sugar-cane mill.
France	1454	Roswag, A. and Son	Wire-cloth for paper-makers.
United Kingdom	222	Ryder, W.	Forging machine.
France	1474	Sautreuil, jun.	Machine for planing and moulding wood.
——	1475	Schwerber, J.	Forging machine.
——	1001	Schneider and Legrand	Shearing machine.
——	1005	Scrive Brothers.	Card clothing.
United Kingdom	22	Smith, M.	Various power looms.
——	220	Shepherd, Hill, and Spink	Self-acting slide lathe.
——	230	Smith, Beacock, and Tannett.	Self-acting slide lathe, drilling and planing machines.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Belgium	134	Société du Phœnix	Soft bobbin frame.
France	1021	Stamin and Co.	Spinning frame.
United Kingdom	238	Stewart, D. Y. and Co.	Mould-making machine for cast-iron pipes.
United States	88	Starr, C.	Bookbinding machine.
United Kingdom	51	Taylor, J.	Heckles.
——	136	Taylor, W.	Machine for forming hemispherical paper shades from flat discs of paper.
Prussia	57	Thomas, H.	Shearing machine for woollen goods.
United Kingdom	630	Tizard, W. L.	Model of a brewery.
France	1508	Touaillon, C.	Dressing machine for millstones.
Belgium	128	Troupin Brothers	Shearing finishing machine.
France	717	Varrall, Middleton, and Elwell	Machinery for manufacturing paper.
United Kingdom	442	Westrup, W. and Co.	Corn mill.
——	112	Wilson, G.	Paper and mill-board cutting machines.
United States	443	Woodbury, J. P.	Wood-planing, tonguing, and grooving machine.

CLASS VII.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom		H.R.H. Prince Albert (Joint Medal to that granted for the original conception and successful prosecution of the Exhibition of 1851.)	Model lodging-house.
——		Fox, Henderson and Co.	Great Building; for the execution.
——		Paxton, Joseph	Great Building; for the design.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	10	Brown, Sir S., Captain, R.N.	Models of slips and railways.
——	152	Bunnett, J., and Co.	Patent shutters and water-closet.
——	90	Carrington, F.A. (Main Avenue West.)	Topographical models of portions of England.
Netherlands	90	Dutch Railway Company	Model of railway drawbridges.
United Kingdom	9	Finch and Willey	Model of a wrought-iron bridge over the Wye.
——	53	Heinke, C. E.	Diving apparatus.
——	91	Ibbetson, Captain, L. L. B. (Main Avenue West.)	Model of the Isle of Wight.
United States	511	Iron Bridge Company, New York	Model of Ryder's patent iron bridge.
United Kingdom	106	James, J.	Model of Britannia bridge.
Switzerland	65	Lané, J. F.	Set of boring tools.
——	257	Leemann, J.	Model of Strasburg cathedral.
United Kingdom	24	Morton, S. and H.	Model of patent slip for ships of the largest class.
France	658	Mulot and Son	Excellent and powerful boring tools.
United Kingdom	16	Pratt, Major	Design for tidal steps.
——	180	Rose, J. T.	Design for a timber viaduct of great span.
——	220	Salter, S., — (Main Avenue West.)	Models of bridges.
——	1	Siebe, A.	Diving apparatus.
——	165	Smith, W. H.	Model of light floating breakwater; for the idea.
——	28	Stuart, W.	Model of Plymouth breakwater.
France	1044	Travers, P. L.	Model of observatory, dome, and roof, at Paris.
United Kingdom	105	Vignoles, C.	Suspension bridge; for model.
——	157	Wilkins, W. C.	Revolving floating light.
——	113	Wilson, T. H.	Gate-bolts and slides for doors.

HONOURABLE MENTION.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	73	Bouch, T.	Model of a railway ferry-boat.
——	95	Bremner and Sons	Model of apparatus for working in situations exposed to the sea.
——	114	Dobson, J.	Model of Newcastle railway-station roofs.
——	31	Hurwood, G.	Apparatus for shutting ships' lights and scuttles.
——	62	Lowe, Alice and Co.	Stink traps.
Switzerland	248	Michel, G.	Model farm-house.
United Kingdom	170	Newnham, T. G.	Models of roofs and windows.

CLASS VIII.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom . .	–	Admiralty	Hydrographic charts, and models of the ships constructed by them.
France	126	Departement des Cartes de la Marine	Hydrographic surveys, and maps of France, Algeria, Africa, and Corsica.
——	–	Depôt de la Guerre à Paris . . .	Great topographical map of France.
United Kingdom . .	159	Geological Survey Department of Great Britain (Cl. I.)	Geological surveys and maps of the United Kingdom.
——	136	Duke of Northumberland . . .	For having caused a large number of models of life-boats to be designed, with the view to obtaining the best form of boat for the preservation of life and property in cases of shipwreck.
France	–	Ecole des Mines à Paris	Geological map of France.
United Kingdom . .	128	Ordnance Department of England .	Illustrations of the Great Ordnance Surveys of Great Britain, for the copper-plate etchings, and electrotype process.
Austria	363	Military Geographical Institute, Vienna.	Survey and detailed maps of the country in and around Vienna, and of Italy.
United Kingdom . .	150	Sir William Snow Harris	System of lightning conductors attached to the masts and hulls of ships, which have been for several years in general use in the Navy, as a means of preserving life and property from the effects of lightning.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Belgium	143	Ancion and Co.	Complete and varied collection of arms, and merit in a manufacturing and commercial point of view.
United Kingdom . .	185	Ansell, C. (Cl. v.)	A gunning punt on a new principle, for fowling purposes.
France	1083	Barbotin, Captain	Improved capstan for managing chain cables.
United Kingdom . .	136	Beeching, J.	Design of a life-boat, which was recommended for the prize of 100 guineas, to be awarded by the Duke of Northumberland for the best life-boat.
Belgium	150	Bernimolin, N., and Brother . . .	Collection of sporting and trade guns.
United Kingdom . .	104	Berthon, The Rev. E. L.	Models of patent perpetual log for indicating the speed and leeway of ships, and of his patent clinometer for showing the list (or inclination) and trim of ships; and also of a collapsible life-boat, of a portable and useful description.
France	58	Bertonnet, —	Sporting guns and arms.
United Kingdom . .	206	Brazier, J., and Son	Lock for best guns.
——	334	Brown, Sir S., Captain, R.N. . .	Chain cables.
——	29	Carte, A. G.	Self-acting life-buoy, an instrument, by which, since 1838, nearly 400 persons' lives have been saved.
France	126	Collin, C. E.	Map engraving.
United Kingdom . .	–	Corporation of London.	Illustrations of the art of ship-building for the commercial marine, almost all showing the greatest and most important improvements in strength, symmetry, and efficiency; and mostly coming from the establishments within the jurisdiction of the Port of London.
France	1057	Claudin, F.	Guns, rifles, and pistols.
United States . . .	449	Darton, W.	Models of merchant-vessels.
United Kingdom . .	223	Deane, Adams, and Deane. . . .	Double and single guns and pistols.
——	55	Dent, E. J., (Cl. x.)	Successful attempt to construct a compass that should not be disturbed by the motion of the ship at sea, nor by the firing of guns on board.
France	473	Delvigne, G..	Apparatus for saving life from shipwreck. A projectile discharged by means of a howitzer. This invention involves a new principle, that of a portion of the line to be carried out being contained in the projectile.
——	–	De Renémeuil	His improvements in the *shading* of maps, by printing different colours at the same time.
——	166	Devisme, —	Sporting guns and arms.
United Kingdom . .	30	Ditchburn, T. J.	Models of paddles and screw steam-vessels.
——	302	Edgington, B.	Tents.
Lübeck	5	Fischer, C. A.	Double gun, rifle, and pistols.
United Kingdom . .	–	Fox, Alfred	Fine specimens of nets, seine, &c., for pilchards.
France	1612	Gauvain, J.	Pistols, form and execution; sporting guns, &c.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	1611	Gastinne-Renette	Sporting guns and arms.
United Kingdom	59	Greener, W.	Guns, barrels perfectly forged and finished. Harpoon guns, for whale fishery, and for saving life from shipwreck.
—	131	Green, Messrs.	Specimen model of a fine merchant vessel designed and built by them for the East India trade.
—	-	Groom, J. J.	Specimens of deep-sea fishing-lines and hooks.
—	-	Hawker, P., Colonel	His improvements and perfection in punt guns.
—	136	Hinks, Henry	Design of a life-boat. Also recommended for the prize of 100 guineas, to be awarded by the Duke of Northumberland.
France	1628	Houiller-Blanchard, H.	Pair of pistols and apparatus.
Belgium*.	139	Jansen, A.	Collection of sporting and ornamental guns.
United Kingdom	188	Jeffery, Walsh, and Co.	Specimens showing the advantages of marine glue, as a substitute for pitch and for other purposes connected with ship-building.
—	21	Jerningham, Captain, R.N.	An anchor, bent on a line, to fire from a Manby mortar a sufficient distance to afford the means of hauling a life-boat through the surf.
—	226	Lang, J.	Double and single guns and pistols.
France	385	Lahure, —	Iron life-boat.
United Kingdom	195	Laurie, R. W.	Buoyant mattresses, &c.
France	1083	Legoff, Captain	An excellent system of stopping chain cables.
Belgium	151	Lardinois, N. C.	Target rifle, with accessories of every kind.
France	1547	Leopold, Bernard	Double and single barrels, of damasque workmanship.
Belgium.	145	Lepage, —	Numerous collection of sporting and trade guns.
France	1364	Lepage Moutier.	Sporting guns; ornamental arms; swords and side-arms of De Luynes; damasque of remarkable novelty.
United Kingdom	22	Manby, Capt. G. W. (Representatives of).	Mortar apparatus, for shipwreck purposes. The object of this instrument is that of saving life from shipwreck, by means of firing a projectile, with a line attached, over a vessel when on shore.
—	149	Mare, C. J. and Co.	Models of sailing and steam vessels, both paddle and screw; ditto of yachts, designed and built for various merchants' services.
—	267	Mortimer, T. E.	Guns, rifles, and pistols.
—	158	Napier and Son (Cl. VI.)	A compass used for registering the hourly deviation of the needle, and for detecting errors in the steerage of a ship.
United Kingdom	260	Needham, Henry	Guns, rifles, and pistols.
—	270	Parson, W.	Guns, rifles, and pistols.
—	136	Plenty, J. and E. Pellew	A good specimen of a life-boat.
Belgium	146	Plomdeur, N.	Best guns, rifles, and pistols.
United States	446	Pook, S. M.	Models of ships of war.
United Kingdom	244	Reeves, Greaves, and Co.	Swords and other side-arms artistically embellished.
Belgium.	141	Renkin Brothers	Numerous collection of sporting and trade guns.
United Kingdom	290	Rhind, W. G.	Deck-seat to form raft. This seat can be readily formed into a safety raft, capable of sustaining eight people.
—	240	Richards, Westley	Best guns and sporting guns.
—	236	Rigby, W. and J.	Guns, pistols, and rifles, and barrels of damasque.
—	291	Rigmaiden, Lieut. J., R.N.	Model of improved mode for setting up the standing rigging of ships.
—	193	Robinsons and Russell.	Models of steam boats, designed and built by them.
France	991	Rocher, M.	Distilling and cooking galley.
United Kingdom	336	Rodger, Lieut. W., R.N.	Models of improvements in form of anchors.
—	294	Royal Thames Yacht Club	Models of vessels belonging to their Club.
—	-	Saunders, J. E. (Cl. XXIX.)	Model of a welled smack for fishing, fitted with auxiliary screw propeller. A novel application to vessels of this description.
—	-	Semmens, J. and T. W.	Model of Mounts Bay fishing-boat. A fine description of boat for the purpose.
France	1475A	Schneider, —	Specimen and plans of steam-boat "L'Ocean," for the river Rhone, which vessel has attained great speed and rendered much service to the commerce on that river.
Switzerland.	68	Sauerbrey, V.	Target rifle.
United Kingdom	125	Smith, S.	Model of a spring machine, for modelling ships of any form or dimensions; an ingenious and ready means of setting up a design in model.
—	305	Smith, Thomas and William	Specimen model of fine merchant vessels; designed and built by them for the East India trade.
France	1478	Sochet.	Distilling apparatus.
United Kingdom	136	Teasdel, Wm.	For a good specimen of a life-boat.
Belgium.	155	Tourey, —	An ornamental double gun, guns and arms.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	222	Trulock and Son	Guns, pistols, and rifles, and barrels of good damasque.
——	185	Tutt, G. (Cl. xxix.).	Model of a Hastings fishing lugger; a very fine description of boat for the purpose.
——	36	White, J.	Models of vessels for merchant service, and yachts; designed and built by him.
——	36A	White, T. J. and R.	Models of fine sailing and steam vessels and yachts.
——	56	Wigram, M., and Sons.	Models of sailing and steam vessels, both paddle and screw; designed and built for various merchants' services.
——	200	Wilkinson and Son.	Guns, rifles, pistols, and swords; swords highly ornamented.
Spain	264	Zuloaga, E.	Fire-arms and swords.

HONOURABLE MENTION.

France	418	Berger, F.	Fowling-pieces.
——	1546	Beringer, B.	Sporting guns and arms.
——	1075	Bernard, Albert	Double and single barrels; good damasque workmanship.
United States	321	Colt, Samuel.	Revolving rifles and pistols.
France	1582	Delacour, —.	Swords and sabres, mounted and ornamented.
Austria	–	Deutscher, —	Tyrolean target rifle.
Belgium	154	Falisse and Trapmann.	Specimens of military fire-arms; collection of nipples.
Switzerland	265	Fischer, F.	American rifle.
United Kingdom	255	Fletcher, Thomas	Guns, rifles, and pistols.
——	278	Grainger, William	Locks for guns.
Bavaria	20	Heienlein, C. V.	Rifle.
United Kingdom	691	Hughes (Cl. x.).	Compass.
Switzerland	5	Jeannet, F.	Rifle.
Austria	116	Kehlners, A. C., Nephew	Pistols, mounted in carved ivory stocks, with accessories.
Bavaria	21	Kuchenreuter, J. A.	Pistols.
United Kingdom	217	Manton and Son	Guns, rifles, and pistols.
Belgium	147	Malherbe, L.	Collection of ornamental and sporting guns.
United Kingdom	248	Mole, Robert	Swords, side-arms, of all kinds; sword-blades.
United States	347	Palmer, W. R.	Target rifle.
Prussia	481	Pistor, W. and G.	Rifle for pointed ball.
United Kingdom	207	Potts, T. H.	Guns, pistols, and rifles.
——	249	Powell and Son	Guns, rifles, and pistols.
France	1681	Prelat, —.	Pistols.
United States	328	Robbins and Lawrence	Military rifles.
Prussia	480	Schnitzler and Kirschbaum	Numerous collection of swords and side-arms.
Mecklenburg-Schwerin	2	Schmidt, J.	Double gun, rifle, and pistols.
Belgium	152	Tinlot, J. M.	Double gun.
——	144	Thonet, J.	Double gun.
United Kingdom	247	Tipping and Lawden	Guns, pistols, and rifles, and collection of trade arms.
Switzerland	69	Vannod, J.	Target rifle.
Frankfort-on-the-Maine	6	Weber and Schultheis.	Two rifles.
United Kingdom	203	Witton and Daw	Guns and rifles.

MONEY AWARDS.

United Kingdom	–	Birnie, Alex.	A complete set of fishing-nets, lines, and hooks, for deep-sea fishing, 50*l*.
——	–	Bothway, Joseph	Models of his improvements in the construction of blocks, combining strength and other advantages with much less weight, 50*l*.
——	174	Dempster, H.	An ingenious system of signals for merchant ships, 20*l*.
——	159	Harvey, David	A model of the "Victoria and Albert" yacht, executed by him, being a fine specimen of workmanship, 40*l*.

CLASS IX.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	15	Busby, W.	Two or four horse plough, horse-hoe on the ridge, ribbing corn drill, and cart.
—	135	Crosskill, W.	Norwegian harrow, meal mill, cart, clod-crusher, and gorse-bruiser.
—	142	Garrett and Sons	Horse-hoe, general purpose drill, four-row turnip drill on the flat, improved hand-barrow drill for grass seeds, steam engine and thrashing machine.
—	233	Hornsby and Sons	Corn and seed drill, drop drill, two-row turnip drill on the ridge, oil-cake bruiser, steam-engine.
United States	73	M'Cormick, C. H.	Reaping machine.

PRIZE MEDAL.

United Kingdom	132	Ball, W.	Two-horse plough.
—	128	Barrett, Exall, and Andrews	Steam-engine and linseed and corn crusher.
—	217	Bentall, E. H.	Cultivator dynamometer.
—	237	Burgess and Key	Improved American churn and turnip cutter.
—	37	Burrell, C.	Gorse bruiser.
Belgium	163	Claes, P.	Corn drill and roller.
United Kingdom	242	Clayton, Shuttleworth, and Co.	Steam engine.
—	47	Clayton, H.	Tile machine.
—	216	Coleman, R.	Cultivator expanding harrow.
—	143	Comins, J.	Horse-hoe.
—	205	Cornes, James	Chaff cutter.
—	96	Crowley and Sons	Cart.
Belgium	510	Delstanche, P.	Plough.
—	166	Duchene, J. J.	Churn.
United Kingdom	129	Gibson, M.	Clod crusher.
—	150	Gray and Sons	Cart.
—	149	Hensman and Son	Thrashing machine, four-horse plough, corn drill.
—	241	Holmes and Sons	Thrashing machine.
—	240	Howard, J. and F.	Two-horse XX plough, four-horse plough, horse rake.
—	414	Hurwood, G. (Cl. VI.)	Meal mill.
Netherlands	74	Jenken, W.	Plough.
France	1299	Lavoisy, A. D.	Churn.
United Kingdom	124A	Newington, Dr. S. (as Inventor)	Top-dressing machine.
—	50	Nicholson, W. N.	Oil-cake bruiser.
Belgium	169	Odeurs, J. M.	Plough.
United States	404	Prouty and Mears	Plough.
United Kingdom	124	Ransomes and May.	Drop drill.
—	108	Reeves, T. R. and J.	Water drill and liquid-manure distributor.
—	185	Samuelson, B.	Turnip cutter.
—	228	Scragg, T.	Tile machine.
—	234	Smith and Co.	Haymaker, chaff cutter, horse rake.
—	1	Stanley, W. P.	Linseed and barley crusher.
France	1028	Talbot Brothers.	Plough.
United Kingdom	271	Tuxford and Sons	Steam engine.
—	220	Wilkinson, T.	Churn.
—	151	Williams, W.	Light and heavy harrows.
—	239	Whitehead, J.	Tile machine.
France	705	Vachon, Son, and Co.	A seed and corn separator.

HONOURABLE MENTION.

United Kingdom	28A	Fowler, J.	Draining plough.

CLASS X.

COUNCIL MEDAL.

NATION.	No. in Catalogue	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	434	Bain, A.	Electric telegraph.
—	433	Bakewell, F.	Copying electric telegraph.
United States	463	Bond, Wm. and Son	The invention of a new mode of observing astronomical phenomena, &c.
France	1108	Bourdon, E.	The invention of metallic barometers, and for his manometers.
United Kingdom	429	Brett, J.	Printing telegraph.
—	144	Brooke, C.	The invention of a means of self-registering natural phenomena, by photography.
—	301	Buckle, S. (Cl. xxx.)	Photographs on paper.
France	443	Buron	Good telescopes, the object-glass being of rock crystal.
United Kingdom	22	Chance, Brothers and Co. (Cl. xxiv.).	A disc of flint glass, 29 inches diameter.
—	296	Claudet, A. F.	Inventions based upon experiments in the practice of photography; and non-inverted pictures.
Switzerland	73	Daguet, F.	Superiority of glass for optical purposes, good specific gravity, clear; crown-glass as clear as flint.
France	160	Deleuil, L. J.	Balance air-pump; and for the invention of an arrangement to keep the charcoal points in electric light at a constant distance.
United Kingdom	145	Dollond, G.	Atmospheric recorder, by means of which the readings of the barometer, those of the thermometer evaporator, fall of rain, direction of the wind, its strength, electric state of the air, &c., are simultaneously registered.
France	1197	Dubosq-Soleil, J.	A very ingenious heliostat, on a new construction, by Silberman; the invention of an apparatus for fixing the charcoal points for electric light; a saccharometer of delicate structure, and much ingenuity, and an elegant and novel instrument, by Brevais, for exhibiting the phenomena of polarized light.
United Kingdom	210A	Dunin, Count E.	Extraordinary application of mechanism to his steel expanding figure of a man.
France	1609	Froment, G.	The goodness of the work of his theodolites, and divided meter.
Tuscany	57	Gonnella, Professor T.	Planimeter, a machine for measuring plane surfaces.
United Kingdom	331	Griffith, Rev. J.	Barometer, with a vacuum capable of complete restoration by an air-trap at the top.
—	428	Henley, W. T.	The convenient and ingenious application of magnetic electricity to the purpose of electric telegraphs.
Netherlands	87	Logeman, W. M.	Excellence of the magnets shown by him.
France	610	Martens, F.	Talbotypes on glass by the albuminous process.
Bavaria	30	Merz and Sons	Equatorial, combining cheapness with excellence of workmanship.
United Kingdom	674	Newman, J.	The originality, excellence, and perfection of his air-pumps, and self-registering tide gauge.
—	334	Oertling, L.	Very delicate large and small balances.
France	1683	Quennessen	A platina alembic, to hold 250 pints, all in one piece, without solder or seam, &c.
United Kingdom	254	Ross, A.	Great improvements in microscopes, and for the solidity of structure, good mechanism, and distribution of strength, great size, &c., of his large equatorial.
—	299	Ross and Thomson. (Cl. xxx.)	Great improvements in photography.
Prussia	310A	Siemens and Halske	Electric telegraph.
United Kingdom	253	Smith and Beck	Excellence of their microscopes.
France	386	Taurines	Dynamometer exhibited and manufactured by J. B. Tailfer and Co.
United Kingdom	26	Vidi	The invention of the aneroid barometer.

PRIZE MEDAL.

NATION.	No. in Catalogue	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	368	Ackland, W.	Dividing engine.
—	201	Allan, T.	Electric telegraph.
United States	395A	Bache, A. D.	Balance.
Austria	135	Batka, W.	Chemical apparatus.
Prussia	76	Baumann, T.	Comparateur.
France	414	Bayard, H.	Talbotypes.
Belgium	–	Beaulieu, A.	Theodolites and sextants.
France	1549	Bertaud, jun.	Slices of crystals.
—	765	Beyerlé, G.	Cylindrical lenses.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	372	Blunt, Henry	Model of Eratosthenes; part of moon.
France	434	Bourgogne, J.	Microscopic preparations.
United States	137	Brady, M. B	Daguerreotypes.
Prussia	670	Breithaupt, F. W., and Son	Surveying instruments.
United Kingdom	432	British Electric Telegraph Company	Their series of electric telegraphs.
United States	187	Burt, W. A.	Solar compass. Surveying instruments.
United Kingdom	–	Challis, Prof.	Scales for calculating the corrections for a transit instrument.
France	123	Chuard	Safety lamp.
——	1155	Collot Brothers	Balance.
United Kingdom	–	Cotton, Wm.	Corn-weighing machine.
——	452	Crichton, J.	Drawing instruments and sextants.
——	333	De Grave, Short, and Fanner	Weighing-machines, assay and other balances.
——	76	De la Rue and Co. (Cl. xvii.)	Iridiscent films.
——	317	Denton, J. B.	Process of relief mapping.
Mecklenburg Schwerin	–	Dolberg, A.	Balance.
United Kingdom	344	Dover, J.	Balance.
——	–	Electric Telegraph Company	Series of electric telegraphs.
——	320	Elliott and Sons	Drawing instruments.
Prussia	274	Engel, F.	Wave surface.
United States	146	Ericsson, J.	Sea-lead; pyrometer, &c.
Bavaria	25	Ertel and Son	Universal astronomical instrument.
United Kingdom	195	Facy, R.	Orrery.
France	501	Fastré, J. T.	Thermometers.
——	836	Flacheron-Hayard	Talbotypes.
——	220	Foucalt, P.	Printing machine for the blind.
——	1239	Galy-Cazalat	Manometer, upon the hydraulic principle.
United Kingdom	457	Griffin, John Joseph	Chemical apparatus.
Switzerland	85	Gysi, F.	Drawing instruments.
France	861	Hamann, E. F.	Planimeter.
United Kingdom	297	Henneman and Malone	Talbotypes.
——	249	Hett, A.	Microscopic preparations.
——	152	Hewitson, J.	Tide-gauge.
Denmark	47	Hjorth, S.	Electro-motive power.
Switzerland	81	Hommel-Esser, F.	Drawing instruments.
United Kingdom	220	Horne, Thornthwaite, and Wood	Good work in photograph apparatus.
——	401	Hughes, W.	Topography for the blind.
——	477	Johnson and Matthey (Cl. i.)	Palladium crucibles.
——	198	Johnson, W. and A. K.	Geological and physical globe.
Denmark	17	Jürgensen and Sons	Metallic thermometer.
United Kingdom	294	Kilburn, W. E.	Photographs.
Wurtemburg	26	Kinzelbach, T.	Dialitic telescope.
United Kingdom	453	Knight and Sons	Chemical apparatus.
Prussia	194	Kummer, K. W.	Large relief globe.
United States	151	Lawrence, M. M.	Daguerreotype.
United Kingdom	8	Leeson, Dr. H. B. (Cl. i.)	Crystals.
——	322	Lloyd, Lt.-Col. J. A.	Storm indicator, or typhodeictor.
Prussia	83	Luhme, J. F., and Co.	Chemical apparatus.
France	656	Maës, J.	Prism of zinc glass.
Austria	139	Marchesi, G. B.	Instruments for the blind.
United Kingdom	9	Mitchell, Rev. W. (Cl. i.)	Models of crystals.
France	1370	Nachet	Microscopes.
United Kingdom	688	Nasmyth, J.	Moon maps.
——	160A	Negretti and Zambra	Meteorological instruments on glass.
——	212	Newton and Son	Globes.
Prussia	77	Nobert, F. A.	Fine lines on glass.
——	87	Oertling, A.	Balance.
United Kingdom	318	Penrose, F. C.	Heliograph.
France	369	Perreaux	Dividing engine.
United Kingdom	92	Phillips, W. H. (Cl. v.)	Fire annihilator.
——	269	Pillischer, M.	Elliptic compass.
France	1679	Plagniol, A.	Camera obscura.
Austria	362	Pretsch, Paul	Photographs.
United Kingdom	254A	Reade, Rev. J. B.	Solid eye-piece.
Belgium	504	Sacré, E.	Balance.
France	999	Schiertz, J. G.	Photographic apparatus.
Switzerland	252	Schoell, C. A.	Model of Mount Sentis.
Grand Duchy of Hesse	77	Schröder, J.	Descriptive models of joining in wood, crystals, &c.
Prussia	483	Seel, H., jun.	Pharmaceutical apparatus.
United Kingdom	677A	Shadbolt, G.	Microscope condenser.
——	711	Simms, W.	Fine astronomical instruments and sextants.
India	–	Smith, Capt.	Coin-weighing machine.
United States	95	St. John, John R.	Detector compass.
Russia	148	Staffel, J. A.	Calculating machine; machine for weighing precious metals, &c.
Saxony	15	Stoehrer, E.	Electric telegraph.
France	390	Thomas, C. X.	Calculating machine.
United Kingdom	667	Topping, C. M.	Microscopic preparations.
Belgium	173	Van Schendel, P.	A model of descriptive geometry—perspective.
United Kingdom	257	Varley and Son	Telescopic camera lucida.
France	719	Vedy, F.	Sextants and reflecting circles.
United Kingdom	430	Walker, C. V.	Graphite batteries, &c.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	664	Ward, W. B.	Botanical cases.
—	56	Watkins and Hill (Cl. v.)	Dry-pile apparatus, galvanometer, &c.
—	444	Westmoreland, J.	Electrical machine.
Switzerland	84	Wettli, C.	Planimeter.
United Kingdom	451	Whipple, J. A.	Daguerreotype of the moon.

HONOURABLE MENTION.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Frankfort-on-Maine	7	Albert, J. W.	Photographs.
Prussia	704	Ausfeld, A.	Planimeter.
United Kingdom	349	Barrett, R. M.	Sextants.
—	708	Barton, H. W.	Military sketching.
Netherlands	83	Becker, C.	Balance.
France	762	Bernard, D. F.	Optical instruments.
Austria	130	Burg, Chevalier A. de	Dynamometer.
Prussia	89	Busch, E.	Optical instruments.
United Kingdom	259	Chadburn Brothers.	Good and cheap instruments.
France	1729	Chevalier, C.	Microscopes.
Belgium	183	Dehennault, J. B.	Anemometer.
United Kingdom	436	Dering, G. E.	Electric telegraph.
—	438	Edwards, J. B.	Chemical apparatus; electrotypes.
United States	263	Fisher, T.	Mathematics simplified.
France	235	Gavard, A.	Pantographs.
United Kingdom	103	Gerard, A.	Trigonometer.
France	262	Henri, M.	Spectacles applied to all distances of the eye.
United Kingdom	300	Hill and Adamson (Cl. XXX.)	Talbotype groups.
Russia	169	Imperial Ijorsk Works.	Drawing instruments.
France	548	Jamin.	Prisms and lenses.
Switzerland	88	Kern, J.	Drawing instruments.
United Kingdom	287	King, T. D.	Polarising microscope stand.
Austria	135	Kusche, J.	Balance.
United Kingdom	291A	Ladd, W.	Microscopic apparatus.
France	1690	Lalanne, L.	A calculating-rule, constructed on new principles
—	567	Laur, J. A.	Planimeter graphique.
United Kingdom	306	Leonard, S. W.	Microscopic drawings.
Sweden and Norway	15	Littman, E.	Balance.
Prussia	81	Lüttig, C.	Drawing instruments.
France	620	Maucomble	Coloured daguerreotypes.
United Kingdom	409	Marratt, J. S.	Telescopes.
Switzerland	95	Massett, L.	Cheap orrery.
United States	491	Mayall, J. E.	Photographs.
France	649	Molteni and Siegler	Reflecting circles, &c.
Prussia	706	Nietzchmann and Vaccanni	Drawing instruments.
Denmark	20	Nissen, J.	Air-pump, balances.
United Kingdom	411	Phillips, J.	Rain-gauge, anemometer.
—	248	Pritchard, Andrew	Microscope.
Prussia	86	Reimann, L.	Balance.
Bavaria	34	Reifler, C.	Drawing instruments.
France	1455	Rouget de Lisle, T. A.	Drawing instruments.
United Kingdom	338	Sang, J.	Planimeter.
Switzerland	59	Schilt, V.	Calculating machine.
Prussia	484	Schroedter, E.	Theodolites.
Austria	130	Stampfer, Prof.	Surveying instruments.
Prussia	482	Suess, W.	Thermo-electric battery.
France	1038	Thierry, J.	Daguerreotypes.
United Kingdom	324	Tree and Co.	Fine ivory and metal scales.
Sweden and Norway	14	Viberg, A. P.	Balance.
Austria	739	Vogel, C. F.	Photographs.
United Kingdom	387	Wertheimer, D. J.	Calculating machine.
—	157	Wilkins, W. C.	Lighthouse.
Wurtemburg	13	Wolff, F. A.	Pharmaceutical apparatus.
United Kingdom	332	Yeates, G.	Road theodolite, cheap air-pumps, &c.

CLASS Xa.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Bavaria	23	Boehm, T.	Important scientific improvements of the flute, and the successful application of his principles to other wind instruments.
France	173	Ducroquet, P. A.	Application of the pneumatic lever to a church organ.

NATION.	No in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom and France.	496 & France 497	Erard, P.	Peculiar mechanical actions applied to pianofortes and harps.
United Kingdom	555	Gray and Davison	Invention in organ building, of a new method of connecting the great organ with the swell organ, by means of a pedal and of a new stop called the keraulophon.
——	556	Hill and Co.	Invention of a stop of great power, and a mode of shifting the stops by means of keys.
France	1725	Sax, A.	Invention of several classes of wind instruments in wood and metal.
——	735	Vuillaume, J. B.	Modes of making violins, in such a manner that they are matured and perfected immediately on the completion of the manufacture, thus avoiding the necessity of keeping them for considerable periods to develop their excellencies.
United Kingdom	209	Willis, H.	Application to organs of an improved exhausting valve to the pneumatic lever, the application of pneumatic levers in a compound form, and the invention of a movement in connection therewith for facilitating the drawing of stops either singly or in connection.

PRIZE MEDAL.

NATION.	No in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	487	Addison, R.	" A Royal Albert" transposing pianoforte.
France	421	Bernardel, sen.	Violins.
——	424	Besson, G.	Various metal musical instruments.
United Kingdom	519	Betts, Arthur	Two violins.
Saxony	25	Breitkopf and Härtel	A grand pianoforte.
United Kingdom	518	Broadwood, John, and Sons	Successful improvements in pianoforte making.
——	735	Bryceson, H.	A church barrel organ.
France	442	Buffet, A.	Oboes, clarionets, flutes, and a "corno-Inglese."
United Kingdom	547	Callcott, J.	Invention of a French horn, without loose crooks.
United States	458	Chickering, J.	A square pianoforte, and the Jury think highly of his grand pianoforte.
United Kingdom	168	Collard and Collard	Pianos, and successful application of several improvements in pianoforte making.
France	1172	Debain, A.	A mechanical pianoforte.
Tuscany	58	Ducci, A. and M.	An organ with a "Baristata" stop.
United States	481	Eisenbrant, C. H.	Clarionet and flutes.
United Kingdom	509	Forster, S. A.	A violoncello, violin, and viola.
France	1231	Franche, C.	A new repetition action in a pianoforte.
Spain	272	Gallegos, J.	A "Guitarra Harpa."
Prussia	848	Gebauhr, C. J.	A pianoforte.
United States	442	Gemunder, G.	A "Joseph Guarnerius" violin (chiefly), and for three other violins, and a viola.
France	454	Godfroy, C., sen.	Flutes.
Nassau	8	Heckel, J. A.	A bassoon of a new and improved construction.
United Kingdom	615	Heeps, Joanna Harriet	Hearing apparatus, made of gutta percha.
Wurtemburg	24	Heiwert, J.	A bassoon with 19 keys, of an improved construction.
United Kingdom	500	Hopkinson, J. and J.	A horizontal grand pianoforte, with new patent action.
——	486	Hund, F., and Son	A cottage pianoforte, in the form of a lyre, termed the "Lyra" pianoforte.
Belgium	176	Jastrzebski, F.	An upright pianoforte.
France	1274	Jaulin, J.	A panorgue, and his improvements in free reeds.
United Kingdom	484	Jenkins, W., and Sons	An expanding piano for yachts, &c.
——	467	Kirkman and Son	A semi-grand piano, and an oblique piccolo piano.
Bavaria	100	Knocke, A.	His mechanical improvements in kettle drums.
United Kingdom	540	Köhler, J.	A slide trombone, and the application of his patent valves to other metal wind instruments.
——	100	Lambert and Co.	A cottage pianoforte.
——	673	Macfarlane, George.	An improved cornet-à-piston.
Belgium	175	Mahillon, C.	Clarionets, and a trombone and ophicleide.
United States	59	Meyer, C.	Two pianofortes.
France	1665	Montal, C.	Four cottage pianofortes.
United States	374	Nuns, R., and Clarke	A 7-octave square pianoforte and a new tuning of Æolian reeds.
United Kingdom	520	Oates, J. P.	Improvements as applied to cornets.
France	943	Pape, J. H.	Certain improvements in pianofortes.
United Kingdom	504	Pask, John	Clarionets and brass instruments.
——	537	Purdy and Fendt	A double bass (chiefly), and for four violins, and two violoncellos.
France	1687	Roller and Blanchet	Three pianofortes.
United Kingdom	536	Rudall, Rose, and Co.	A Carte's Boehm patent flute.
Wurtemburg	23	Schiedmayer and Sons	A square pianoforte, in mahogany.
Prussia	707	Schulze, J. F., and Sons	An organ.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	469	Southwell, William	A grand pianoforte.
——	470	Stodart, Wm., and Son.	A square pianoforte.
France	1510	Triebert, F.	Oboes and a "corno-Inglese."
United Kingdom	527	Ward, Cornelius.	A newly-constructed bassoon, and improvements in drums.
——	526	Wheatstone and Co.	A novel invention of a portable harmonium.
——	499	Wornum, R.	An improved piccolo pianoforte.

HONOURABLE MENTION.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	1719	Alexandre and Son	Two harmoniums à percussion.
——	404	Aucher and Son	Two upright pianofortes.
Belgium	174	Berden, F., and Co.	Three cabinet pianofortes.
United Kingdom	553	Bishop, James C.	A cabinet organ, containing composition pedals, &c.
France	1555	Bréton, —	A clarionet on Boehm's principle.
United Kingdom	546	Card, W.	Flutes.
New South Wales	5	Clinch, J.	A set of bagpipes, made by George Sherrer, Sydney.
France	1163	Courtois, Antoine	A bombardon and cornets.
United Kingdom	554	Dawson, C.	An organ, called an Autophon; the tunes being produced by means of perforated sheets of mill-board.
France	475	Detyr, N. and Co.	Two upright pianofortes.
Austria	141 D	Deutschmann, J.	A seraphine.
Wurtemburg	20	Dieudonné and Blädel	A grand pianoforte, with double action.
United Kingdom	505	Dodd, E.	Violin, violoncello, double bass, and harp strings.
——	543	Dodd, J.	Violin, viola, and violoncello bows; and silver strings for the violin, violoncello, and harp.
Wurtemburg	21	Doerner, F.	A square pianoforte.
France	477	Domeny, —	Harps.
India.	-	East India Company, The Hon.	Four gongs.
France	844	Gautrot and Co.	Bombardons.
United States	435	Gilbert and Co.	A pianoforte with Æolian attachment.
United Kingdom	503	Greaves, E.	A chromatic tuning fork.
——	468	Greiner, G. F.	A tuning apparatus (in addition to 50*l.* in money).
——	510	Heaps, J. K.	A violoncello.
France	1268	Herz, H.	Four pianofortes.
United States	438	Hews, G.	A square pianoforte.
Canada	185	Higgins, P.	The quality and cheapness of a violin.
Denmark	30	Hornung	A square pianoforte.
Switzerland	87	Hüni and Hübert	A grand pianoforte.
Austria	151	Indri, A.	Violin, violoncello, double bass, harp, and guitar strings.
United Kingdom	533	Jones, B.	An improved grand triple-string Welsh harp.
France	1633	Kleinjasper, —	A cottage pianoforte.
Saxony	18	Klemm, G. and A.	A violin ornamented with mother-of-pearl.
France	556	Labbaye, —	A bombardon.
Russia	172	Lichtenthal, M.	A semi-grand pianoforte.
France	1711	Martin, —	A reverberating organ.
——	633	Mercier, S.	Two cottage pianofortes.
——	1365	Muller, A.	Two portable melodiums.
Bavaria	35	Pfaff, M.	A bombardon ophicleide.
United States	90	Pirson, J.	A patent square pianoforte.
Wurtemburg	25	Rexer, C.	A pair of orchestra kettle drums, tuned on a new plan.
Austria	153	Riedl, J. F. (Widow of)	A chromatic horn.
United Kingdom	559	Robson, T. J. F.	An enharmonic organ, invented by T. Perronet Thompson, Esq., M.P.
Hamburgh	14	Rühms, H.	An upright pianoforte.
——	13	Schröder, C. H.	A grand pianoforte.
France	1489	Simon and Henry	Violin and violoncello bows.
Prussia	893	Sommer, F.	A sommerophone.
France	1699	Soufleto, —	Three cottage pianofortes.
Austria	154	Stehle, J.	A double bassoon.
United Kingdom	494	Towns and Packer	A semi-grand transposing pianoforte.
Malta	1	Tonna, J.	A double bass, made of bird's-eye maple.
France	398	Tulou, —	Flutes.
Austria	155	Uhlmann, J.	F, E, and A clarionets, oboe, and corno-bassetto.
Belgium	181	Vogelsangs, J. F.	A grand piano.
United Kingdom	561	Walker, J. W.	An organ, adapted for a hall or music-room.
Prussia	-	Wehrle and Steuert	A self-acting organ, manufactured by F. Wehrle, Black Forest, Baden.
——	80	Westermann and Co.	A grand pianoforte, made of rosewood.
United States	533	Wood, J. S.	His invention of a "piano-violino," in addition to £50 in money.

MONEY AWARDS.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	468	Greiner, G. F.	For the expenses incurred in making his new and useful method of bringing into unison the strings of each choir of the pianoforte, also for his invention of a new and mechanical contrivance for pianos, £50.
United States	533	Wood, J. S.	For the expenses incurred in constructing the ingenious mechanical contrivance in his piano-violin, £50.

CLASS Xb.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	55	Dent, E. J.	Large-turret clock, on account of the combination of strength and accuracy of time-keeping attained in it, which are also accomplished by a cheaper mode of construction than in other turret-clocks of high character.
France	275	Japy Brothers	Clock and watch movements made by machinery, much cheaper than any other movement, and equally good.
Switzerland	94	Lutz, C.	Watch-balance springs, which were submitted by the Jury to the test of stretching out and heating, without affecting their form.
France	736	Wagner, J. (Nephew)	Clock with a continuous motion for driving telescopes, and for his collection of turret-clocks, which on the whole display great fertility of invention.

PRIZE MEDAL.

Switzerland	22	Audemars, L.	Watches and watch-movements.
Sardinia	33	Benoit, A.	Watches, and tooth-polishing machine.
France	441	Brocot, A.	Half-dead jewelled escapement.
Switzerland	9	Du Bois, F. William	Astronomical clock.
France	1589	Detouche and Houdin	Good collection of clocks.
United Kingdom	57	Frodsham, C.	Chronometers and watches.
Switzerland	8	Grandjean, H.	Pocket chronometers.
——	24	Gros Claude, C. H.	Two watches.
France	516	Gannery, V.	Astronomical clock.
United Kingdom	27	Gowland, James	Clock escapement.
France	525	Gourdin, J.	Small turret-clock.
United Kingdom	7	Hutton, J.	Chronometers.
——	32	Jackson, W. H. and S.	Watches, solid key.
Denmark	17	Jürgensen and Sons	Chronometer.
United Kingdom	12	Loseby, E. T.	Compensated balance.
Switzerland	25	Lecoultre, A.	Watches, watch-movements and pinions.
——	96	Mercier, S.	Watches.
United Kingdom	68	McDowall, Charles	Escapement (clock).
France	601	Montandon Brothers	Watch main-springs.
Switzerland	99	Patek, Philippe, and Co.	Chronometers, watches, &c.
United Kingdom	35	Parkinson and Frodsham	Chronometers and watches.
Prussia	342	Richard, Louis	Chronometer.
France	984	Reydor Brothers, and Colin	Cheap house-clocks.
——	1425	Redier, A.	Cheap watch-alarums.
——	1685	Rieussec, N.	Watch, with printing seconds-hand.
United Kingdom	130	Roberts, R.	Turret-clock, and watch-plate drilling machine.
——	123	Roskell, J.	Collection of models and watches.
——	124	Rotherham and Sons	Collection of watches.
France	733	Vissière	Chronometers.

HONOURABLE MENTION.

United Kingdom	52A	Aubert and Klaftenberger	Watches.
France	407	Bailly-Comte and Son	Cheap turret-clocks.
Switzerland	74	Baron and Uhlmann	Chronometers and watches.
——	31	Bock, H.	Watches.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom . .	34	Barraud and Lund	Compensation-balance and watches.
——	94	Bolton, T.	Cheap watches.
France	450	Chavin, (elder Brother)	Cheap turret-clocks.
United Kingdom .	128	Cousens and Whiteside	Stop-watch.
Switzerland . . .	34	Courvoisier, F.	Chronometers and watches.
——	78	Elffroth, D. H.	Watch in pencil-case.
——	23	Favre, Brandt	Machine for cutting epicycloidal teeth.
——	–	Favre, H. A.	Chronometer, with printing seconds-hands for marking minute portions of time.
France	1186	Leroy and Son	Carriage clocks and watches.
——	292	Laumain, C.	Pocket-chronometers.
Switzerland . . .	15	Mermooz Brothers	Chronometers and watches.
France	350	Pierret	Cheap clock-alarums.
United Kingdom . .	128	Shepherd, C.	Electric clock-escapement.

MONEY AWARD.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Switzerland . . .	101	Retor, F.	To enable him to carry on further experiments to test the isochronism of spirals, his invention of a new and ingenious free spring-escapement being particularly adapted for that purpose, £50.

CLASS Xc.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom . .	619	Arnott, Dr. J.	Mode of applying cold as a novel therapeutical agent.
France	13	Auzoux, Dr. L.	Anatomical models. These models are calculated to aid the study of anatomy; human and comparative.
United Kingdom . .	631A	Avery, John	Illuminating apparatus for exploring long and narrow canals.
——	676	Bigg, H. and Son	Collection.
France	79	Burat Brothers	Herniary bandages.
Tuscany	–	Calamai, Prof. L.	A series of models in wax, representing the anatomy of the torpedo.
United Kingdom . .	570A	Caplin, Madame R. A.	Corsets.
——	570	Caplin, J.	Gymnastic apparatus, and orthorachidic instruments.
France	1145	Charrière, J. F.	Collection.
United Kingdom . .	682	Coxeter, J.	Collection.
——	274A	Evans, W.	Artificial leg.
——	643A	Evans and Co.	Collection.
——	631	Ferguson and Sons	Collection.
——	–	Gordon, J.	Anatomical model in ivory.
——	286	Gowing, Thos. Wm.	Veterinary instruments.
——	565	Grossmith and Desjardins	Artificial eyes.
——	729	Hutchinson, Dr.	Spirometer.
Switzerland . . .	106	Junod, T.	Apparatus for hemospatic.
France	1333	Lüer, A.	Collection, and the great ingenuity and admirable workmanship of several instruments for operation on the eye.
United Kingdom . .	654	Machell, Thomas	Saw, or osteotome.
United States . . .	39	Palmer, B. F.	Artificial leg.
Portugal	633	Polycarpo, A.	A case of surgical instruments.
United Kingdom . .	629	Rein, F. C.	Acoustic instruments for the deaf.
——	642	Simpson, H.	Collection.
——	624	Simpson, G.	Anatomical model of the human figure. This figure consists of pieces that may be detached at pleasure, and is calculated to stand the heat of tropical climates.
	1505	Thier	Téterelle.
France	625	Towne, J.	Anatomical models in wax.
United Kingdom . .	631A	Weiss and Son	Collection.
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CLASS XI.

PRIZE MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United States	2	Amoskeag Manufacturing Company.	An assortment of drillings, tickings, sheetings, and cotton flannel.
Switzerland	111	Anderegg, T.	Cambric muslins of unusually fine yarns.
United Kingdom	16	Anderson, D. and J.	Ginghams.
——	24	Brook, Jonas, and Brothers	Two to nine-cord sewing thread.
——	44	Christy and Sons	Turkish bath towel.
France	156	Daudville, A.	Excellence of manufacture in harness window curtains, and piece muslins.
Belgium	183	De Bast, C.	Grey calicoes.
France	148	Dubar Delespaul	Cotton trouserings.
——	494	Duranton, J. B.	Shirt-fronts, loom-made, in imitation of needle-work.
Switzerland	122	Fehr, J. C.	Jacquard muslins.
France	200	Férouelle and Rolland	Novelty of design and beauty of manufacture, in coloured and figured muslins.
United Kingdom	8	Finlayson, F., and Co.	Beauty of design, and superiority of execution, in fast-coloured sprigged lappets.
——	53	Gardner and Bazley	Fine yarns.
France	256	Hartmann and Son	Figured cottons.
United Kingdom	60	Horrockses, Miller, and Co.	Shirtings and long cloths.
——	54	Houldsworth, T., and Co.	Fine yarns.
——	48	Johnson, J.	Quiltings and toilet covers.
France	1631	Jourdain, X.	Muslin.
Prussia	604	Lamberts, A. Christ. Son	Cotton kalmucks and beavers.
Austria	185	Lang, Johann	Ginghams; design suited to French and German taste.
Switzerland	150	Leumann Brothers	Specimens of Turkey red.
Portugal	707 to 712	Lisbon Weaving Company	Cotton blankets and shawls.
United Kingdom	6	McBride and Co.	Cotton diaper, woven by power.
——	59	Mair, J., Son, and Co.	Cheap window curtains, by a new arrangement of the Jacquard loom.
——	49	Major and Gill	Loom-made double coutils and nankeens, for corsets.
France	715	Mallett (of Vantroyen and Mallett).	Yarns.
United Kingdom	37	Martin, W., and Son	Furniture dimities.
——	39	Myerscough, Steele, and Co.	Toilet quilts and bed-covers.
Switzerland	131	Näf, M.	Toilet quilts and bed-covers.
——	198	Nef, J. J.	Spotted muslins.
France	379	Ourscamp, The Company of (Peigné Delacourt, Manager).	Bleached madapollams.
United Kingdom	62	Owtram, R., and Co.	Figured and chequered cambrics.
Saxony	42	Pansa and Hauschild	Four-thread and other numbers of knitting cottons.
United Kingdom	11	Paterson, Jamieson, and Co.	Imitation of Madras handkerchiefs.
Switzerland	–	Ransauer, Aebly	Tartan and book muslin.
——	168	Raschle and Co.	Imitation of Madras handkerchiefs; those with blue grounds especially good.
United Kingdom	14	Symington, H. H., and Co.	Harness window curtains.
Saxony	90	Thümer and Töpffer	Cotton table cloths.
Prussia	711	Vogel and Carner	Levantines.
Wurtemburg	29	Weigle, J. J.	Waiscoatings (with relation to cost).
United States	352	Willimentic Duck Manufacturing Company.	Cotton sailcoth.

HONOURABLE MENTION.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Switzerland	112	Bänziger and Co.	Ginghams and striped and checked goods.
——	117	Breitenstein and Co.	Ginghams and striped and checked goods.
United Kingdom	32	Clarke, I. P.	Taste and ingenuity in winding and making up the sewing threads exhibited.
Belgium	192	De Cuyper, J. F.	Ginghams and striped and checked goods.
United Kingdom	19	Dixon, P., and Sons	Ginghams and striped and checked goods.
Bavaria	56	Jansen and Lühdorff	Ginghams and striped and checked goods.
——	43	Lienhardt, F.	Ginghams and striped and checked goods.
United Kingdom	22	Lowthian and Parker	Ginghams and striped and checked goods.
——	20	McGibbon, E.	Ginghams and striped and checked goods.
——	21	Pearson and Co.	Ginghams and striped and checked goods.

CLASS XII.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	130	Akroyd, J., and Son	Damasks, including also the award for carded Genappe yarns.
Russia	182	Aksenoff, J.	Woollen cloths.
France	400	Albinet, jun.	Blankets.
United Kingdom	12	Apperley, J. and D.	Black cloth.
——	103	Armitage Brothers	Woollen cloths.
——	276	Astorian Company, Huddersfield	Articles made of hare fur.
France	1062	Bacot, P., and Sons	Fancy, black, and satin, doeskins; also fine piece-dyed black cloths, of a thin make.
United Kingdom	105	Barnicot and Hirst	Woollen cloths.
——	109	Beardsell, Isaac, and Co.	Woollen cloths.
——	120	Beardsell, C., and Son	Woollen cloths.
——	95	Bennett, J., and A.	Woollen cloths of new materials.
France	–	Benoist, Malot, and Walbraume	Fine flannels.
Saxony	121	Bernhard, W.	Woollen cloths.
France	1082	Bertèche, Chesnon, and Co.	Fancy doeskins.
——	336	Biétry and Son	Cashmere cloths.
——	1550	Billiet and Huot	Yarns.
Belgium	195	Biolley, F., and Son	Thin piece-dyed black for exportation.
United Kingdom	165	Bottomley, M., and Son	Figured goods.
France	34	Bouchez Pothier	Merinos.
Prussia	491	Braun Brothers	Woollen cloths.
United Kingdom	86	Brooke, J., and Sons	Woollen cloths.
——	469	Brown, J. and H., and Co.	Scotch tweeds, &c.
——	129	Brown, W.	Damasks made of wool, silk, and cotton.
Prussia	816	Bruhm and Nägler	Cloths, of worsted weft and silk warp.
France	82	Caillet Franqueville	Merinos.
United Kingdom	273	Carr, T. and W.	Woollen cloths, also beavers.
France	86	Chatelain and Foron	Flannels.
——	1559	Chenneviere, T.	Woollen cloths.
Prussia	506	Clarenbach and Son	Woollen yarns.
United Kingdom	13	Clark, J. and T.	Woollen cloths.
——	228	Crombie, J., and Co.	Scotch tweeds.
France	132	Croutelle (Nephew)	Yarns.
——	157	David Brothers, and Co.	Merinos and cloths, mixed with organzine and spun silk.
——	138	David-Labbé and Co.	Merino fabrics (lowness of price).
United Kingdom	214	Davies, R. S., and Sons	Fine scarlets.
France	471	Dauphinot-Pérard	Merinos.
Belgium	203	Deheselle, A. J.	Flannels, swanskins, &c.
France	142	Delattre and Son	Worsted fabrics and merinos.
——	144	Delfosse Brothers	Merinos.
United Kingdom	234	Dicksons and Laings	Woollen fabrics.
Belgium	196	Dubois, G., and Co.	Trouser cloths.
United Kingdom	269	Early, Edward	Witney blankets.
——	268	Early, J., and Co.	Witney blankets.
——	130A	Ecroyd, W., and Son	Carded and Genappe yarns.
——	27	Eyres, W., and Sons	Woollen cloths.
Russia	351	Fielder, A. G.	Woollen cloths.
United Kingdom	37	Firth, E., and Sons	Blankets with cotton warp.
——	143	Foster, J., and Son	Worsted stuff goods, including also the award for alpaca, mohair, and lustre yarns.
France	484	Fortin-Boutellier	Felt cloths for pianos.
Prussia	220	Förster, Fr, Firma: Jer. Sig. Förster	Spanish stripes.
Canada	139	Gamble, W.	Blankets.
Prussia	100	Geissler, C. S.	Woollen cloths.
——	50	Gevers and Schmidt	Woollen cloths.
United States	441	Gilbert and Stevens	Flannels exhibited by Johnson, Sewell, and Co.
United Kingdom	47	Gott and Sons	Woollen cloths (for exportation).
Russia	189	Goutchkoff, E. and J.	Woollen cloths, worsted and organzine silk warp fabrics, and Cashmere-de-laines.
United Kingdom	67	Gray, S.	Woollen cloths.
Saxony	124	Grossmann, C. G.	Woollen cloths.
——	101	Grüner, F. W.	Merinos.
Prussia	357	Haas, L. F., and Sons	Woollen cloths.
Austria	259	Haas, P. and Sons	Furniture damasks and woollen velvet.
Prussia	99	Haberland, G. A.	Woollen cloths.
United Kingdom	25	Hagues, Cook, and Wormald	Blankets for various markets, also travelling rugs, including award for Spanish stripes.
——	28	Hargreave and Nusseys	Woollen cloths from new materials.
——	207	Helme, W.	Doeskins, cassimeres, &c.
Prussia	367	Hendrichs, F.	Woollen cloths.
United Kingdom	38	Henry, A. and S., and Co.	Woollen cloths.
Saxony	130	Herrmann, W.	Woollen cloths.
France	1269	Hindenlang, sen.	Cashmere and merino yarns.
Saxony	86	Hösel, R., and Co.	Damasks.
United Kingdom	166	Holdsworth, J., and Co.	Damasks and other furniture cloths.
——	210	Hooper, C., and Co.	Fine cloths, also elastic cloths for gloving.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	174	Horsfall, J. G., and Co.	Light cloths.
——	191	Inglis and Brown	Tweeds.
Russia	184	Isaieff, P.	Woollen cloths.
Prussia	97	Itzigsohn, M.	Woollen cloths.
France	278	Juhel Desmares, J.	Woollen cloths.
United Kingdom	144	Jowett, T., and Co.	Fabrics from alpaca weft, and silk and cotton warps; also of silk warp and linen weft.
——	186	Kay, Richardson, and Wroe	Chiné goods of worsted, cotton, silk, and linen, with printed warps.
Austria	191	Keller, Joseph	Woollen yarns.
Prussia	371	Kesselkaul, J. H.	Woollen cloths.
——	528	Knüpfer and Steinhäuser	Merinos and brocaded satin de Chinés.
France	1285	Lachapelle and Levarlet	Woollen yarns.
——	566	Lantein and Co.	Barège and woollen yarns.
United Kingdom	5	Leach, J., and Sons	Flannels.
Saxony	44	Leipsic Spinning Company	Merino yarns.
France	588	Lenormand, A.	Woollen cloths.
United Kingdom	254	Lloyd, W., and Co.	Welsh flannels.
——	104	Lockwood and Keighley	Woollen cords and velveteens.
Saxony	85	Lohse, E.	Damask goods made with worsted and cotton, and worsted and silk.
France	1331	Lucas Brothers	Merino yarns.
Prussia	103	Lutze Brothers	Woollen cloths.
United Kingdom	209	Marling, S. S., and Co.	Woollen cloths.
France	–	Mathieu, Robert	Merinos.
United Kingdom	135	M'Crea, H. C., and Co.	Damasks.
Saxony	129	Meissner, F. T.	Woollen cloths for exportation.
United Kingdom	140	Milligan, W., and Son	Embroidered alpaca goods, under a patented process of the exhibitors.
France	648	Mollet-Warmé Brothers	Fabrics of worsted mixed with silk, much used for foreign consumption.
Prussia	731	Morand and Co.	Draps d'été, or summer cloths twilled like merinos.
France	1668	Moureeau, —	Stuffs for furniture hangings, screens, table-covers, &c.
Prussia	350	Offermann, F. W.	Fancy trouser goods.
United Kingdom	213	Palling, W.	Billiard cloths, and scarlet hunters' or milled cloths.
France	673	Parnuit, Dautresme, and Co.	Woollen cloths.
Canada	146	Patterson, J.	Blankets.
France	1381	Paturle-Lupin, Seydoux, Sieber, and Co.	Merinos, draps d'été, mousseline-de-laines, barèges, and chalis, including also the award for yarns.
United Kingdom	40	Pawson, T., Son, and Martin	Woollen cloths.
——	184	Pease, H., and Co.	Coburg cloths, single and double twill, worsted weft and cotton warp, including also the award for yarns.
Prussia	369	Peill and Co.	Woollen cloths.
France	678	Pesel and Mennet	Cashmere fabrics.
——	679	Petit-Clément	Merinos.
——	682	Pin-Bayard	Woollen cloths, and damask worsted shawls.
United Kingdom	19	Pocock and Rawlings	Woollen cloths, exhibited by Messrs. Barber, Howse, and Mead.
——	173	Rand, John, and Sons	Fabrics of wool, and wool combined with cotton and silk, including the award for yarns.
——	259	Read, J.	Frieze cloths and milled tweeds, exhibited by Mr. R. Allen, Dublin.
——	480	Roberts, W., and Co.	Tweeds.
——	54	Robinson, T.	Blankets.
France	1449	Roger Brothers and Co.	Merino yarns.
United Kingdom	142	Rogers, G.	Coburg cloths of worsted and cotton.
——	250	Salter, S., and Co.	Woollen cloths.
——	139	Salt, Titus	Alpaca and mohair fabrics, also their yarns; moreens for furniture hangings.
France	1000	Schlumberger, G., and Co.	Damasks for furniture hangings, of worsted and silk.
Saxony	49	Schmidt, J. G., jun., Sons	Folded card-yarns.
Austria	193	Schmieger, A.	Woollen yarns.
——	226	Schöll, A.	Woollen cloths.
Prussia	374	Schöller, L., and Sons	Woollen cloths.
United Kingdom	3	Schofield, Brown, Davis, and Halse	Flannels, by Messrs. J. Schofield and Co., Haybrook, Rochdale.
Prussia	496	Schürmann and Schröder	Woollen cloths.
United Kingdom	141	Schwann, Kell, and Co.	Fabrics of various descriptions, and all adapted for foreign markets.
France	1011	Sentis, Son, and Co.	Woollen yarns.
United Kingdom	98	Shaw, J. W. and H.	Woollen cloths.
Austria	230	Siegmund, W.	Fabrics of wool and silk, &c.
France	1013	Signoret-Rochas, P.	Woollen cloths (economy of production).
United Kingdom	235	Smith, J., and Sons	Flannels.
——	24	Snell, John	Beauty of finish in woollen cloth.
Saxony	47	Solbrig, C. F.	Merino yarns.
——	117	Spengler, Karl	Woollen cloths.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	17	Stancomb, W. and J., jun.	Trouser goods.
——	496	Stowell and Sugden	Mohair yarns.
——	167	Sugden, J., and Brothers	Genappe, mohair, and poplin yarns, including also award for fabrics of English wool, combined with cotton.
——	75	Sykes, D., and Co.	Woollen cloths.
——	34	Sykes, J., and Son	Woollen cloths.
Russia	187	Tchetverikoff, —	Woollen cloths.
United Kingdom	32	Thornton, Firth, Ramsden, and Co.	Woollen cloths.
——	116	Tolson and Sons	Trouser goods and vestings.
——	162	Townend Brothers	Genappe, mohair, and poplin yarns.
——	147	Tremel, A., and Co.	Fabrics of worsted, alpaca, and mohair, shot with cotton, silk, and linen.
——	4	Tweedale, J., and Sons	Flannel.
Saxony	89	Vogel, W.	Damasks.
Russia	190	Volner, —.	Woollen fabrics.
United Kingdom	87	Walker, Joseph, and Sons, Lindley, Huddersfield.	Mohair cloths.
——	79	Walker, J., and Sons, Millshaw, Leeds.	Woollen cloths.
Prussia	720	Weissflog, E. F.	Merinos, and brocaded "satins de Chiné."
United Kingdom	51	Wilkinson, John	Felt cloth for ship's sheathing and other purposes.
——	245	Wilson, J. J. and W.	Railway wrappers and Windermere rugs.
Saxony	91	Winkler and Son	Chambard fabrics, merinos, &c.
United Kingdom	117	Wrigley, J. and T. C., and Co.	Woollen cloths.
Belgium	204	Xhoffray and Co.	Woollen yarns.
United Kingdom	49	York and Sheepshanks	Woollen cloths.
Netherlands	34	Zaalberg, J. C., and Son	A fancy blanket.
Saxony	92	Ziegler and Haussmann	Merinos.

HONOURABLE MENTION.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	165	Bottomley, Wilkinson, and Co.	Satin-faced figured goods of worsted and cotton. (Exhibited by Mr. Jacob Beyrens.)
France	1103	Bouchart Florin	Orleans cloth.
——	1122	Buffault and Truchon	Blankets.
United Kingdom	151	Clough, R.	Merinos made of English long wool.
France	1138	Cauvet, —	Merino yarns.
United Kingdom	149	Craven, J., and Son	Orleans cloth of worsted and cotton.
——	152	Dalby, James	Figured fabrics of worsted and alpaca, with cotton and silk warps.
——	150	Drummond, James	Figured fabrics of worsted and alpaca, with cotton and silk warps.
France	221	Fournival, Altmayer, and Co.	Yarns.
Austria	210	Ginzel, R. C.	Woollen cloths.
United Kingdom	65	Green, R. F., and Sons	Orleans cloth.
France	860	Guilbert and Wateau	Orleans cloths.
——	1264	Guyon, E.	Blankets.
United Kingdom	145	Harris and Fison	A fabric made with weft spun from the down, or fur, of the Angola rabbit.
——	128	Hoadley and Pridie	Damasks.
United States	–	Holden, B. T. and D.	Blankets.
United Kingdom	161	Kershaw, S. and H.	Orleans cloth of worsted and cotton.
——	168	Milner, John, and Co.	Orleans cloth of worsted and cotton.
Austria	218	Moro Brothers	Woollen cloths.
Belgium	497	Scheppers, F.	Woollen stuffs.
United Kingdom	131	Shepard and Perfect	Damasks.
——	88	Taylor, J., and Sons	Damasks.
New South Wales	–	Walker, J.	Tweeds.
United Kingdom	134	Ward, J. W.	Damasks.
——	138	Wilson, J.	Ponchos.
Netherlands	35	Zuurdeeg, J., and Son	Blankets.

Note.—*The Jury desire to award the sum of £10 to the undermentioned Exhibitor.*

United Kingdom	237	Bamford, J.	Fine light gauze flannels.

CLASS XIII.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	48	Alsop, Robins, and Co.	Sewing silks.
Prussia	360	Andreae, C.	Velvet ribbons.
France	1064	Balay, Jules	Ribbons made of silk in the gum.
—	1065	Balleidier, F.	Assortment of vestings and figured velvets, and terry.
—	21	Barth, Massing, and Plichon	Black silk plush for hats.
—	41	Barrès Brothers	Their perfection of trams for tulle and organzine, 16, 18, 20, 22, 26, and 28, dernier, for satin and plush.
Switzerland	153	Bauman and Streuli	Plain and armure silks, and glacé gros-de-Naples.
France	1079	Bellon, Joseph, and Co.	Black satins and taffetas.
—	1085	Bertrand, Gayet, and Dumontat	Chiné and figured silk shawls, scarfs, and cravats.
Switzerland	157	Bischoff, Christopher and John	Black taffetas, gros-de-Rhin, and some good black satins and ribbons.
France	197	Bonnet, J. and C.	Black satins and black taffetas.
—	771	Bonneton, J.	Organzine for plush and satin.
—	1110	Bouvard and Lancon	A few specimens of their looms, which exhibit manufacturing talent of a high order.
Sardinia	24	Bravo, Michael	Organzine for satins.
United Kingdom	49	Bridgett, Thomas, and Co.	Sewing silks, purse twist, and sarsnet ribbons.
France	1117	Brisson Brothers	Black silk plush, principally made by power.
United Kingdom	38	Brocklehurst, J. and T., and Sons	Persians, serges, sarsnets, gros-de-Naples handkerchiefs.
France	1118	Brosse and Co.	Coloured velvets.
United Kingdom	41	Brough, J. and J., and Co.	Sewing silks.
France	1120	Brunet, Lecomte, Guichard, and Co.	Chiné and embroidered silk, gauzes, grenadines, and crêpes for dresses, shawls, collars, scarfs, and cravats.
—	1125	Buisson and Co.	Gauze ribbons.
United Kingdom	31	Campbell, Harrison, and Lloyd	Moiré antique, figured and brocaded silks.
France	1134	Carquillat (Weaver of Lyons)	Woven portrait of Pope Pius IX., and ditto of the Duc d'Aumale's visit to his workshop; also of the Queen.
United Kingdom	30	Carter, Vavaseur, and Rix	Figured silks and moiré antique.
—	23	Casey and Phillips	Plain black radzimore and other plain silks.
France	113	Chambon, Casimir	Fine six-thread grenadine and organzine for satin.
—	1143	Champagne and Rougier	An assortment of rich figured silks.
—	796	Chartron and Son	Organzine, for tulle, for ribbons, and for plush and satin.
Sardinia	39	Chichizola, J., and Co.	Plain velvets, and figured silks.
France	1154	Colliard and Comte	Assortment of ribbons.
United Kingdom	70	Cope, Hammerton, and Co.	Figured ribbons.
—	22	Cornell, Lyell, and Webster	Ribbons.
France	96	Coudere and Soucaret	Gaze à bluter, from 10 to 220 threads per inch.
United Kingdom	72	Coventry Ribbons' Committee	An excellent specimen of the skill of the parties concerned in the production of it.
—	66	Cox, R. S., and Co.	An assortment of fancy ribbons.
—	40	Critchley, Brinsley, and Co.	Figured silks, handkerchiefs, and cravats.
Switzerland	152	De Bary, T., and Bischoff.	Figured ribbons.
Prussia	503	Diergardt, F.	Plain and figured velvets, and velvet ribbons.
France	1192	Donat, Andrè	Vestings and silks for cravats, in plain, figured, and broché satin, and grenadine.
—	1193	Donat and Co.	Black silk plush.
—	175	Dumaine, X.	Organzines.
—	1225	Fontaine, F.	Vesting and garment silks.
Switzerland	152	Freyvogel and Heussler	Figured ribbons.
Prussia	119	Gabain, George	Silks in damasks, and brocatelle for furniture.
France	1247	Gindre, L., and Co.	White and coloured satins.
—	1248	Girard, Nephew, and Co.	Black and coloured velvets.
United Kingdom	17	Graham and Sons	Black moiré satins and velvets.
—	36	Grout and Co.	Black crapes, crêpe aerophane, crêpe lisse, &c.
—	52	Grosvenor, W., and Co.	Furniture silks.
Sardinia	41	Guillot and Co.	Plain velvets, figured velvets, imitation of white lace on velvet ground.
United Kingdom	42	Hadwen, John, and Sons	Spun silk-yarn.
—	62	Harrop, Taylor, and Pearson	An assortment of black and shot plain silks.
France	870	Heckel and Co.	Satins in white, black, and colours, of all qualities.
Austria	260	Hell, George	Assortment of brocatelles.
France	537	Herme, Auguste	Organzine.
United Kingdom	25	Hill, James, and Co.	Plain and figured silks.
Switzerland	153	Hoehn and Baumann	Lustrings.
United Kingdom	61	Holdforth and Son	Spun silk-yarns in all numbers.
France	1625	Hooper, G., Carroz, and Tabourier	Plain, figured, and printed silk gauzes; also illusion tulle.
United Kingdom	64	Houldsworth, James, and Co.	Furniture silks.
Turkey	–	Ibrahim Aga	Specimens of figured velvets.
France	1087	Jame, Bianchi, and Duseigneur	Grenadine and organzines.
United Kingdom	1	Keith and Co.	Furniture silks.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Russia	203	Kolokolnikoff, Paul.	Specimens of gold and silver brocade, chenille, and other textures.
——	353	Kondrasheff	A variety of silks in brocade damask, portraits à la Jacquard.
France	898	Langevin and Co.	Spun silks.
——	1292	Lapeyre and Dolbeau	Damask reps, figured and Chiné silk shawls.
——	1293	Larcher, Faure, and Co.	Specimens of ribbons.
Austria	265	Lemann, J., and Son	Brocatelle embroidered in gold and silver, also broché gold on chenille and velvet grounds.
United Kingdom	21	Le Mare and Sons	Black and coloured velvets, satins, moiré, and glacé silks.
France	1649	Le Mire and Son	Figured silks, with their newest styles in lampas, damask, brocatelle, and embroidery.
——	–	Lyons Chamber of Commerce	Assortment of fancy silks.
——	612	Martin and Casimir	Black silk plush.
——	333	Massing Brothers, Hubert, and Co	Assortment of black silk plush.
——	1349	Mathevon and Bouvard	Specimens of rich silks.
——	1657	Menot, Jean	Organzine, both white and yellow.
Prussia	530	Menghius Brothers	Plain and fancy velvets, and velvet ribbons.
Austria	346	Messat, Ant.	Figured taffetas, gauze, and crêpe ribbons.
——	247	Moering, Charles	Figured and chiné ribbons.
Sardinia	43	Molinari, A.	Plain velvets, and rich figured velvet for furniture.
France	1360	Montessuy and Chomer	Crêpes, crêpe lisse, crêpe aerophane, and gauze of many kinds.
Turkey	–	Mustapha, Aga Hadgi	Crapes.
Switzerland	153	Naef and Schwarzenbach	Lustrings and gros-de-Rhin.
Spain	214	Orduña, V.	Damasks, velvets, and other silks.
Tuscany	31	Poidebard, N.	Organzines and trams.
Russia	205	Poliakoff and Zamiatin	Gold brocade and glassett.
France	1403	Ponson, C.	Plain silks.
——	1402	Potton, Rambaud, and Co.	Assortment of rich figured silks, and a woven picture of Her Majesty, Prince Albert, and Prince of Wales.
——	1435	Reynier (Cousins)	Velvets, gauzes, satins, and taffeta handkerchiefs; collars, shawls, and scarfs, in excellent taste.
Austria	268	Reichardt, F.	Plain, figured, and moiré silks, for black and coloured satin.
France	1432	Repiquet and Silvent	Fancy vests in velvet plush.
Switzerland	152	Richter Linder	Plain satin ribbons.
Sardinia	30	Rignon, F., and Co.	Organzine for satins.
United Kingdom	24	Robinson, J. and W., and Co.	A variety of satins, serges, velvets, plush, &c.
——	5	Robinson, I. and R., and Co.	Velvet vestings, black armozine silks, and satins, for cravats.
——	6	Robinson, J. and T.	Black and coloured velvets.
Switzerland	153	Ryffel and Co.	Half-florence, florence, and marceline.
United Kingdom	3	Sanderson and Reid	Figured vestings.
Russia	372	Sapognikoff, Heirs of	Specimens of gold and silver brocade, and other textures.
Switzerland	152	Sarasin and Co.	Specimens of figured ribbons.
——	152	Sarasin, J. F.	Specimens of figured ribbons.
Austria	80	Scheibler and Co.	Organzine, 28 derniers for satin, and grenadine, 48 derniers in four threads.
Prussia	534	Scheibler and Co.	Plain and fancy velvets, and velvet ribbons.
United Kingdom	37	Spitalfields School of Design	Figured and brocaded silks.
Austria	270	Schopper, M. A.	Brocatelles.
Switzerland	153	Schwarzenbach, F. J.	Gros-de-Rhin, and Poult-de-socé.
United Kingdom	15	Seamer, Thomas	Moiré antique, and plain velvets.
Prussia	514	Simons, J., Heirs of	A variety of velvets, figured silks, cravats, handkerchiefs, scarfs, vestings, gauzes, &c.
Sardinia	40	Soley, Bd.	Rich-figured silks, armures, and a royale ground for furniture, and some gauze diaphane for the same purpose.
Switzerland	152	Soller and Co.	Specimens of figured ribbons.
France	1490	Soubeyrand, Louis	Organzine.
Switzerland	153	Stapfer, J.	Plain coloured, striped, and checked gros-de-Naples.
——	153	Staub Brothers	Figured silks.
——	152	Sulger and Stueckelberger	Figured ribbons.
France	1030	Teillard, C. E.	Plain glacé silks, armures, moiré antiques, and rep silks.
——	1704	Vatin and Co.	An assortment of fancy silk gauzes, dresses, and shawls.
Austria	87A	Verza Brothers	Trams.
France	1524	Vignat Brothers	Chiné ribbons, and some figured ribbons.
Prussia	535	Vom Bruck, H., Sons	An assortment of plain velvets, and velvet ribbons.
United Kingdom	9	Walters and Sons	Black plush for hats.
——	41	Wardle, H. and T.	Figured silks, handkerchiefs, and cravats.
——	65	Winkworth and Procters	Shot and glacé gros, and figured and Chiné silks.
Switzerland	153	Zeller, Felix, and Son	Gros-de-Naples and satinets, both Gaspé.
——	153	Zurrer, Jacob	Persians and sarsnets.

HONOURABLE MENTION.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Switzerland	154	Alioth, T. S., and Co.	Chappes and spun silks.
——	153	Amann and Egli	Satinet, Chiné lustrings, and gros-de-Naples.
France	763	Bert	Collection of ancient silks.
Switzerland	152	Bischoff Brothers	Ribbons.
Rome	7	Bracci, Filanda Al Fano	Organzine.
Prussia	830	Bachoven and Vollschwitz	Black plush for travelling caps.
Austria	250	Bader Brothers	An assortment of checks and Chiné silks, cravats, handkerchiefs, and scarfs.
United Kingdom	26	Brooks, Thomas	Plain silks.
Switzerland	158	Boelger, Mark	Chappes and spun silks.
France	764	Bertrand, Ad.	Figured umbrella and parasol silks, plain poplins, Chiné, and figured silks.
Austria	252	Bujatti, Franz	Damask and furniture silks, black satins, and table-covers for Greece.
United Kingdom	68	Caldecot, R. and R.	Ribbons.
France	1137	Causse and Garion	White poil, 12, 13 derniers, for ribbons, and for organzine and trams, both white and yellow.
Austria	71	Chwalla, Anton	"Drammed" silks (a tours comtés).
France	1176	Delarbre, Victor	White and yellow organzine.
——	1580	Deydier, Paul	Organzine.
——	831	Eymieu, P., and Son	Spun silk, both shot and warp.
Austria	255	Fries and Zeppezauer	Damask and broché shot cotton, also figured silks.
France	832	Fabrèque-Nourry, Barnouin, and Co.	Spun silk, both weft and warp.
Sardinia	37	Formento, L.	Organzine, 26, 28 derniers.
Switzerland	153	Gessner, Auguste	Armures, glacés, and striped and checked gros-de-Naples.
Prussia	533	Greef, F. W.	Velvets, and silks, for parasols and umbrellas.
France	1241	Gantillon, T. E.	Woven landscape.
Austria	262	Hornbostel, C. G., and Co.	An assortment of plain and figured silks and figured silk handkerchiefs, terry velvets, and figured crêpe shawls.
Switzerland	153	Huber-Rordorf	Striped and plain gros-de-Naples.
Russia	207	Iraf Ogli	Plain and striped goods, made from Caucasian silk.
Prussia	524	Jacobs and Bering	Specimens of parasol silks.
Bavaria	38	Knorr, F.	Silk plush for hats.
Prussia	525	Kaibel, John	Chiné and figured silks.
Austria	264	Kostner, Albert	Black plush for hats.
France	1298	Lavernhe and Mathieu	Poil or tram singles, for gaze-à-bluter, and crêpe-de-Chiné, and for organzine.
Russia	204	Lokteff, J.	Ribbons, plush waistcoats, in gros-grains, and neckerchiefs.
——	371	Lapteff, N.	Plain, checked, striped, Chiné, and figured silks.
France	921	Martell, Geoffroy, and Valensot	An assortment of figured and broché silk cravats.
Switzerland	227	Meyer Brothers	Handkerchiefs, marceline, and flounce brochés, marceline, jaspé, &c.
France	1353	Méjean, A.	Organzine and grenadine for lace.
Rome	–	Meifredi, Armentario	Organzine.
Prussia	582	Meyer and Engelmann.	Parasol silks, cravats, shawls, and vesting.
——	523	Neviandt and Pfleiderer	Cravats and handkerchiefs.
Austria	248	Pfenningberger, J.	Ribbons.
Switzerland	152	Preiswerck, D., and Co.	Ribbons.
Austria	88	Rossi, G. M.	Trams and organzines.
Switzerland	161	Ryhiner and Sons	Chappes and spun silks.
——	1472	Sauvage, R., and Co.	Moire silks, armures, and taffetas.
Austria	269	Schipper, Carl	Black plush for hats.
Bavaria	37	Simon, H.	Silk plush for hats.
Russia	202	Sitoff Brothers	Silver-gilt fringes, braidings, and wire-thread, and samples of brocade.
United Kingdom	29	Soper, Henry	Parasol silks.
Austria	87	Steiner, G., and Sons	Trams and organzines.
United Kingdom	7	Stillwell and Son	Damask for furniture.
France	1500	Thevenet, Raffin and Roux	Rich rep silks, Chiné shawls, and Chiné silks.
——	1037	Thibert and Adam	Black silk plush for hats.
——	1040	Thomas Brothers	Flounces of various shades.
——	1511	Troccon, A.	Silk shawls and silks for cravats.
——	921	Valansot, M.	Terry velvets, and plushes for bonnets.
United Kingdom	28	Vanner, J., and Son	Parasol silks.
Switzerland	162	Von der Muehl Brothers	Glacé gros-de-Naples.
United Kingdom	8	Washington and Davis	Plain and figured plushes for vestings.
Switzerland	153	Wirz and Co.	Satinet and black gros-de-Naples.
United Kingdom	10	Wilson and Co.	Silk plush for hats.
Russia	209	Zaloghin	Gros-de-Naples, glacé and checked, gros-moiré (watered silk), and satin.

CLASS XIV.

PRIZE MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Russia	19	Alexandrovsk Manufactory, The Imperial	Canvas.
United Kingdom	5	Andrews, Michael	Damask table cloths and napkins.
Belgium	216	Berthelot and Bonté	Hand-spun flax-yarn.
Saxony	51	Beyer's Widow and Co.	Damask cloths and napkins.
United Kingdom	27	Birrell, David	Damask table-cloths and napkins.
Prussia	562	Bolenius and Nolte	Fine linens.
France	32	Boniface and Son	Cambrics.
United Kingdom	20	Clibborn, Hill, and Co.	Diapers.
Belgium	212	Cooreman, A. J.	Lace thread made from hand-spun yarn.
United Kingdom	92	Coulson, J., and Co.	Damask table-cloths and napkins.
—	63	Cox Brothers.	Low-priced striped bedding and hessians.
Belgium	235	Cumont-Declercq	Linen threads (colour).
France	137	Dautremer and Co.	Flax yarns.
Belgium	221	Decock-Wattrelot and Baudouin.	Fine linens.
Prussia	549	Eickholt, Anton, Heirs of.	Designs of damasks and colours of linen.
Spain	193	Ferrol, The Royal Manufactory of Isabella II., at	Canvas.
United Kingdom	48	Finlayson, Bousfield, and Co.	Strength, taste, and neatness in threads (coarse and middle sizes).
—	79	Fraser, Douglas	Canvas made by steam-power looms.
France	526	Grassot and Co.	Damasks.
—	866	Haro, E. F.	Canvas for historical painting.
United Kingdom	16	Henning, John	Damask table-cloths and cambrics.
—	45	Hives and Atkinson (Cl. IV.).	Mill-spun yarns.
—	53	Holdsworth, W. B., and Co.	Satin-finish linen threads.
Belgium	468	Kums, E.	Assortment of canvas, Russia-sheetings, &c.
United Kingdom	10	Kirk, W., and Son	Brown linens of low description and price, Hollands.
Prussia	128	Kramsta, C. G. and Sons	Bleached platillas for export.
United Kingdom	63	Laing, J. and A.	Ducks, imitation Russia-sheeting.
—	63	Lawson, Alexander	Assortment of low-priced dowlas, hucks, sheeting, window-blinds, &c.
—	19	McCay, Thomas	Fronting linen, made of mill-spun warp and hand-spun weft.
—	25	McMurray, T., and Co.	Fine linens.
France	320	Malo-Dickson and Co.	Canvas.
United Kingdom	55	Marshall and Co. (Cl. IV.).	Preparation of "China grass."
France	926	Merlie-Lefevre and Co.	Cordage.
—	636	Mestivier and Hamoir	Cambrics.
United Kingdom	71	Milvain and Harford	Canvas made with bands.
Belgium	231	Moerman-Vanlaere, J.	Assortment of canvas, of tow, flax and hemp; also railway-waggon coverings.
—	222	Parmentier, P.	Fine linen of mill-spun yarn, also handkerchiefs.
Austria	288	Peldrian's Heirs.	Fine linen of hand-spun yarn.
United Kingdom	7	Richardson, J. N., Sons, and Owden.	Light shirting linens for export.
—	18	Sadler, Fenton, and Co.	Heavy shirting linens for home trade (bleached).
France	1007	Scrive Brothers	Damasks (including their yarn and power-loom goods).
United Kingdom	63	Smieton, J., and Son	Dowlas, crequillas, creas, &c., of light and low-priced quality for export.
Saxony	53	Wäntig, C. D., and Sons	Damask table-cloths and napkins.
United Kingdom	45	Warnes, — (Cl. IV.)	Growth and preparation of flax. (Exhibited by Messrs. Hives and Atkinson.)
Prussia	543	Westermann, A. H., and Co.	Linens.
United Kingdom	42	Wilford, J., and Sons	Plain and fancy drills, and China-grass sheeting.

NOTE.—*The Jury award the sum of £10 each to the following Exhibitors.*

United Kingdom	106	Harvey, Ann, Belfast	Hand-spun flax-yarn.
Prussia	546	Heepen Spinning School (for a little girl 10 years of age).	Spun flax-yarn.
United Kingdom	–	McGill, Jane, Belfast	Hand-spun flax-yarn.

HONOURABLE MENTION.

Belgium	209	Ameye-Berte, R.	Waggon-coverings, and heavy goods made by power looms.
Switzerland	163	Beck and Sons, and other Exhibitors.	Damask and drills.
United Kingdom	6	Bell, T., and Co.	Cambric handkerchiefs.
—	–	Bernard and Co.	Hot-water steeped flax.
—	29	Beveridge, E.	Waggon coverings and heavy goods, made by power-looms.
Prussia	562	Bolenius and Nolte.	Yarns.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Prussia	799	Burbach Brothers and Co.	Hemp water-pipes without seams.
Russia	216	Bruzghin, A.	Canvas.
United Kingdom	36	Canter, Jos.	Ducks, drabbets, &c.
——	36	Carter, Brothers	Ducks, drabbets, &c.
Spain	191	Carthagena, Royal Arsenal at	Cordage.
United Kingdom	24	Corry, Blain, and Co.	Damask, also a design for a table-cloth.
——	93	Coulson, W.	Damask cloth.
France	1170	Daudré, A.	Damasks.
Belgium	239	Déroubaix, H.	Drills and other articles.
——	208	Dobbelaere-Hulin	Sheetings, hand-spun, and imitation Russian.
——	233	Dommer, T.	Cambric handkerchiefs and other linen articles.
United Kingdom	63	Don Brothers and Co.	Brown sheetings and Osnaburghs.
——	63	Don, W. and J., and Co.	Brown sheetings and Osnaburghs.
——	63	Easson, A.	Sailcloth and sacking.
——	–	Edinburgh Rope and Sailcloth Company.	Canvas.
Prussia	470	Elmendorf, E. F.	Middle-sized yarns.
Austria	284	Ferie, Wenzel	Lawns.
United Kingdom	36	Fletcher, H. T.	Ducks, drabbets, &c.
——	106	Gailey, D. (Cl. iv.)	Cold-water steeped flax.
Belgium	230	Ghent Linen Company	Assortment of the heavier tow yarns.
France	240	Godard and Bontemps	Fine cambrics.
Belgium	237	Goens, L. J.	Cordage.
France	254	Guynet and Becquet	Fine cambrics.
United Kingdom	36	Haxworth and Carnley	Ducks, drabbets, &c.
——	36	Hattersley, Parkinson, and Co.	Ducks, drabbets, &c.
——	74	Holloway, T. J.	Cordage.
——	28	Hunt, W., and Son	Damasks.
——	36	Jackson and Matthewman	Ducks, drabbets, &c.
Russia	102	Kazalett, A.	Cordage.
Prussia	120	Kirstein, C.	Linens.
——	556	Krönig, F. W., and Sons	Linens.
France	1019	Landerneau, Linen Joint Stock Company of	Canvas made from hemp.
United Kingdom	63	Leadbetter, J., and Co.	Low-priced checked and striped linens.
France	1313	Legrand, D.	Fine cambric handkerchiefs.
Saxony	52	Lieske and Häbler	Damasks.
United Kingdom	22	Malcolm, J.	Bleached lawns and handkerchiefs.
Russia	222	Mengden, Michael Von	Damasks.
United Kingdom	67	Moore, W. F.	Canvas.
——	36	Pigott and Newton	Ducks, drabbets, &c.
——	81	Renny, Sons, and Co.	Canvas.
——	21	Richardson, J. and T., and Co. (Springfield).	Cambric handkerchiefs.
——	23	Richardson and Co. (Lisburn)	Excellency of bleach in fine linens.
Wurtemburg	36	Seemann, C. and H.	Fine white and printed linen.
Austria	290	Siegl, J., and Co.	Bleached creas.
Hanover	6	Schulze, D.	Middle-sized yarns.
Belgium	226	St. Bernard, Antwerp, the House of Correction at	Dowlas, imitation Russia-sheeting, ducks, &c.
United Kingdom	51	Titley, Tatham, and Walker	Excellence in colour of the linen threads.
Belgium	215	Van Ackere, J. C.	A piece of fine hand-spun linen, double thread in warp.
Netherlands	26	Vanden Hoogen, T.	Cordage.
——	45	Vander Voort, H.	Damasks.
United Kingdom	38	Walton and Co.	Sheetings and huckabacks.
——	63	Warden, A. J.	Jute carpeting.
Prussia	542	Wessel, F. W.	Linens.
China	–	Whoyune (Canton)	Cloths and handkerchiefs of China grass.
Belgium	211	Wilford, W.	Canvas.
United Kingdom	31	Wilks, J.	An assortment of linens, huckabacks, and Russia sheetings.

CLASS XV.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	1182	Deneirouse, E., Bois-Glavy, and Co.	The discovery of a new and important process in the production of elaborate designs.

PRIZE MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	256	Atkinson, R., and Co.	Collection of poplins.
Austria	309	Berger, Joseph, and Son	A collection of shawls, and a square of Kashmir wool worked with gold.
United Kingdom	285	Blakely, E. T.	Collection of shawls and barège scarfs.
—	270	Bliss, William	A variety of shawls.
France	68	Boas Brothers	Shawls of Indian yarn.
United Kingdom	311	Bolingbroke, C. and F.	Plain, striped, and watered poplins.
—	9	Brown and Forster	Vestings, of cotton warp and weft wool; likewise stuffs of other descriptions, also waistcoatings of plush vigonia.
Belgium	244	Catteaux Brothers	Pantaloon stuffs of cotton, wool, and linen-cotton.
—	245	Catteaux Gauquié	Cotton, woollen, and linen stuffs.
France	1148	Chocqueel, Felix	Cutting and printing of light shawls.
—	809	Croco, F.	Vestings.
Austria	–	Cormaldi, Diego	Vestings embroidered on a new principle.
United Kingdom	202	Cross, William	Tartans made of fine Indian wool.
France	1167	Damiron and Co.	Collection of fine wool shawls.
United Kingdom	113	Day, John, and Son	Pantaloon stuff, warp of cotton with a weft of carded wool, crossed on one side only, of the character of cassinet.
France	1592	Duché and Co.	Fine shawls of Indian wool.
Austria	304	Echinger Brothers	Vestings.
France	–	Fassin, jun.	Waistcoatings, &c.
United Kingdom	291	Forbes and Hutchinson	Shawls.
Prussia	587	Funke, R.	Mixed cloths and dresses.
France	1243	Gaussen, Fargeton, and Co.	A variety of shawls of Indian wool.
United Kingdom	279	Glen and M'Indoe	Excellence and economy in printing shawls. (Exhibited by Keith, Shoobridge, and Co.)
Prussia	591	Grafe and Neviandt	Vestings of cotton warp.
United Kingdom	–	Graham, John	Embroidered crape shawls, from China.
France	1259	Grillet and Co.	Two long shawls of elaborate design.
—	1621	Hebert, F., and Son	Shawls, woven from Indian wool.
Prussia	575	Heymann, C., and Co.	Vestings.
—	117	Kauffmann, H.	Woollen velvets of plushes of goats' hair, of various descriptions, printed, and Chiné.
United Kingdom	279	Keith, Shoobridge, and Co.	Large collection of printed shawls.
—	300 & 275	Kerr, Robert (Kerr and Scott)	Fine specimens of every description of shawls, and a variety of tartans.
Austria	387	Laporta, H. F.	Embroideries, on several textures.
United States	464	Lawrence, Stone, and Co.	Tartans made from native wool.
United Kingdom	115	Learoyd, James	Cassinets of superior quality, exhibited by Mr. Schwann.
—	115	Learoyd, William	Cassinets of novel and excellent quality, exhibited by Mr. Schwann.
—	192	Lees, R. and G.	Specimens of tartan plaids.
France	1309	Lefebure-Ducatteau Brothers	Vestings.
Belgium	240	Lemaire, Descamps, and Plissart	Specimens of pantaloon stuffs.
—	242	Lienart-Chaffaux, Madame	Specimens of pantaloon stuff.
France	1327	Lion Brothers and Co.	Collection of shawls.
Prussia	113	Marx and Weigert	Utrecht velvet and shawls.
Russia	281	Merlin, A. and V.	A long white woven shawl.
United Kingdom	–	Milner and Hale	Excellent cashmerettes.
Prussia	532	Morgenroth and Krugmann	Woollen velvet, plain and figured.
United Kingdom	10	Murley, W. J. C.	Vestings.
—	466	Paton, J. and D.	Collection of tartans.
France	1380	Patriau, C.	Vestings of Cashmere.
Prussia	573	Pferdmenges and Kleinjung	Vestings.
United Kingdom	255	Pim Brothers and Co.	Collection of poplins.
—	301	Robertson, J. and J.	Shawls.
Austria	306	Rockstroh, H.	Specimens of waistcoatings.
United Kingdom	196	Sanderson, R. and A., and Co.	Collection of tartans.
Prussia	161	Stieff and Harrass	Variety of vestings.
United Kingdom	283	Swaisland, C.	Printed shawls of great excellence.
—	111	Taylor, J., and Son.	Vestings.
—	37	Tee and Son, (Cl. xiv.)	Variety of fabrics.
France	1506	Thierry-Mieg	Collection of shawls.
United Kingdom	309	Towler, Campin, and Co.	Collection of shawls and first-class printed goods.
Prussia	494	Van der Beeck, J. C.	Fancy tartans.
United Kingdom	51	Walmesley, H. (Cl. xi.)	Poplins.
—	287	Whitehill, M., and Co.	Merino shawls.
Austria	320	Zeisel, J. and J. and C. Blümel	Collection of shawls.

HONOURABLE MENTION.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	137	Aked and Sons	Pantaloon cloths.
Portugal	682	Barboza, J.	Pantaloons.
United Kingdom	185	Bennett and Co.	Utrecht velvet.
France	33	Bonte, L.	Pantaloon stuffs.
—	1094	Bonfils, Souvraz, and Co.	Shawls.
United Kingdom	12	Bull and Wilson	Waistcoatings.
Saxony	109	Buckhardt, H. T.	Cassinettes, &c.
France	1140	Chambellan, G., and Co.	Collection of shawls.
—	89	Chinard, Charles	Collection of shawls.
—	125	Cocu, A.	Vestings.
—	1586	Depouilly Brother, Boivaux, and Co.	Barege shawls.
United Kingdom	267	Fry, W., and Co.	Various furniture and dress pieces.
Belgium	241	Gilson and Bossut	Specimens of pantaloon stuffs.
France	1252	Godefroy	Specimens of printed shawls.
United Kingdom	58	Haley, John, and Son	Flannel shawls.
Prussia	567	Haarhaus, J. C., Sons	Collection of tartans.
Austria	311	Haydter, Sebastian	Shawls, &c.
United Kingdom	13	Henry, E., and Sons. (Cl. XI.)	Embroidered merinos.
France	263	Hess, G.	Vestings.
United Kingdom	288	Holms, William, and Brothers	Clan tartans.
—	278	Jameson and Banks	Collection of shawls.
—	294	Lawson, J., and Co.	Printing and designs.
Prussia	136	Lehmann, D. J.	Specimens of plush and woollen velvets.
—	114	Levin, H., Sons	Vestings.
United Kingdom	276	Lewis and Allenby	A design of their own composition, of peculiar Indian style.
Prussia	133	Max Meyer and Co.	Silk and cotton plush.
—	134	Opdenhoff and Hartung	Harness shawls and tartans.
—	574	Pferdmenges Brothers	Light cloths, called cassinettes.
United Kingdom	266	Reynolds, W.	Poplins, for furniture.
Austria	315	Rheinhold, W.	Long and square shawls.
—	316	Riss, Joseph	Shawls.
United Kingdom	296	Roxburg, John and Andrew	Specimens of woven shawls.
Prussia	580	Rurtmann and Meckel	Vestings.
France	–	Sabin, Rebeyre	Cravats, scarfs, and shawls.
United Kingdom	125	Schofield, J.	Pantaloon cloths, vestings in wool, silk, and cotton, and kerseymeres.
Prussia	675	Shulte, J. H.	Valentias and Cashmere designs.
Austria	271	Siebert, F.	Embroideries.
Bavaria	41	Trendel, jun.	Light pantaloon stuffs of cotton and wool.
United Kingdom	310	Willett, E., Nephew, and Co.	Paramattas, or bombazines.
—	468	Wilson and Son	Collection of clan tartans.

CLASS XVI.

PRIZE MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	323A	Adcock and Co.	A collection of feathers for ornamental purposes.
United States	498	Baker, B. J.	Light harness of superior workmanship.
France	756	Barrande, J. P.	An assortment of morocco and kid leather of varied colours.
—	415	Bayvet Brothers and Co.	An assortment of morocco, roan, and calf leather.
—	56	Berthault	An assortment of parchment and vellum.
United Kingdom	332 & 352	Bevingtons and Morris.	A collection of furs and skins, and an assortment of sheep-skin rugs.
—	78	Blackwell, S. and R.	Phaeton harness.
—	90	Blyth, R.	Lady's saddle and a hunting ditto.
—	294	Bossard, J.	Curried calf leather of superior quality.
—	58	Brace, H.	Two cases of bits, stirrups, and spurs.
—	65	Brown and Son	Specimen of saddle-trees.
—	77	Caistor, A. B.	Hussar and hunting saddles, with pair of hunting pads.
—	307	Clarke, R., and Sons	A collection of manufactured furs.
—	48	Clark, C. and J.	Sheep and lamb-skin rugs.
—	50	Cooper, M.	Racing saddle and case of saddlery.
—	314	Corry, J. and F.	Italian lamb-skins, for gloves.
France	1571	Courtois, E.	Black and coloured varnished calf and hides.
—	806	Courtepée-Duchesnay	Boot-fronts from the calf-skins of Paris.
United Kingdom	283	Cozens and Greatrex	Tanned and curried leather.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom . .	293	Cox, W. H., and Co.	Two foreign butts, very well tanned.
United States . . .	51	Crawford, H. M.	Calf-skins tanned in oak bark.
United Kingdom . .	96	Cuff, R.	Saddle (riding), bridle, and harness.
France	813	Deaddé, J.	A large assortment of calf and cow hides.
United Kingdom . .	10	Deed, J. S.	Angora goat and English sheep-skin rugs. Assortment of morocco leather (and Honourably Mentioned).
France	472	Delacour, H. P..	Horse-hair and "vegetable silk" damask.
United Kingdom . .	290	Dixon and Whiting.	An assortment of varnished and enamelled hides and splits.
Grand Duchy of Hesse	33	Dörr and Reinhardt	An assortment of varnished calf leather.
United Kingdom . .	306	Drake, R.	Three very beautiful muffs.
——	293	Draper, R. and H.	A remarkable heavy and well-tanned English hide.
France	182	Duport, V.	Three split hides of twice the usual length.
——	167	Dezaux-Lacour	Curried calf-skins.
United Kingdom . .	107	Earnshaw, H.	A case of harness.
Russia	–	Eggers, F.	A fur carpet.
France	1212	Emmerich and Georger	An assortment of coloured and black morocco
——	210	Fieux and Co.	Manufactured sole and harness leather.
United Kingdom . .	99	Forrer, A. (Cl. xxiii.)	Ornaments worked in hair and gold.
France	1244	Gauthier, J.	Black and coloured varnished leather.
Austria	346	Geyer, J.	National cloak made from lamb-skins.
France	534	Guillot, J. A.	Boot fronts of various kinds.
Belgium.	257	Haussens-Hap, B.	Horse hair, and also fibre stuffing for furniture.
Prussia	282	Heintze and Freudenberg. . . .	Black varnished calf leather.
United Kingdom . .	20	Hemsworth and Linley.	Boot fronts and cordovan.
——	293	Hepburn, John and Thomas . . .	An English crop butt.
France	538	Herrenschmidt, G. F.	Boot fronts and curried calf.
Grand Duchy of Hesse	32	Heyl, C.	Varnished calf leather.
United States . . .	58	Hickey and Tull	Two portmanteaus.
France	1271	Houette, A., and Co.	An assortment of black and coloured varnished leather.
United Kingdom . .	301	Hudson's Bay Company	A collection of fur skins.
Canada	109	Jetu, C. A.	Curried porpoise leather, and samples of leather from the skin of the whale.
Belgium.	306	Jorez, jun.	A white varnished hide.
United Kingdom . .	62	Kane, G.	Portmanteaus and camp furniture.
——	–	Keilich, Henry	Models of a miniature tigress and cubs.
Prussia	139	König, L.	A camaille of superior workmanship.
France	1639	Landron Brothers	Well-tanned sole leather.
United States . . .	41	Lacey and Phillips	A case of harness.
Belgium	256	Ladoubée, Le Jeune C.	Saddlery and harness.
United Kingdom . .	63	Lambert and Son	Waxed calf-skins, boot-fronts, and cordovan.
——	89	Langdon, W., jun.	A light phaeton harness.
——	38	Last, S.	Railway portmanteau.
——	330	Laycock and Sons	Horse-hair damask, &c.
France	909	Lemonier and Co.	Ornamental hair-work.
United Kingdom . .	24	Lever, J. and J.	Specimens of vellum and parchment for book-binding, &c.
France	1330	Lolagnier, —	Specimens of leather.
Switzerland. . . .	175	Mercier, J. J.	Curried calf leather.
Prussia	672	Merklinghaus and Wex	Dressed hides, manufactured for saddlery and harness.
United Kingdom . .	304	Meyer, S. and M.	Manufactured articles, made from the skins of the rabbit.
——	67	Middlemore, W..	Lady's embroidered saddle, and ditto with elastic seat, also mounting-rein for unbroken horses.
Canada	113	Morris, R.	A set of double sleigh harness.
Grand Duchy of Hesse	36	Mayer, Michel, and Deninger . .	Japanned and varnished hides, and calf leather, and morocco, roans, and skivers.
Nova Scotia . . .	2	Nova Scotia, Central Committee of .	A choice collection of skins.
France	1373	Nys and Co.	Black varnished calf leather.
United Kingdom . .	286	Oastler and Palmer.	Large assortment of enamelled and varnished leather, and crop butt.
——	79	Passmore, W.	A set of single-horse harness.
France	677	Peltereau, August	Sole leather.
——	949	Peltereau, F., jun.	Sole leather.
United Kingdom . .	279	Pollock, J.	A very perfect set of Scotch harness.
France	688	Prax and Lambin	A varied collection of saddlery and harness.
——	1411	Prin, A., jun.	Russet and black curried calf leather.
United Kingdom . .	285	Pullman, R. W. and J..	Chamois leather of every description.
Russia	–	Russian Imperial Cabinet of St. Petersburgh.	A pelisse lining, made from the necks of the silver fox, &c.
——	232	Skvorsoff, M.	Curried calf leather and a few calf-skins curried with the hair attached.
United Kingdom . .	310A	Smith, G., and Sons	An assortment of furs, made from Russian sable, &c.
——	17	Stockill, W.	Specimens of boot fronts.
——	92	Swaine and Adeney	A large assortment of whips and canes.
France	1022	Suser, H..	A good assortment of curried calf leather an boot fronts, and boots and shoes for exportation.
Turkey	1	Turkey, His Highness the Sultan of.	A collection of skins.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	1033	Texier, —, jun.	Specimens of buck, doe, and fawn leather.
—	1384	Ventujol and Chassang.	Boot fronts, manufactured from Bordeaux calf-skins.
Denmark	7	Warming, E.	A fur carpet.
United Kingdom	243	Webb, E.	Coloured hair-cloth, and cloth composed of silk and hair, and horse-hair carpets.
—	86	White, J. C.	Silver-mounted harness with improved registered tug.
Belgium	259	Weinknecht, T.	Two carpets made of fox-skins and other furs.
United States	205	Wisdom, Russel, and Whitman	Specimens of curled hair for furniture.
United Kingdom	11	Wilson, Walker, and Co.	An assortment of coloured sheep, morocco, and calf leather.
Prussia	841	Zeitz, J. F	A coat-lining, made from minx tails, &c.

HONOURABLE MENTION.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United States	476	Adams, H.	Portable saddle.
United Kingdom	64	Ashford, W. and G.	Specimens of whips.
—	56	Banton, E.	A case of harness.
Belgium	262	Bauchau-de Baré, A.	Tanned hides.
United Kingdom	93	Bell, C.	A lady's saddle and single harness.
—	–	Boldner, S	Fur hearth-rug, representing the Royal Arms of England.
—	112	Booth, J. P.	Various articles of ladies' dress, made from Turkey down and feathers.
—	246	Bouchet, C.	Specimens of the new crochet work in wig-making, on skin and on net.
—	293	Boutcher, Mortimore, and Co.	Collection of tanned sole leather.
Austria	334	Boulogne, P.	Kid and lamb-skin leather, dressed for gloves.
United Kingdom	245	Browne, F.	Head-dresses of ornamental hair.
—	293	Bucknall, George	Tanned hippopotamus hides.
France	77	Budin, R. A.	Curried horse hides.
Prussia	386	Buschmann, J. W.	Manufactured sole leather.
United Kingdom	4	Buse, N.	Curried calf leather.
—	94	Bywater, W. M.	Harness and improved Russian cavalry bridles.
—	251	Carles, H. R.	Wigs and head-dresses.
—	259	Causse, D. A.	Perukes and head-dresses.
—	273	Cowan, L.	A set of Scotch cart harness, of patent leather.
France	1574	Croizat, J.	Perukes without toupees, produced by machinery.
—	812	David, C.	A collection of dyed morocco.
—	1181	Delisle and Co.	Specimens of sheep and morocco leather.
United Kingdom	311	Dick, A.	A well-manufactured hearth rug.
—	34	East and Son	Dyed and embossed sheep leather, in imitation of Utrecht velvet.
France	1214	Estivant Brothers	Buenos Ayres hide tanned in oak-bark.
United Kingdom	18	Evans and Son	Specimens of well-manufactured parchment, and direction lables.
—	293	Evershed, —, Sussex	Well-tanned light sole leather. (Exhibited by Boutchier, Mortimore, and Co.)
France	510	Fortier-Beaulieu	Curried leather.
United Kingdom	74	Foster, Son, and Duncum (Cl. xxix.)	A muff and boa, of Marabout feathers.
—	32	George, C.	Specimens of morocco and Russian leather.
—	289	George, J.	Specimens of leather.
France	850	Giraud Brothers	Dyed morocco leather.
Belgium	469	Ghislain-Dubois	Cow hide, curried for strap leather.
New South Wales	–	Hall, —	Enamelled kangaroo skins.
Switzerland	172	Hauser, J. de J.	A specimen of sole leather.
Canada	332	Henderson, J.	Sleigh robes and other furs.
France	261	Henoc, —	Screens and feather brooms, made of ostrich, peacock, and other feathers.
United Kingdom	13	Hogarty Brothers	Curried calf leather and boot fronts.
—	16	Holmes, T.	Specimens of the tanned hide of the walrus, &c.
—	60	Hudson, S.	A hunting-saddle with elastic seat, and a side-saddle with safety stirrups.
—	106	Hughes, R.	Heraldic mountings for harness.
—	253	Isidore and Brandt	Wigs, perukes, and other works in hair.
—	266	Kelsey, J. T.	A well-tanned crop hide, weighing 82 lbs.
France	1325	L'Huillier, E.	Feather for ornamental purposes.
—	1329	Loddé, A. A.	Plumes of feathers and screens of various kinds.
United Kingdom	53	Lutwyche and George	Well-manufactured morocco leather, and dyed sheep-skin rugs.
Luxembourg	4	Luxemburg Glove Manufactory	Bronze and black kid leather.
Belgium	267	Masson, Charles.	Tanned sole leather.
France	1345	Massemin, C. L.	Calf leather, adapted for boot fronts.
Denmark	10	Mattat and Sons.	Dressed leather, both for white and tan-coloured gloves.
United Kingdom	52	Maxwell and Co.	Socket spurs, in several stages of manufacture.
Bavaria	46	Mayer, I.	Varnished calf and enamelled coach hides.
Grand Duchy of Hesse	37	Minoprio and Hohwiesner.	Varnished calf and coloured japanned hide.
Prussia	383	Oberconz, H.	Curried leather, and for a well-tanned hide.
France	338	Paillart Brothers	Calf and sheep leather.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	91	Penny, J.	A state pony bridle.
—	284	Randall and Dicks	Manufactured assortment of chamois and gaiter leather.
Prussia	741	Ranniger, J. L., and Son	An assortment of lamb leather.
France	1434	Reulos, A. J.	Curried horse leather, adapted for boots and shoes.
United Kingdom	262	Robey, W.	Ladies' head-dresses.
Spain	249B	Roig, S.	An assortment of morocco leather.
United Kingdom	49	Rood, G., and Co.	Hearth-rugs made from dyed Angora goat-skins, door-mats, &c.
Frankfort-on-Maine	9	Roth, C. W.	Varnished calf leather.
Prussia	743	Sondermann, W.	Vellum and parchment of extreme whiteness.
United Kingdom	51	Southey and Co.	An extensive assortment of good leather, for coach and harness makers.
Canada	134	Stewart, W.	A set of single sleigh harness.
Belgium	254	Taillet, V.	Boot and shoe leather.
France	695	Thibierge, —	Perukes and ladies' fronts.
United Kingdom	154	Tollet, George (Cl. xx.)	Tippets, cloaks, victorines, and muffs.
—	264	Tyzack, W. V.	Specimens of manufacture in false hair.
Spain	249A	Vignaux, L. J.	Varnished calf leather for boots and shoes.
United Kingdom	14	Windsor and Son	An assortment of dyed sheep-skin rugs, skins for cavalry saddles, and several manufactured articles.
—	249	Winter, W.	Wigs and head dresses.
—	25	Wood, W. and S.	An assortment of calf-skins curried and dyed in imitation of morocco leather.

CLASS XVII.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Austria	362	Vienna, Imperial Court and Printing Office of	Novelty of invention, and the number of new combinations in the art of typography.

PRIZE MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	7	Angrand	Ornamental, coloured, and fancy papers.
United Kingdom	56	Atkinson, William	Bookbinders' cloth.
—	196	Barritt and Co.	General bookbinding.
France	40	Barère, B.	Engravings by Collas' tracing machine.
United Kingdom	195	Besley, R., and Co.	Types.
France	1090	Blanchet Brothers and Kleber	White and coloured papers.
United Kingdom	62	Bone and Son	Cloth bookbinding.
Saxony	178	Brockhaus, F. A.	An extraordinary collection of three hundred and fifty-six volumes, the whole printed at his own establishment in the year 1850.
United Kingdom	136	Bradbury and Evans	Various specimens of printing.
France	788	Callaud, Belislenouel de Tinan, & Co.	Various specimens of paper.
United Kingdom	78	Caslon and Co.	Variety of types.
Sardinia	89	Chirio and Mina	Printing, and printing materials and woodcuts.
United Kingdom	68	Clarke, J.	Various specimens of bookbinding and tree-marbling on calf-leather.
France	798	Claye, J.	Wood-cut and other surface printing.
United Kingdom	88	Cross, G.	New mode of fastening the leaves of scrap-books without guards.
—	69	Cussons and Co.	Bookbinders' cloth.
—	143	Dewdney, J.	Writing-paper, &c.
France	–	Derriey, M.	Music-types, founts, &c.
Prussia	148	Decker, R. L.	Printing, and types.
Denmark	4	Drewsen and Sons	Writing-paper.
France	817	Desrosiers, A.	Printing.
—	822	Doumerc, E.	Printing and paper.
Van Diemen's Land	331 & 333	Dowling, H.	Tasmanian printing.
France	181	Dupont, P.	Printing, and fac-similes.
Turkey	–	Duzoglou, Messrs.	Writing-papers.
India	–	East India Company, The Honourable	Collection of Indian paper.
Prussia	145	Ebart Brothers	Paper, glazing boards, & carton-pierre, for roofing.
Egypt	248 & 374	Egypt, His Highness the Viceroy of.	A collection of one hundred and sixty-five volumes of books printed in the Arabic, Persian, and Turkish languages; likewise a catalogue of all the books published in Egypt.
United Kingdom	8	Evans, J. S.	Specimens of binding in white vellum.
Bavaria	81	Faber, A. W.	Black-lead pencils.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	10	Fisher, J. H.	A new mode of printing from copper-plate in two colours at once, with a peculiar sort of ink, suitable for bank-notes and cheques.
—	124	Figgins, V. and J.	Types.
Saxony	168	Fischer, C. F. A.	An assortment of paper; also a specimen of mill-board.
France	518	Gaymard and Geroult	A specimen of ledger-binding.
—	238	Gilbert and Co.	Pencils.
Belgium	284	Godin, I. L., and Son	A great variety of printing, writing, and drawing papers.
Austria	376	Habenicht, A.	Bookbinding, porte-monnaies, and other leather goods.
—	381	Hardtmuth, L. and C.	Pencils.
Belgium	285	Hanicq, P. J.	A collection of printed books. The Liturgies in red and black are especially worthy of notice.
Austria	367	Haase, G., and Sons	General excellence of their types, and printing.
United Kingdom	106	Hayday, James	Bookbinding (exhibited by Messrs. Cundell and Addey.)
United States	502	Herrick, J. K.	Superior ruling of account books.
Netherlands	59 & 60	Honig Breet, C. and I.	Specimens of parchment and double elephant writing paper.
United States	439	Howe, S. G.	A system of characters (slightly angular in form, without capitals) for the blind.
Prussia	392	Hösch and Sons	A variety of white and coloured writing and tissue papers.
United Kingdom	21	Hyde and Co.	Sealing-wax adapted for hot countries.
—	42A	Joynson, W.	Writing paper.
—	147	Lamb, J.	Manufacture of pottery tissues.
France	895	Laboulaye, C., and Co.	Printing types.
—	1636	Lacroix Brothers	Writing paper.
United Kingdom	24	Leighton, J. and J.	Bookbinding in various stages, and the restoration of fac-similes of missing pages to valuable works.
—	163	Lewis, Mrs. C.	Bookbinding.
France	1652	Lortic, P. M.	Bookbinding.
—	321	Mame and Co.	Printing and bookbinding.
—	584	Marcellin-Legrand	Specimens of type founding.
—	619 & 377	Mauban and Vincent Journet	Printing paper.
—	624	Mayer, Madame T.	Fancy ornaments for confectioners.
Rome	12	Miliani, P.	Hand-made plate and writing papers.
Grand Duchy of Hesse	66	Mönch and Co.	Porte-monnaies, pocket-books, and dressing-cases.
France	324	Montgolfier, —	Paper, and imitation parchment, adapted for many useful purposes.
—	544	National Printing Office	Variety of Oriental and other types, and for the beauty of execution of their specimen-book, in which great taste is displayed; also three Oriental volumes, with borders round every page in gold and colours. The ultramarine blue, printed as an ink direct from the type, is pure and bright.
—	665	Niédrée, J. E.	Specimens of bookbinding.
—	938	Odent and Co.	Variety of papers: also paper called animal parchment.
Canada	189	Palsgrave, J. T.	Printing types.
France	1395	Plon Brothers	Variety of wood-cuts and other printing.
Wurtemburg	44	Rauch Brothers	Variety of writing papers.
United Kingdom	5	Remnant, Edmonds, and Remnant	A novel application of materials in bookbinding.
—	89	Rivière, R.	Bookbinding.
Prussia	780	Rübeland, Ducal Foundry Inspection at.	Specimens of stereotype in iron, and the Bible printed therefrom.
United Kingdom	36	Saunders, T. H.	A novel style of ornamental water-mark on paper, the water-mark giving gradation of shades. It was invented by Mr. Oldham, of the Bank of England, under whose instructions Mr. Saunders applied it in the manufacture of paper.
Wurtemburg	41	Schaeuffelen, G.	Plate, printing, writing, and tissue papers, the mark put on dry, by a peculiar process, after the paper is made.
France	1480	Schloss, Widow, and Brother.	A large collection of portfolios, porte-monnaies, porte-cigars, and other leather articles.
Prussia	783	Schreiber, J. C. G.	Enamelled card-boards, and paper, &c.
Austria	360	Smith and Meynier.	Specimens of writing paper.
United Kingdom	92	Sinclair, Duncan, and Son	Specimens of printing types.
France	380	Sœhnée Brothers	Superior bookbinders' varnish.
United Kingdom	42	Spicer Brothers	A collection of papers, showing the present state of the paper manufacture in England.
—	182	Stephenson, Blake, and Co.	Types.
—	44	Thomas and Sons	Account books for excellence of paper, ruling, and binding.
Russia	260 & 302	Vargounin and Brothers	Writing paper. (There is a great improvement, within a few years, in the make and finish of Russian papers.)
United Kingdom	-	Venables, Charles J.	Plate, lithographic, and other printing papers.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	149	Venables, Wilson, and Tyler	An assortment of paper from the principal manufacturers of the United Kingdom, and the cheapness of their own printing paper.
——	-	Venables, George	Wrapping papers, more particular that which is used for paper bags.
Prussia	822	Vieweg and Son	Variety of publications.
United Kingdom	93	Waterston, George	Sealing-wax.
——	111	Westleys and Co.	Bookbinding, &c.
——	48	Westley, J.	Bookbinding.
——	53	Williams, J.	Account books.
——	139	Wright, J.	Bookbinding.

HONOURABLE MENTION.

United Kingdom	96	Bancks Brothers	Improvement in the water-mark of paper.
——	69	Banks, Son, and Co. (Cl. I.)	Black-lead pencils.
——	189	Barker, J.	Specimens of type-metal casts from wooden matrices, applicable to calico and other printing.
France	1067	Barbat, —	Letter-press and lithographic printing.
United Kingdom	59	Batten, D.	Specimens of bookbinding.
Austria	366	Battagia, G.	Specimens of typography, with simple and convenient binding.
Belgium	478	Bemand, R.	Specimens of white and coloured parchment.
Grand Duchy of Hesse	60	Berge Brothers	Cigar-cases, leather purses, &c.
Austria	380	Berger, C. H.	Variety of wafers in paper and gelatine.
France	63	Bondon, L.	Specimens of enamelled paper.
United States	473	Bradley, B., and Co.	Book-cloth binding, and block gilding.
Belgium	277	Briard, J. H.	Printed Bibles and Testaments.
New South Wales	-	Callaghan, Mr., Attorney General	A volume printed from types cut and cast at Sydney, and printed by John Rowe.
United Kingdom	106	Cundall and Addey	Specimen of a book-cover in pierced metal.
France	1484	De Serlay, C. G.	Variety of tinted papers.
——	483	Dufour, L.	Specimens of gold, silver, and other fancy papers.
——	1194	Dopter, J. V. M.	Specimens of lace and other fancy papers.
Netherlands	79 & 109	Enschede and Sons	Printing types and stereotype plates.
Sardinia	47	Farina, A.	Small punches and types.
Algeria	24	Flechey, J. B.	Cigarette, and other papers manufactured from the leaves of the dwarf palm-tree.
Grand Duchy of Hesse	38	Freund, E. A.	Variety of enamelled card-boards and paper.
United States	420	Gassett, H.	Superior ruling of account books.
France	234	Gauthier, jun.	Superior brass letters for the use of bookbinders.
——	522	Gillot, —	A new method of etching plates for surface printing.
Belgium	286	Glenisson and Vangenechten	Card-boards, and marbled and surface-coloured papers.
Prussia	746	Graf, H.	Block gilding, on the covers of a large folio altar Bible.
France	1256	Grangoir, J. M.	Locks for pocket-books, &c.
——	857	Gruel, Madame	Bookbinding.
——	250	Guesnu, —	Numerous specimens of ornamented paper and stationery.
Grand Duchy of Hesse	62	Haas and Co.	Pocket-books, porte-monnaies, and other leather goods.
Bavaria	47	Haenle, L.	Burnished gold, and other ornamental papers.
Prussia	284	Hänel, E.	Various matrices, types, and printing.
——	44	Heyl, J. F., and Co.	Superior transparent wafers.
United Kingdom	17	Hider, Elizabeth	Fancy floral ornaments, as applied to valentines.
Saxony	180	Hirschfeld, J. B.	Coloured-surface printing.
France	882	Hulot, A.	Impressions from relievo engraved plates, &c.
Belgium	444	Jamar, A.	Specimens of illustrated books and woodcuts.
United Kingdom	22	King, T. and J. H.	New type music.
——	107	Knight and Hawkes	Stereotyping.
Prussia	329	Koch, C. A.	Writing and plate papers.
——	152	Kühn, C., and Sons	Portfolios, pocket-books, albums, and porte-monnaies; and also ruling of account-books.
France	906	Lebrun, L. J.	Bookbinding.
Prussia	149	Leisegang, W.	Block gilding on velvet.
United Kingdom	158	Leighton and Son	Bookbinding.
Prussia	147	Liepmann, J.	An ingenious mode of producing several impressions from a mass of colour in which the various gradations of tint are an inch or more in thickness, and which, on being moistened with oil, and subjected to pressure, yields a copy of the subject represented.
United Kingdom	26	Macomie, A., and Co.	Specimens of binding.
United States	482	McAdams, J. and W.	Ruled account-books, and circular ruling.
United Kingdom	128	Manchin and Morel	Novelty in the application of bitumen to the purpose of stereotyping.
——	29	Martin, J.	New mode of sizing paper, by which it is rendered waterproof.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	609	Marion, A.	Fancy, ornamental, and plain paper, and stationery.
—	629	Meillet and Pichot	Postage and other stamps.
—	637	Meyer, E.	Specimens of printed designs in fifty colours, from surface-blocks, in imitation of Berlin patterns for needlework.
United Kingdom	150	Miller and Richard	Type-founding.
—	58	Morell, H. (Cl. iv.).	Wax and wafers.
France	661	Néraudeau, J. A.	Ledger-binding.
—	334	Obry, Bernard, and Co.	Black and other papers.
Prussia	394	Piette, L.	Various papers.
United Kingdom	33	Pinches and Co.	Specimens of stamping in relief on envelopes and writing-paper.
France	1393	Piques,	Pasteboard.
Bavaria	82	Rehbach, J. J.	Black-lead pencils.
Wurtemburg	39	Reichhold, G.	Fancy leather goods, porte-monnaies, &c.
Netherlands	112	Regeer, H. J.	Bookbinding.
Russia	361	Revillon	Specimens of printing, and Greek, Oriental, and other types.
Wurtemburg	73	Rometsch, C.	Substitute for writing slates.
United Kingdom	34	Royston and Brown	Ledgers and account-books.
France	693	Simier, J.	Bookbinding.
Prussia	383	Schüll, L.	White and tinted papers.
United States	330	Sibell and Mott	Specimens of account-books.
Canada	191	Starke and Co.	Specimens of ornamental printing.
United States	88	Starr, C.	Binding works for the blind, with thickened margins to prevent the embossing from being pressed out.
United Kingdom	45	Turnbull, J. L. and J.	Drawing-boards.
France	712	Vanderdorpel and Son	Various fancy stationery.
—	730	Vincent and Tisserant	Sealing-wax, wafers, and writing-ink.
United States	123	Walker, E., and Co.	A Bible elaborately bound and ornamented, with a recess for a family register inside the cover.
United Kingdom	46	Waterlow and Sons	Specimens of good account-books.
Grand Duchy of Hesse	43	Weber, J. B.	Specimens of marbled papers.
United Kingdom	159	Wodderspoon, J.	Improvements in ledger-binding, by the introduction of patent vellum cloth bands.
—	68	Wolff, E., and Son (Cl. i.)	Crayons and pencils.

Note.—*The Jury desire to award the sum of £10 each to the under-mentioned Workmen, as the most appropriate recognition of their Skill and Taste.*

United Kingdom	97	Budden, E.	The workman who bound an album, very elaborately ornamented, in which taste and good work are displayed.
—	91	Neil, R.	For the care, industry, and perseverance displayed in binding an imperial 4to. Bible in cream morocco, under great disadvantages; the work was executed at his own home after his daily occupation, by gas-light, in the winter; and notwithstanding these difficulties, a considerable degree of excellence is attained.

CLASS XVIII.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	146	Armitage, G., and Co. (Cl. xii. & xv.)	The dyes of Orleans and Coburg cloths of cotton and wool.
Prussia	106	Bergmann and Co.	Dyed Berlin woollen-yarns.
France	1548	Bernoville, Larsonnier, and Chenest.	Fancy fabrics printed in steam colours.
United Kingdom	51	Black, James, and Co.	Printed muslins, jaconets, and fancy fabrics.
France	29	Blech, Steinbach, and Mantz	Printed mousseline-de-laines (all wool), calicoes, and jaconets, in madder colours.
Prussia	606	Bockmühl Brothers, Schlieper, and Hecker.	Printed calicoes.
Austria	230	Bossi, J.	Fancy fabrics, printed in steam colours.
France	90	Chocqueel, L.	Fancy fabrics, printed in steam colours, for dresses and shawls.
United Kingdom	27	Dalgleish, Falconer, and Co.	Machine-printed calicoes.
France	1583	Delamorinière, Gonin, and Michelet.	Fancy fabrics printed in steam colours, for dresses.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	1191	Dollfus, Mieg, and Co.	Printed muslins and jaconets; also mousseline-de-laines (all wool).
United Kingdom	1	Evans, D., and Co.	Printed silk handkerchiefs and table covers.
France	1381	Francillon	Dye of merinos exhibited by Paturle-Lupin and Co.
—	198	Féau-Béchard, V. A.	Skein-dyed woollen yarns for shawls.
—	1252	Godefroy, L.	Fancy fabrics, printed in steam colours, for dresses.
—	248	Gros-Odier, Roman, and Co.	Printed muslins and jaconets; also mousseline-de-laines (all wool).
—	1263	Guinon, A. P.	Skein-dyed silk, bleaching silk, and the application of picraque acid.
—	256	Hartmann and Son	Fabrics printed in madder colours.
United Kingdom	36	Howe, J., and Co. (Cl. IV.)	Skein-dyed silk.
—	36	Hoyle, T., and Sons	Machine-printed calicoes.
—	4	Inglis and Wakefield	Machine-printed mousseline-de-laines and bareges.
France	274	Japuis, J., B. and Sons	Printed furniture, cotton, and chintz.
—	1634	Koechlin Brothers	Printed mousseline-de-laines (all wool), and calicoes.
Austria	187	Leitenberger, F.	Printed calicoes.
United Kingdom	60	Le Lievre, H.	Skein-dyed black silk.
—	8 & 282	Littler, Mary Ann (Cl. XII. & XV.)	Printed silk handkerchiefs.
—	212	Partridge, N. (Cl. XII & XV.)	The dye of broad-cloths of different colours on each side.
—	148	Ripley and Sons (Cl. XII. & XV.)	The dye of Orleans and Coburg cloths, mixed of cotton and wool.
—	39	Sale, J. N.	Printed cotton shirtings.
France	1481	Schlumberger, jun., and Co.	Cylinder-printed calicoes and jaconets.
United Kingdom	41	Schwabe and Co.	Printed calicoes in madder and garancine.
France	1003	Schwartz and Huguenin	Printed cotton chintz colours for furniture.
United Kingdom	47	Simpson and Young	Mousseline-de-laine (cotton warps) printed by cylinder in six and seven colours; also calicoes printed in steam colours.
France	383	Steiner, C.	Turkey-red, plain dye and printed.
United Kingdom	37	Steiner, F. and Co.	Turkey-red, plain dye and printed.
—	25	Thomson Brothers and Sons	Printed mousseline-de-laines (cotton warp).
Switzerland	36	Vaucher, Du Pasquier, and Co.	Calicoes and jaconets printed by cylinder.
France	720	Vessière, A.	Merinos.
Switzerland	155	Wegner, T. R.	Skein-dyed silk.
United Kingdom	7	Welch, Margetson, and Co.	Printed silk handkerchiefs.
—	18	Welch, Thos.	Printed table-covers.
Switzerland	146	Ziegler and Co.	Plain Turkey-red dye.

CLASS XIX.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	19	Ball, Dunnicliffe, and Co.	Velvet and Simla lace, being new patented fabrics suitable for shawls, dresses, and for various ornamental and useful purposes, and of great commercial importance, also for imitation. Valenciennes lace, black and white point tulle, of great merit.
France	-	Gobelins and Beauvais Tapestry, Government Manufactory of. (Joint Medal with Class XXX.)	Originality and beauty of design of the different specimens exhibited for furniture, and the extraordinary excellence of execution of most of the productions exhibited.

PRIZE MEDAL.

United States	183	Albro and Hoyt	Floor-cloths.
Switzerland	110	Alther, J. C.	Muslin curtains.
France	1544	Aubry Brothers	Laces.
United Kingdom	388	Ayers, W.	Wide thread lace.
Savoy	158	Bach, G. F. and Son	Fancy gimps and silk fringes.
Switzerland	188	Bänziger, J.	Embroidered double-flounce dress of novelty.
Belgium	324	Beck and Sons	Broad and narrow Valenciennes laces of good fabric.
United Kingdom	394	Bennoch, Twentyman, and Rigg	Gimps, fringes, and cameo braids.
Austria	389	Benkowits, Marie	Embroidered crape on white silk.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	54	Berr and Co.	Robe, shawl, scarf, veil, berthe, cape, &c.
——	435	Braquenié and Co.	Aubusson carpet, tapestry, &c.
United Kingdom	24	Brie, J., and Co. (Cl. xx.)	Embroidered shirt-fronts.
——	110	Brinton and Sons	Carpet, velvet pile, and Axminster rugs.
——	58	Brown, S. R. and T.	Book-robe, short cambric handkerchiefs, stomacher, and collars.
——	57	Brown, Sharps, and Co.	Embroidered muslin robe.
Prussia	164	Burchardt and Sons.	Printed mole-skin table-covers, floor-cloths, and painted window blinds.
United Kingdom	115	Burch, J., and Co.	Specimens of printed velvet pile and Brussels carpets.
——	75	Burgh, R.	Specimens of gimps, tassels, and ornaments.
——	130	Clarke, Esther	Honiton lace flounce; design and quality unequalled in its class.
France	83	Castel, E.	Aubusson carpet.
United Kingdom	530	Crace, J. G. (Cl. xxvii.)	Specimens of Brussels and velvet-pile carpets.
——	142	Crossley and Sons	A carpet, rugs, and table-covers.
——	71	Danby, C. and T.	Variety of silk fringes, &c.
France	1578	Darnet, —	Variety of shirt-fronts.
——	1173	Debbeld-Pellerin and Co.	A counterpane.
Belgium	316	Defrenne, Sophie	Brussels point handkerchief.
Prussia	175	Dinglinger, A. F.	Sofa carpets.
France	267	Delaroche-Daigremont	Muslin robe, jacket, and cambric handkerchiefs.
Belgium	305	Delehaye, A.	Application of Brussels flounce, real.
United Kingdom	155	Dove, C. W., and Co.	Specimens of fine frame Brussels carpet.
Belgium	314	Duhayon-Brunfaut, and Co.	Wide and narrow Valenciennes laces, &c.
Switzerland	191	Ehrenzeller, F.	Net and muslin curtains.
United Kingdom	74	Evans, R. and Co.	Silk fringes, braids, and fancy buttons.
——	165	Faudel and Phillips	Embroidered hangings for a state bed.
Switzerland	192	Fisch Brothers	Net curtain of novelty.
United Kingdom	2	Fishers and Robinson	Imitation laces, &c.
Spain	221	Fiter, J.	A rich black blond dress and mantilla.
France	204	Flaissier Brothers	Alayuck velvet carpets.
United Kingdom	45	Forrest, J., and Sons	Jacket flouncings, &c.
France	1603	Foulquié, Mlle., and Co.	Collars, half shawls, &c.
Spain	237	Gilart, R.	The royal arms, worked with coloured silks, &c.
Hamburg	33	Gompertz, B.	Hair-embroidered pictures of the Queen and the Prince of Wales, &c.
United Kingdom	34	Greasley and Hopcroft	Jacquard shawl, &c.
——	3	Groucock, Copestake, Moor, and Co.	Honiton guipure half-shawl, &c.
Belgium	341	Haeck, I. T.	Real Brussels plait veil.
United Kingdom	186	Hamburger, Rogers, and Co.	Epaulettes, military hats, &c.
Belgium	337	Hammelrath, P. H.	Narrow Valenciennes laces, &c.
Sweden and Norway	28	Hamren, Sophie	Needlework embroidery.
United Kingdom	190	Hare, John, and Co.	Specimens of oil-cloth, &c.
——	192	Harris, G., and Co.	Three specimens of velvet pile.
——	269	Heald, Benjamin, Government School of Design, Nottingham.	Pattern for a broad lace flounce.
——	201	Henderson and Widnell	Specimens of fine tapestry, &c.
Belgium	310	Heusschen-Van Eeckhoudt, and Co.	Two bobbin Brussels lace dresses, &c.
France	539	Heyler, Mlle. M.	Silk-net mittens and gloves.
United Kingdom	25	Heymann and Alexander	Machine-made lace curtains.
Saxony	168B	Hietel, J. A.	Seven tableaux embroidered in hair and silk.
United Kingdom	1	Holden, J., and Co. (Cl. xiv.)	Muslin insertions and trimmings.
——	64	Houldsworth, James, and Co. (Cl. xiii).	Embroidery by machinery.
——	5	Howell, James, and Co.	Guipure Honiton lace shawl.
France	268	Hubert, Madame Josephine	Head-dresses, &c.
——	1280	Jullien, —, sen.	Specimens of gimps, &c.
Belgium	306	Jorez, jun.	Printed mole-skin table-covers.
Netherlands	43	Kroonenberg, W. F.	A large carpet.
United Kingdom	4	Lambert and Bury	Limerick lace shawl and tunic dress.
——	83	Lambert, Brown, and Patrick	Epaulettes and laces, &c.
——	232	Lapworth, A.	Specimens of velvet-pile carpets, &c.
France	1305	Le Crosnier, —	Varnished and printed table-covers, &c.
——	1646	Lefébure, A.	White thread lace, counterpane, &c.
United Kingdom	79	Lees, R., and Co.	Printed mohair velvet.
——	236	Lester, T.	Wide white-thread lace.
——	65	Macdonald, D. & J., and Co.	Embroidered muslin robe, cap, and bassinet.
——	59	Mair, J., Son, and Co. (Cl xi.)	Three muslin robes.
——	29	Mallet and Barton	Imitation black trimming laces, &c.
France	599	Mallet Brothers	Specimens of Valenciennes lace and lappet.
Spain	236	Marguerite, Signora	A dress from fibre of the pine-apple. (Per W. P. Hammond and Co., London.)
Belgium	302	Melotte, E.	Gold embroidery.
France	631	Méraux, J. H.	Patterns for flounces, handkerchiefs, lappets, &c.
——	641	Michelin, T.	Fancy ribbon trimmings for dresses and cloaks.
——	652	Moreau and Co.	Embroidered shirt-fronts.
——	1362	Mornieux, F.	Galloons and buttons.
——	655	Moulard, Mlle.	Lace head-dress, caps, &c.
Belgium	308	Naeltjens, G.	Bobbin, Brussels berthe, coiffure, lappet, &c.
United Kingdom	257	Newcomb and Jones	Velvet-pile carpet.

NATION.	No. in Catalogue	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Belgium	297	Overman and Delevigne	Carpets.
France	675	Pagny	Point-lace shawl and scarf.
United Kingdom	263	Pardoe, Hoomans, and Pardoe	Velvet-pile carpets.
Tuscany	101	Parlanti, E.	A piece of embroidery, &c.
Belgium	298	Polak, Mlle. F.	Black lace flouncings, &c.
France	1684	Randon, L.	White blond flounce scarf, &c.
Belgium	309	Reallier, Mlle.	Brussels point-lace handkerchief, &c.
United Kingdom	32	Reckless and Hickling	Shawls, &c.
France	1433	Requillart, Roussel, and Chocqueel	Moquette or velvet carpet.
United Kingdom	17	Riego De La Branchardiere, E.	Crochet-work frock, berthe, &c.
——	25A	Robinson, Thomas	Lace curtain.
Saxony	161	Roeller and Huste	Painted table-covers, &c.
United Kingdom	282	Rolph, J.	Double-flounced scarf, &c.
——	305	Salomons and Sons (Cl. XII. & XV.)	Embroidered work.
Prussia	118	Schaerff, R.	Coach laces, &c.
Switzerland	201	Schlaepfer, Schlatter, and Kürsteiner	Net curtains, &c.
Saxony	60	Schmidt, G. F.	Cushions, &c., for a set of furniture.
Switzerland	202	Schoch, Schiess, and Son	Embroidered handkerchiefs.
Saxony	71	Schreiber, F. A.	Pillow lace.
Prussia	657	Seel, G.	Pictures in hair.
France	1009	Seib, J. A.	Enamelled floor-cloth.
United Kingdom	318	Smith (Turberville), Boyle, and Co.	Carpets, &c.
Belgium	338	Soenen, F.	Lace handkerchiefs and lappets.
Switzerland	208	Staeheli-Wild, C.	Embroidered table-covers, &c.
United Kingdom	41	Steegmann, H. and Co.	Lace curtain.
Sardinia	86	Stefani, W.	Silk-embroidered tableaux.
Belgium	307	Stocquart Brothers	Black point-lace shawl, &c.
Switzerland	203	Sutter, J. J.	Chintz book robe, &c.
——	206	Tanner and Koller	Embroidered muslin dresses, &c.
——	205	Tanner, J. U.	Embroidered work.
United Kingdom	315	Templeton, James, and Co.	Axminster carpets, &c.
——	55	Treadwin, C. E.	Honiton lace.
Belgium	313	Vanderkelen-Bresson	Brussels lace.
——	303	Van Halle, J.	Vestments, robes, &c.
——	333	Van Kiel, Sisters	Mechlin lace.
France	718	Vaugeois and Truchy	Embroidery.
United Kingdom	235	Viccars, R.	Lace.
——	33	Vickers, William	Lace shawls, &c.
——	327	Victoria Felt Carpet Company, Leeds	A carpet and felt cloth.
France	1706	Videcoq and Simon	A Chantilly shawl, &c.
United Kingdom	337	Watson, Bell, and Co.	Carpets.
——	6	Weedon, Francis	Lace.
——	27	Whitlock and Billiald	Laces.
——	345	Whitwell, J., and Co.	Carpets.
——	358	Wright, Crump, and Crane	Carpets.
Denmark	5	Wulff, Jens, and Sons	Lace, &c.
Switzerland	209	Zuppinger, T.	Invention in weaving chenille in carpets.

HONOURABLE MENTION.

NATION.	No. in Catalogue	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	21	Adams and Sons	Thread edgings.
France	1545	Audiat, F.	Embroidered laces.
United Kingdom	95	Barnes, R. Y.	Oil-cloth.
Austria	388	Bauhofer, F.	Arms of England, embroidered with gold.
Saxony	56	Boehler, F. L.	Embroidered cambric handkerchief.
France	767	Bisiaux	Painted oil-cloth.
United Kingdom	64	Brown, Hugh	Muslin flounce and trimmings.
——	2	Brown, J. R. and W. (Cl. XIV.)	Muslin robe.
——	114	Brown, McLaren, and Co.	Velvet carpets.
Belgium	328	Bousson-De Vlieghere	Imitation Spanish point lace.
United Kingdom	21	Capper and Waters (Cl. XX.)	Court suit in needlework.
——	122	Cardwell, C. and T.	Pillow lace.
——	18	Clarke, Jane	Lace.
France	152	Dabaret-Tampé	Silk buttons.
Belgium	329	Darteville and Mounoury	Imitation Brussels scarf.
Portugal	853 & 881	Daufrias, B., and Co.	Scotch carpets.
France	1584	Delcambre, A.	Gold-colour lace, point lace, and scarf.
——	–	Duchel and Son	Moquette carpet.
United Kingdom	159	Ellis, Sophia A.	Specimens of tatting in collars, &c.
Belgium	321	Everaert, Sisters	Black lace shawl, dress, jacket, and veils.
Spain	238	G. M., Signora	Curiously-embroidered shirt.
United Kingdom	386	Gill, W. L.	Honiton lace.
France	251	Guillemot Brothers	Coach and livery laces.
Prussia	166	Grünthal	Berlin patterns for needlework.
Austria	619	Haas and Sons	Moquette carpet.
United Kingdom	85	Harrison, T.	Altar-cloth and cushions of Genoa velvet.
——	195	Hartree, E. and G.	Table-cloth embroidered on silk canvas.
——	295	Heald, Henry	Pattern of half-shawl.
——	199	Helbronner, R.	New style of needlework.
——	290	Henderson and Co.	Damask Venetian carpet.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	28	Herbert, Thomas, and Co.	Imitation blonds, laces, &c.
Switzerland	195	Holdregger, C.	Embroidered curtains.
France	1625	Hooper, Carroz, and Tabourier	Imitation lace scarf, lappets, and berthe.
United Kingdom	210	Humphries, Thomas	Seven-frame velvet pile carpet.
Grand Duchy of Hesse	46	Ihm, F.	Moleskin table-covers.
United Kingdom	77	Irish Work Society.	Knitted, netted, and crochet lace.
——	84	Jackson, C.	Appliqué embroidery.
——	48	Jancowski, W.	Small picture embroidered in tent-stitch.
——	123	Kightly, J.	Pillow lace.
——	225	Kingsbury, Louisa	Basket of flowers, &c.
Austria	263	Krichl, E.	Arms of England embroidered in gold, silver, and silk.
United Kingdom	379	Ladies' carpet (needlework)	The design by Mr. Papworth.
——	213	Ladies' Industrial Society, Dublin	Infants' lace robes.
France	901	Laroque, Sons, Brothers, and Jaquemet.	Aubusson carpets.
United Kingdom	10	Laugher and Cosens	Honiton half-shawl.
France	902	Laurent, J. B.	Silk buttons and trimmings.
United States	453	Lawrence, A. and A., and Co.	Carpet.
France	1306	Lecun and Co.	Scotch carpets.
Prussia	167	Lehmann, M.	Painted moleskin table-covers
France	613	Martin, C. A.	Silk buttons, fringes, &c.
United Kingdom	51	Mee, Cornelia	Banner screen and flags of all nations.
France	1354	Mercier, —	Purses, Greek caps, and reticules.
United Kingdom	252	Morton and Sons	Brussels carpet.
Russia	274	Nakhitchevan, upon the Don, The town of	Articles in leather, embroidered in gold.
Prussia	168	Neie, F. W.	Berlin pattern for needlework.
United Kingdom	258	Newton, Jones, and Willis	Church carpets and hangings, and episcopal robes.
——	56	Onion, E.	Fringe, tassels, and ornaments.
Prussia	169	Parey, C. F. W.	Needlework carpet.
United Kingdom	88	Purcell, Frances	Embroidered table-cover.
France	1414	Puzin	Lace and trimmings for carriages.
United Kingdom	62	Robertson and Sons	Cambric table-covers, collars, and other embroidery.
Belgium	301	Roy, C. F.	Brussels flounce.
Sardinia	35	Rey Brothers	Thick coarse carpeting.
Greece	56	Saris and Renjos	Embroidery in gold.
Prussia	160	Schleuss. H.	Embroidery.
Belgium	322	St. Joseph, Establishment of	Flanders guipure lace flounce, sleeves, and trimming lace.
Saxony	62	Schnorr and Steinhaeuser	Table-cover.
——	156	Schubert, Mrs.	Table-cover worked on net lace.
France	1008	Seguin, Joseph	Black diamond open ground lace in half-shawl, mantle, and laces.
United Kingdom	301	Sim, C. J.	Two pair of pillow-lace lappets.
——	302	Simcox, G. P.	Brussels carpet.
——	371	Smith and Baber	Oil-cloth.
Prussia	173	Sommerfeld, B.	Needlework.
United Kingdom	239	Standring, J. and Brother (Cl. XXIX.)	Braids, laces, plaited lines and fringes for dresses.
Switzerland	204	Tanner, B.	Muslin.
Sardinia	49	Tessada, F.	Cambric handkerchiefs.
Prussia	171	Todt, A.	Berlin patterns for needlework.
France	-	Tuissant, —	Scarf.
United Kingdom	179	Turton, Samuel	Design for lace curtain.
Switzerland	140	Vonwiller, Ulric de Gasp	Variety of low-priced articles.
United Kingdom	275	Westhead and Co. (Cl. XXIX.).	Tapes.
——	351	Wilson, J. and W.	Kidderminster carpets.
——	354	Woodward, B. Higgins	Five-frame Brussels carpet.
Prussia	225	Zeisig, H.	Upholstery and coach trimmings.

CLASS XX.

PRIZE MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Switzerland	227	Abt Brothers and other Exhibitors	Straw plait.
United States	471	Addington, W. H.	Shoes for mining purposes.
United Kingdom	13	Allan, James, and Co.	Straw hats and bonnets.
——	100	Allen and Solly	Collection of articles, showing progress in hosiery.
——	32	Atloff, J. G.	Economic plan of cutting leather for shoes.
——	202	Angrave Brothers	Drawers and shirts.
——	80	Ball, W. Y., and Co.	Kid gloves.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	22	Bathier, V.	Novelty and cheapness in the production of wooden shoes.
United Kingdom	103	Berni and Melliard	Case of hats.
—	205	Biggs, H. W., and Sons	Specimens of low-priced hosiery.
—	201	Billson and Hames	Good quality of Thibet wool, low panipier, and variety of socks.
—	1	Buckmaster, W., and Co.	Various articles of Court costume.
—	196	Cartwright and Warners	Yarns prepared from Mexican and Virginian wools, and articles made therefrom.
France	87	Chenard Brothers	Beaver hat, and hares'-fur hats.
—	1150	Chosson and Co.	Kid gloves.
Austria	327	Christl, J.	Workmanship of shoes, &c.
United Kingdom	48	Clarke, Cyrus, and James (Cl. xvi.)	Elongating galoshes.
France	124	Cochois and Colin	Dresses and embroidery.
—	1162	Coupin, J.	Felt hats.
United Kingdom	78	Dent, Allcroft, and Co.	Gloves of high-class workmanship.
France	1185	Deschamps, N.	Plan of cutting leather for boots and shoes.
—	147	Doucet and Duclerc	Embroidered shirts.
—	1200	Dufossée, sen.	Strong work in boots, &c.
—	1201	Dufossée and Melnotte	Excellent workmanship in boots and shoes.
United Kingdom	185	Ensor, T.	Two-finger gauntlets and gloves.
—	2	Foster, Porter, and Co.	Plush-plumage gloves.
—	82	Fownes Brothers	Gloves.
—	193	Fry, J.	Lisle thread hose, of excellent make, and Segovia goods.
—	179	Gilbert and Co. (Cl. xvi.)	Riding boots.
Saxony	72 to 83	Glaeser, J. S., jun.	Women's cotton gloves.
United Kingdom	8	Gregory, Cubitt, and Co.	Straw hats and bonnets.
Austria	343	Groskopf, George	Strong boots and shoes.
United States	385	Haight, Mrs. W.	Shirt.
United Kingdom	198	Harris, R., and Sons	Examples of hosiery.
—	150	Hefford and Facer. (Cl. xvi.)	Glazed Wellington boots.
—	192	Hickson and Sons (Cl. xvi.)	Excellence of light export shoes and boots.
—	194	Holland, T., and Co.	Fleecy hosiery, for medical uses, and superior Segovia goods.
—	114	Hook, John. (Cl. xvi.)	Ladies' shoes.
France	1627	Houbigant-Chardin	Gloves.
United Kingdom	99	Hurst and Sons	Excellence of home and export hosiery goods.
Turkey	408 to 413	Janina, Feruveladgi (The Tailors' Association of)	Albanian costumes. (See Turkish Catalogue).
France	1279	Jouvin and Doyon	Kid gloves.
—	893	Jouvin (Widow)	Gloves.
United States	116	Jeffers, W. H. (The Workmen of)	Ladies' boots and shoes. (Honourable Mention to Exhibitor.)
France	892	Joly, Mesdames, Sisters	Corset of novel description.
—	551	Josselin, J. J.	Corsets.
Austria	333	Kunerth, A.	Turkish slippers.
—	391	Krach Brothers	Double pilot cloth coat.
Saxony	72 to 83	Landgraff, G.	Women's single-thread cotton hose.
France	903	Lauret Brothers	Embroidered silk hose of high quality.
—	296	Laydet and Co.	Case of gloves.
—	1303	Lecoq-Préville	Assortment of habit kid gloves.
—	578	Lefébure, J. P.	Invention for making boots and shoes.
United Kingdom	16	Long, George	Hats and bonnets made on the pillow-lace principle.
Austria	394	Malatinzky, E.	Richly-embroidered overcoats.
France	1347	Massez, —	Excellence of production of boots and shoes.
United Kingdom	83	McDougall, D.	Hosiery knitted by the Scotch peasants.
—	118	McGee, Jno. G., and Co.	Waistcoat pieces.
—	142	McKenzie, W. B.	Shetland knitted shawls and hose.
France	1352	Meier, F.	Workmanship in ladies' shoes.
Saxony	72 to 83	Meinert Brothers	Woollen shirts for exportation.
France	639	Meyrueis and Sons	Extra-fine embroidered silk hose.
United Kingdom	89	Miles, S.	Collection of articles of dress.
France	930	Milon, P. D., sen.	Workmanship of hosiery.
Prussia	186A	Mohr, W.	Light clogs and kid boots.
France	652	Moreau and Co.	Embroidered shirts.
United Kingdom	101	Morley, I. and R.	Silk and cotton hose of the best quality.
—	173 & 215	Muirs, Connell, and Brodie	Rye-straw bonnets.
Saxony	72 to [illegible]	Nacke and Gehrenbeck	Women's cut-up white cotton hose of fine quality.
Tuscany	67	Nannucci	Leghorn hats, and capotes.
United Kingdom	20	Nevill, A., and Co.	Ladies' under-clothing, hosiery, drawers, &c.
Saxony	72 to 83	Neuber, F.	Low-priced cotton hose, suitable for exportation.
France	336	Opigez and Chazelle	Embroidered silk.
United Kingdom	212	Parker, J. (Cl. xvi.)	Boots, strong and light.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	116	Parker and Sons (Cl. XVI.)	General excellence of boots and shoes.
——	157	Peplow, W. (Cl. XVI.)	Workmanship, and application of spring to boots
France	1398	Poirier, P.	Self-coloured leather boots.
Russia	310	Popinoff, Sophia	Shoes, slippers, and other articles.
Austria	336	Prague, Glovers' Association	Gloves.
France	1444	Robert-Werley and Co.	Corsets.
Russia	275	Shekonin, Alexis	Embroidered boots and shoes.
United Kingdom	105	Simmons and Woodrow	Selection of felt bonnets.
Austria	392	Singer, J.	Dress coats.
Turkey	874, 875, 876	Sofialioglou's Daughter (Constantinople.)	Veils embroidered in gold and pearls, with silver fringes. (See Turkish Catalogue.)
Saxony	72 to 83	Solbrig, F.	Adaptation in price, to export demand in certain qualities of hosiery.
Switzerland	234	Sulszberger and Akermann	Variety of Swiss straw plaits.
United Kingdom	127	Taylor and Co.	Plushes made from waste silk.
France	391	Thierry, C. A.	Gentlemen's boots.
United Kingdom	211	Thomas and Son (Cl. XVI.)	High-class workmanship in boots.
——	79	Thresher and Glenny	Fabric for under clothing in warm climates.
——	92	Thurman, Piggot, and Co.	Floss-velvet gloves.
Turkey	–	Turkey, H.H. the Sultan of	Admirable collection of costumes.
Belgium	345	Van Beneden-Bruers	Stays of good description without seams.
United Kingdom	11	Vyse and Sons	Case of bonnets.
Tuscany	66	Vyse and Sons	Leghorn hats and capotes.
United Kingdom	207	Walsh, William (Cl. XV.)	Welted cork soles.
——	195	Ward, Sturt, Sharp, and Ward	Hosiery, &c.
Luxembourg	3	Wemmer, J.	Shoes for labouring men.
United Kingdom	12	Welch and Sons.	Hats and bonnets.
——	212	Welch, Margetson, and Co.	Braces, carriage rugs, ties, cravats, &c.
Saxony	72 to 83	Wex and Lindner	Hosiery of great excellence.
United Kingdom	186	Whitby, E., jun.	Habit lambskin gloves.
——	183	Wilson and Son.	Thread hosiery, with lace fronts.
Switzerland	227	Wohler and Co.	Variety of straw plaits.

HONOURABLE MENTION.

Canada	331	Adams, W. H. F.	Cloth made up into coats.
Prussia	172	Adolphi, C. F. W.	Ladies' boots and shoes.
United Kingdom	149	Allen and Sons (Cl. XVI.)	Stout-made boots.
Switzerland	210	Bally and Co.	Display of good braces.
Canada	–	Barbeau, J.	Deer-skin boots.
France	1069	Baton, W., and Sons	Hats made of hares'-fur.
United Kingdom	118	Bearn and Jeffs (Cl. XVI.).	"Stabbery" in boots.
——	220	Beckett, George (Cl. XVI.)	Well-made boots and shoes.
Belgium	349	Berger, Madame	Variety of stays.
United Kingdom	207	Biddle, John.	Saxony wool goods, spun silk, and beaver and hares'-fur wrought up.
——	66	Braund, J.	Cap with talc peak.
France	73	Brediff Brothers	Strong shoes.
United States	411	Breed, N. A., and Co.	Children's shoes.
France	1115	Bridard, I.	Strong boots and shoes.
——	1116	Briquet and Perrier	Braces.
Turkey	988 & 989	Bukudgy, The Girl (Constantinople)	Slippers. (See Turkish Catalogue.)
Belgium	263	Calm-Février	Boots for exportation.
Turkey	991 & 995	Carabet's wife (Constantinople)	Slippers. (See Turkish Catalogue.)
United Kingdom	154	Clark, B. (Cl. XVI.)	Ladies' boots "clumped" with wood.
——	208	Corah, H., and Sons	Contributions of hosiery.
——	142	Cowling, J. (Cl. XVI.)	Shooting boots.
——	141	Creak, James (Cl. XVI.)	Stout boots.
France	1569	Coulbois	Varnished skins, and boots made therefrom.
Switzerland	189	Depierre Brothers	Embroidered straw bonnets.
United Kingdom	145	Doe, W. (Cl. XVI.)	Navigator's boots.
Grand Duchy of Hesse	33	Dörr and Reinhardt	Boots.
India	–	East India Company, The Hon.	Collection of cloths, silks, &c.
United Kingdom	176	Farrange, Miss	Knitted stockings.
Austria	332	Friedl, L.	Boots and shoes for ladies.
France	208	Fromont-Clolus	Boots and shoes, and wooden shoes.
United Kingdom	230	Garner, D. (Cl. XVI.)	"Lasts."
——	212	Gordon, E. (Cl. XVI.)	Screwed-clamps solid boots.
——	134	Hadden, A., and Sons	Specimens of dyed wools.
——	211	Harding, T.	Buttons.
——	111	Harris and Tomkins	Smock-frocks.
France	1265	Hayem, —	Cravats.
Austria	331	Helia, J.	Ladies' boots and shoes.
United Kingdom	84	Holmes, J and Co.	Shawl-cloak.
——	199	Hudson, James	Various kinds of hosiery.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	194	Hubert, C. (Cl. xvi.)	Boots and shoes.
France	270	Huet (Widow)	Elastic braces.
Turkey	98	Istche, The Girl (Constantinople)	Slippers. (See Turkish Catalogue.)
France	886	Jacobs and Dupuis	Boots and shoes for ladies of the higher classes.
United States	116	Jeffers, W. H.	Collection of boots and shoes. (Prize Medal to the workman).
United Kingdom	175	Kearse, T.	Novel plan of inserting India-rubber in articles of dress.
——	81	Lart, John, and Sons	Hosiery of peculiar fit.
Austria	329	Langder, J.	Boots and shoes.
Russia	311	Lerkhe	Clogs and galoshes.
United Kingdom	119	Longdon, R., and Sons, and Thomas Smith.	Elastic welt in boots and shoes.
——	67	Lyons, J.	Military caps.
——	54	Melton, H.	Lady's riding hat.
United States	93	Milward, James, and Sons	Bonnets made of cotton braid.
Russia	234	Miller, jun.	Light boots.
United Kingdom	97	Musson, R. and J.	Plaited gloves, and silk gloves.
——	167	Norman, Samuel Willis	Lady's corked-soled boots.
——	197	Peal, Nathaniel (Cl. xvi.)	Fishing or hunting boots.
——	126A	Pearson, J.	Child's bonnet and feathers.
——	41	Piper, T. F.	Hygienic child's corset.
——	6	Pope and Plante	Surgical elastic sock and belt.
France	1416	Rabourdin	Braces.
——	974	Rapp, C. F.	Tasteful-looking goods (boots and shoes.)
United Kingdom	-	Richards, John, jun.	The make of silk hose, No. 1000. (Exhibited by J. and R. Morley.)
——	224	Robert, A. (Cl. xvi.)	Excellence of workmanship in boots.
——	307	Sayce, J. and Co. (Cl. xii. and xv.)	Light piuma coat.
——	141	Scott, P.	Fine breasted shirts and collars.
——	228	Scott, S. T. (Cl. xvi.)	"Last" to elongate model of foot.
Grand Duchy of Hesse	47	Schumacher, jun.	Well-made boots and shoes.
United Kingdom	91	Shaw, John	Application of Jacquard to stocking frame.
——	29	Smith, J. E.	Shirt without seams or gathers.
——	119	Smith, Mrs. Charlotte	Corset.
——	147	Society of Needlewomen	Shirts of good shape.
France	1492	Soulès, Hypolite, Mme.	Corsets.
United Kingdom	86	Solomon, Mrs. S.	Embroidered ball dress.
——	177A	Stewart, Jane	Elegant knitting.
Turkey	986, 994, & 996	Terzy's Wife (Constantinople)	Slippers. (See Turkish Catalogue.)
Russia	314	Toltshkoff (Gov. of Njni, Novogorod).	Curiously-made felt shoes.
Tunis	12	Tunis, Exhibitor from	Slippers.
——	10	Tunis, Exhibitor from	Fez caps and shawls.
——	41	Tunis, Exhibitor from	Silk wrought as a separate article.
——	48	Tunis, Exhibitor from	Dresses in cotton and silk.
Belgium	427	Vanderoost, M.	Boots.
France	709	Valtat and Rouillé	Good shirts.
——	725	Viault Esté, J. J. J. B.	Case of ladies' shoes.
United Kingdom	177	Vincent, Richard	Clothes made of sheepskins, in imitation of cloth.
——	63	Walker and Babb	Portable alpaca coat.
——	22	Wheeler and Ablett	Shirt elaborately embroidered.
——	206	Wheeler, T. and Co.	Application of stocking-frame to weaving shawls.
——	205	Wilshin, S. B. (Cl. xvi.)	Method of fastening skates to boots.

CLASS XXI.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	113	Spear and Jackson (Cl. xxii.)	For exhibition of circular saws, and particularly one 60 inches in diameter, of marked and very superior excellence, manufactured by a process of peculiar merit, the result of a novel application of mechanical ingenuity recently effected by themselves.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	23	Addis, J. B., jun.	Carving tools.
France	753	Arnheiter, M.	Cutlery.
United Kingdom	193	Blake and Parkin (Cl. xxii.)	Saws and files.
——	110A	Brookes, W., and Son (Cl. xxii.).	Edge tools.
United States	259	Brown and Wells	Tools.
United Kingdom	18	Buck, J.	Turning and other tools.
——	192	Butcher, W. and S. (Cl. xxii.)	Edge tools and razors.
——	240	Butterley, Richard (Cl. xxii.)	Sickles.
——	115	Cocker and Sons (Cl. xxii.)	Files and edge tools.
France	129	Coulaux and Co.	Saws.
Wurtemburg	57	Dittmar Brothers	Cutlery.
United Kingdom	49	Eastwood, G.	A plane.
——	203	Eyre, Ward, and Co. (Cl. xxii.)	Cutlery.
——	114	Fenney, Frederick (Cl. xxii.)	Razors.
Austria	420	Fischer, A.	Files.
France	218	Froely, A.	Fine files.
United Kingdom	194	Gibbins and Sons (Cl. xxii.)	Scissors.
France	851	Goldenberg, G., and Co.	Saws and tools.
——	858	Guerre, sen.	Cutlery.
United Kingdom	225	Hague, S. (Cl. xxii.)	Penknives.
Austria	517	Haindl, A.	Cutlery.
United Kingdom	31	Hannah, A.	Augers, &c.
——	146	Hardy, T. (Cl. xxii.)	Dressing-case instruments.
Turkey	1553	Hassan	Scissors.
Wurtemburg	58	Haueisen and Son	Scythes.
United Kingdom	135	Hawcroft and Sons (Cl. xxii.)	Razors.
Sweden and Norway	11	Heljestrand, C. V.	Razors.
Prussia	187	Henkels, J. A.	Cutlery.
United Kingdom	188	Higginbotham, G. and W. (Cl. xxii.)	Scissors.
——	47	Hill, Joseph V.	Saws.
——	33	Hilliard and Chapman	Cutlery.
Prussia	637	Hoeller, A. and E.	Cutlery.
United Kingdom	181	Howarth, J. (Cl. xxii.)	Edge tools (engraving).
——	228	Hunter, Edwin (Cl. xxii.)	Scissors.
——	215	Hutton and Newton (Cl. xxii.)	Scythes and reaping-hooks.
Russia	286	Iakovleff, Mme. Catharine	Cutlery.
United Kingdom	191	Ibbotson Brothers (Cl. xxii.).	Cast-steel scythes, &c.
——	209	Ibbotson, Richard (Cl. xxii.)	Saws.
Russia	167	Imperial Artinsk Works	Scythes.
United Kingdom	109A	Johnson, Cammell, and Co. (Cl. xxii.)	Files.
——	5	King and Peach.	Planes.
——	161	Kirk and Warren (Cl. xxii.)	Files.
——	14	Loy, William	Skates.
——	15	Loy, W. T.	Cutlery.
——	112	Makin, W. (Cl. xxii.)	Rag-engine roller bars, bottom plates, and rag knives.
Prussia	617	Mannesmann, A.	Files.
United Kingdom	139	Mappin and Brothers (Cl. xxii.).	Cutlery.
——	169	Marsden Brothers and Co. (Cl. xxii.)	Joiners' tools.
——	132	Martin, Stephen (Cl. xxii.)	Razors.
——	32	Mathieson, Alexander	Joiners' tools.
——	181	Matthews, W. (Cl. x.)	Table cutlery.
——	7	Morton, J. and G.	Table knives.
——	13	Moseley and Sons	Planes.
United States	323	North Wayne Scythe Company	Scythes.
United Kingdom	149	Nowill, J., and Sons (Cl. xxii.)	Cutlery.
——	233	Peace, J. (Cl. xxii.)	Saws.
——	641	Philp and Whicker (Cl. x.)	Cutlery.
France	348	Picault, G. F.	Cutlery.
——	969	Proutat and Co.	Fine files.
United Kingdom	690	Rodgers, J., and Sons (Cl. xxii.).	Cutlery.
——	198	Saynor and Sons (Cl. xxii.)	Gardeners' knives.
Prussia	673	Schmolz, W., and Co.	Cutlery.
United Kingdom	10	Sharp Brothers, and Co.	Table knives.
United States	119	Simmons, D., and Co.	Edge tools.
United Kingdom	208	Slack, Sellers, and Co. (Cl. xxii.)	Saws.
——	204	Sorby, R., and Sons (Cl. xxii.)	Edge tools.
——	214	Staniforth, Thomas (Cl. xxii.)	Scythes and sickles.
——	124	Steer and Webster (Cl. xxii.)	Scissors.
Switzerland	63	Stotzer, Frederick	Fine files.
United Kingdom	39	Stubs, Peter	Small files.
Turkey	1550	Tahir	Scissors.
France	1027	Talabot and Co.	Scythes.
United Kingdom	129	Taylor, Henry (Cl. xxii.)	Engravers' tools.
——	2	Thornhill, Walter	Garden tools.
——	38	Tomlin and Co.	Sickles and shears.
——	117	Turner, Thomas, (Cl. xxii.)	Files, saws, and cutlery.
——	190	Turton, Thomas, and Sons (Cl. xxii.)	Files.
——	159	Unwin and Rodgers (Cl. xxii.)	Cutlery.
——	178	Unwin, W. (aged 16) (Cl. xxii.).	Sportman's knife.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	17	Waldron and Sons	Scythes.
——	148	Walters, J., and Co. (Cl. xxii.)	Cutlery.
——	196	Ward and Payne (Cl. xxii.)	Edge tools.
Austria	448	Weinmeister, G.	Scythes.
——	573	Wertheim, F.	Tools.
United Kingdom	122	Wilkinson and Son (Cl. xxii.)	Sheep shears, vice, and chains.
——	175	Wilkinson, T. and G. (Cl. xxii.)	Scissors.
——	195	Wilson and Sons (Cl. xxii.)	Shoe and butchers' knives.
——	125	Wostenholm, G., and Sons (Cl. xxii.)	Cutlery.

HONOURABLE MENTION.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	11	Addis, S. J.	Carving tools.
France	4	Alcan and Locatelli	Files.
United Kingdom	118	Algor, J. (Cl. xxii.)	Shoe knives.
United States	97	Allen, A. B., and Co.	Tools.
United Kingdom	365	Atkin and Son (Cl. xxii.)	Joiners' tools.
——	160	Atkinson and Marriott (Cl. xxii.)	Files.
——	20	Baker, William	Awl-blades.
——	37	Barker, R.	Butchers' steels.
——	48	Beach, W.	Cutlery.
——	232	Bell, J. (Cl. xxii.)	Silver knives.
——	212	Biggin and Sons (Cl. xxii.)	Saws.
——	130A	Bloomer and Phillips (Cl. xxii.)	Joiners' tools.
——	3	Bradford, R. and W.	Cutlery.
——	26	Bradford, Samuel	Cutlery.
——	145	Briggs, S. (Cl. xxii.)	Awl-blades.
——	171	Brookes, J. (Cl. xxii.)	Dressing-case instruments.
——	182	Brown and Sons (Cl. xxii.)	Joiners' tools.
Austria	120	Bubenitscek, J.	Cutlery.
Switzerland	270	Burkhardt, James	Razors.
United Kingdom	109	Carr, J., and Riley (Cl. xxii.)	Saws and files.
——	142	Clayton, George (Cl. xxii.)	Table cutlery.
Prussia	628	Coppel, A.	Pen and pocket-knives.
United Kingdom	165	Cousins and Sons (Cl. xxii.)	Scissors.
——	217	Cutler, John (Cl. xxii.)	Edge tools and shears.
——	157	Deakin, George (Cl. xxii.)	Scissors (horse).
——	110	Deakin, G , and Co. (Cl. xxii.)	Table cutlery.
——	120	Ellin, T., and Co. (Cl. xxii.)	Table cutlery.
——	151	Elliott, J. (Cl. xxii.)	Razors.
——	156	Ellis, J. (Cl. xxii.)	Cutlery.
Austria	501A	Fischer, G.	Files.
United Kingdom	206	Fisher and Bramhall (Cl. xxii.)	Files.
——	167	Flather, B. (Cl. xxii.)	Joiners' tools.
——	219	Garfit and Son (Cl. xxii.)	Scythes and reaping-hooks.
Prussia*.	551	Gerresheim and Neeff	Cutlery.
United Kingdom	123	Gilbert Brothers (Cl. xxii.)	Razors.
——	187	Jowitt and Battie (Cl. xxii.)	Files.
Turkey	1304	Kirkar	Scissors.
United Kingdom	24	Knight and Sons	Turning tools.
Saxony	30	Krumbholz aud Trinks	Cutlery.
Canada	121	Ladd, C. P.	Axes.
France	1641	Lanne, E.	Cutlery.
Canada	124	Leavitt, G.	Axes.
Austria	496	Lechner, M.	Files.
Switzerland	215	Lecoultre, J.	Razors.
United Kingdom	225	Leon, A. (Cl. xxii.)	Bowie knives.
Saxony	31	Levy, H.	Pearl-handle carvers.
United Kingdom	231	Linley, G. A. F. (Cl. xxii.)	Sheep shears.
——	128	Marples, R. (Cl. xxii.)	Joiners' tools.
——	162	Marsh Brothers (Cl. xxii.)	Cutlery and edge tools.
——	35	Mathieson, T. A.	Plane.
——	36	McPherson, C. and H.	Braces and bits.
Belgium	352	Monnoyer, P. J.	Table cutlery.
Denmark	22	Naylor, J. W.	Files (various).
United Kingdom	133A	Newbould and Baildon (Cl. xxii.)	Table cutlery.
——	137	Nicholson, W. (Cl. xxii.)	Cutlery.
Austria	444	Offner, Brothers	Scythes.
——	445	Pamer, S.	Scythes.
United Kingdom	119	Parkin and Marshall (Cl. xxii.)	Table cutlery.
——	233	Pearce, Henry (Cl. xxii.)	Files.
Austria	446	Penz, J.	Scythes.
Prussia	619	Pickardt, G.	Files.
Portugal	632	Polycarpo, A.	Garden knives.
Hamburgh	43	Ritter, W.	Augers, &c.
Austria	552	Rossler, J.	Cutlery.
United Kingdom	34	Sanders, G.	Razor strop.
Prussia	640	Schwarte, J. D.	Cutlery.
Canada	122	Scott and Glasford	Axes.
United Kingdom	147	Sellers, J. (Cl. xxii.)	Cutlery.
Canada	123	Shaw, Samuel	Axes.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	158	Slagg, H. W. (Cl. xxii.)	Sickles.
Turkey	1303	Sophia, Province of.	Scissors.
United Kingdom	21	Stewart and Co.	Razor guard.
Sweden and Norway	12A	Stille, A.	Razors, &c.
Austria	559	Stuckhart, John	Cutlery.
France	1496	Tabourdeau, P.	Cutlery.
——	1024	Taborin, P. F.	Files.
United Kingdom	205	Tasker, Henry, (Cl. xxii.)	Saws.
——	211	Taylor Brothers (Cl. xxii.)	Saws.
Prussia	671	Thomas, C.	Cutlery.
Canada	120	Wallace, A.	Planes.
United Kingdom	187	Warburton and Co. (Cl. xxii.)	Augers.
Austria	572	Weiss, J., and Sons	Tools.
United Kingdom	134	Winks, B., and Sons (Cl. xxii.)	Razors.
——	8	Wood, J.	Razors.
Spain	256A	Ybarra, J.	Files.
Austria	450	Zeitlinger, J. A.	Scythes.

CLASS XXII.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	1053	André, J. P. V.	Iron fountain in nave, and the design of the alligator and fish fountain.
——	1055	Aubanel, J.	Castings of animals, and gilt cast-iron door.
——	1709	Barbedienne, F., and Co. (Joint Medal with Cl. xxvi.)	Sculpture in metal, bronzes, &c.
United Kingdom	641	Coalbrook Dale Company	Cast-iron statues, new method of bronzing steel-grates, and diamond flooring for steam-engines.
——	700	Hardman and Co.	Ecclesiastical brass work.
——	140	Hoole, Robson, and Hoole	Drawing-room steel-grates.
France	923	Matifat, C. S.	Original designs in bronze.
Bavaria	90	Miller, Ferd.	Casting in bronze of a colossal lion, and statues of Libusa, and George I. of Bohemia.
Prussia	271	Minister of Trade, for the Royal Prussian Foundry.	Three vases, and candelabra with group of figures in cast-iron.
United Kingdom	102	Stuart and Smith	Drawing-room grates on Sylvester's patent, and the novel application of a revolving canopy invented by Laurie.
Belgium	26	Vieille-Montagne Zinc Mining Company.	Specimens of zinc castings.
United Kingdom	373	Winfield, R. W.	Brass foundry work and metallic bedstead, with taper rolled pillars, and chandeliers.

PRIZE MEDAL.

United Kingdom	265	Abate, F.	Specimens of a new art termed Metallography.
United States	462	Adams and Co.	Bank lock.
United Kingdom	300	Allen and Moore	Metal buttons.
——	150	Armitage, M. and H.	Anvils, &c.
Prussia	189	Arnheim, S. J.	Iron-safe bureau.
United States	138	Arrowsmith, G. A.	Permutation locks.
United Kingdom	283	Aston, W.	Buttons.
——	663	Aubin, C.	Locks.
——	805	Baily and Sons	Cast-iron staircase work, brass work, &c.
——	319	Baker and Co.	Flower-stand and cages.
——	287	Banks, E.	Buttons.
——	34	Barnard and Bishop	Wrought-iron hinge.
——	695	Barron and Sons	Locks.
——	329	Bartleet and Sons	Needles and fishhooks.
——	25	Bartrum and Pretyman	Wrought copper nails, &c.
——	361	Bedington and Tonks	Brass work (various).
Prussia	407	Beissel's Widow, and Son	Needles of English steel.
United Kingdom	98	Benham and Sons	Cooking apparatus.
——	606	Bentley, W. H.	Cooking apparatus.
Prussia	310	Blaeser, G.	Bronze statue of Beethoven, &c.
France	28	Blanzy, Poure, and Co.	Metallic pens.
United Kingdom	349	Blews and Son	Ship lamps and bells.
Prussia	633	Böker, R. and H.	Hardware (various).
United Kingdom	353	Bolton, T.	Brass and copper tubes.
——	680	Boobbyer, J. H.	Locks.
France	776	Boucher, E., and Co.	Culinary vases, tinned by a new process.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	330	Boulton, W., and Son.	Needles and fish-hooks.
—	653	Bramah and Co.	Locks and castings (and Special Approbation).
France	437	Bricard and Gauthier	Locksmiths' work, &c.
United Kingdom	458	Bright, R.	Carriage lamps.
—	364	Brisband, H.	Buttons.
—	477	Brown and Redpath	Stoves for ships.
—	633	Burney and Bellamy	Tanks for oil, water, &c.
France	1129	Cain, J.	Bronzes—birds in nest, &c.
United Kingdom	655	Carpenter and Tildesley	Locks.
—	459	Childs, J.	Brass lamp for lighthouses.
United States	417	Chilson, Richardson, and Co.	Hot-air furnace.
Russia	365	Chopin, Felix	Bronze candelabrum.
United Kingdom	646	Chubb and Son	Locks and safes (and Special Approbation).
—	446	Clarke and Restell	Lamps, gas-burners, and locks.
—	657	Clarke, T. and C., and Co.	Enamel ware.
—	434	Cochrane, J.	Gas meter.
—	115	Cocker, S., and Sons	Needles.
—	234	Cocker and Sons	Needles.
—	27	Coombe and Co.	Iron and copper netting.
—	255	Cope and Collinson	Brass work (various.)
—	416	Corcoran, B., and Co. (Cl. VI.)	Metallic cloth.
United States	46	Cornelius and Co.	Chandeliers.
United Kingdom	698	Cottam and Hallen	Gates, cast-iron, and enamelled cast-iron horse-manger.
—	307	Cotterill, Edwin	Locks.
—	63	Cottingham, N. J. (Main Avenue West.)	Brass lectern.
—	62	Cowley and James	Beds and steam tubes.
—	244	Crook, W.	Cooking apparatus.
United States	298	Day and Newell	Parautoptic permutating locks (and Special Approbation).
United Kingdom	186	Deane, Dray, and Deane	Stove grates.
Belgium	361	De Bavay, Paul	Pointes de Paris nails, &c.
France	779	De Braux d'Anglure	Statues of galvanized zinc, bronze busts, &c.
Wurtemburg	71	Deffner, C.	Japanned tin goods.
United Kingdom	482	Defries, N.	Gas meter, bath heated by gas, &c.
—	800	De la Fons, J. P.	Locks.
Belgium	363	De Latour, Albert	Iron castings.
Spain	260	De Miguel, F.	Iron bedsteads, &c. (and Special Approbation).
Belgium	365	De Rosée, Baron A.	Brass caldrons, &c.
France	1588	Desjardins-Lieux	Medallions, &c.
Prussia	280	Devaranne and Son	Castings in zinc.
France	188	Dietrich and Son	Specimens of iron castings, &c.
United Kingdom	797	Dixon, J., and Sons	Powder flasks.
—	476	Dowson, J. E.	Cundy's hot-air ventilating stove.
Prussia	638	Dreyse and Collenbusch	Copper rivets.
Belgium	353	Drion, E.	Wrought nails.
Austria	456	Dubsky, Count	Wire tacks, twisted nails.
United Kingdom	350	Dugard, N. and H.	Carriage lamps.
—	89	Duley, J.	Cottage cooking stove.
—	336	Edelsten and Williams	Pins.
—	51	Edge, J.	Pit chains.
—	441	Edge, T.	Gas meter.
—	387	Edwards, F.	Arnott's stove.
Prussia	200	Egells, F. A.	Cast-iron chimneypiece.
Austria	435	Egger, J. B.	Leaden pipe, 1,800 feet long, in one piece.
Prussia	762	Einsiedel, Count G.	Cast-iron goods, &c.
United Kingdom	302	Elliott and Son	Buttons.
—	103	Evans, Jeremiah, Son, and Co.	Cooking apparatus.
—	352	Everitt and Son	Brass and copper tubes.
Belgium	154	Falisse and Trapmann	Percussion caps.
United Kingdom	444	Faraday and Son	Gas chandelier on Professor Faraday's principle.
—	686	Feetham, Miller, and Sayer	Stove grates, &c. (and Special Approbation).
—	161	Firmin and Sons (Class XX.)	Buttons.
Austria	420	Fischer, A.	Malleable cast iron.
Prussia	296	Fischer, C. H.	Figures in bronze, &c.
United Kingdom	38	Flavel, S.	Cooking apparatus (and Special Approbation).
France	1227	Fontaine, P.	Brass pans.
Prussia	293	Franz, J.	Bronze figures of Victory, &c.
—	289	Friebel, L.	Bronze Newfoundland dog, &c.
Austria	412	Fürstenberg, Prince	Stoves, monuments, crucifix.
France	227	Gagneau Brothers	Lamps, bronzes, &c.
United Kingdom	556	Gardener, M.	Chandelier.
—	483	Garton and Jarvis	Stoves.
Austria	703	Gasser, J.	Bronzes.
Prussia	267	Geiss, M.	Statues in zinc, "Eve," &c. (and Special Approbation).
United Kingdom	652	Gerish, F. W.	Locks and hinges.
France	520	Gervais, —	Copper boiler with grate.
United Kingdom	654	Gibbons, J., jun.	Locks.
—	324	Gillott, J.	Metallic pens.
—	438A	Glover, T. (Cl. I.)	Gas meter.
—	380	Goddard, H.	Cooking apparatus.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	481	Goodbehere, G. T.	Ships' stoves.
——	335	Goodman, G.	Needles and pins.
——	405	Gray, J., and Son	Locks.
——	262	Gray and Son	Fire-irons, &c.
——	518	Gray, T. W.	Brass-work (various).
——	66	Green, T. (Cl. IX.)	Aviary.
——	39	Greening and Sons	Strong wire cloth, woven by steam-power.
——	254	Griffiths, T. F.	Tin and enamel ware.
France	1617	Grignon, M.	Bronzes, &c.
Saxony	37	Gruhl, F.	A bell (very fine tone).
United Kingdom	524	Guest and Chrimes	Water closet and fire cocks.
France	255	Hadrot, L., jun.	Moderator lamps.
United Kingdom	563	Hale, J.	Curb chains.
——	282	Hammond, Turner, and Sons	Buttons.
——	82	Handyside, A.	Cast-iron fountain.
——	616	Hanson, J.	Manufactured lead.
——	211	Harding, T. (Cl. XX.)	Buttons.
——	284	Hardman and Iliffe	Buttons.
——	660	Harley, G.	Locks.
——	636	Hart and Sons	Door-plates.
——	421	Haslam, W.	Wrought-iron hinges, &c.
——	52	Hatfield, J. A.	Statue in bronze.
——	318	Hawkins, J.	Brass, copper, and iron screws and bolts.
——	97	Haywood, J.	Church stove.
——	647	Haywood and Son	Locks, gilding, &c.
——	331	Hemming, H.	Fish-hooks.
——	316	Henn and Bradley	Taper screws, &c.
United States	124	Herring, S. C.	Salamander safe.
United Kingdom	351	Hetherington, T. and C.	Carriage lamps.
Prussia	631	Hilgers and Sons	Hardware.
United Kingdom	326	Hincks, Wells, and Co.	Metallic pens.
——	519	Hodges, T.	Bells.
——	348	Holden, H. A.	Carriage lamps.
——	1	Hood, S.	Cast-iron enamelled stall and manger.
——	275	Horne, T.	Curtain poles, &c.
——	334	Horsfall, H.	Pins, and wire for fish-hooks.
United States	486	Howland, C.	Bell telegraph.
United Kingdom	649A	Huffer, J.	Locks.
——	609	Hughes and Kimber	Copper and steel plate for engravers.
——	–	Ibbetson, Capt. L. L. B.	Bronzing, iron and metallic castings—new method (and Special Approbation).
——	304	Ingram, T. W.	Buttons.
——	317	James, J.	Fish-hooks and needles.
——	237	Jeakes, W.	Stove grates (and Special Approbation).
——	810	Jennings, G.	Water closet.
——	106	Jobson and Co.	Radiating stove.
Prussia	285	Kalide, T.	Boy with swan, in bronze, &c.
France	1632	Karcher, H., and Westermann	Articles in stamped iron.
United Kingdom	76	Keep and Watkin	Anvils, vice, &c.
——	601	Keith, G.	Refrigerator.
——	327	Kell, A., and Co.	Metallic pens.
——	804	Kennard and Co.	Stoves and iron castings.
——	360A	Kenrick and Son	Enamelled ware.
——	553	Kent, G.	Knife-cleaning machine.
——	489	Kepp and Co.	Copper bath.
Prussia	209	Kesseler, C.	Bronze statue of Polyhymnia.
United Kingdom	96	Kirby, Beard, and Co.	Pins, &c.
Austria	434	Kitschelt, A. (Cl. XXIV.)	Cast-iron vases, &c.
United Kingdom	689 & 694	Knight and Forster	Metallic pens.
——	239	Knowles, H.	Buttons.
Russia	287	Krumbigel	Gilt bronze candelabra.
United Kingdom	32	Kuper, W.	Metal ropes.
France	1284	Lacarrière, A.	Lustres, chandeliers, &c.
United Kingdom	534	Lambert, T.	Water-closet and diaphragm valve.
France	298	Laureau, L.	Figures, in a galvanized compound of bronze and pewter.
——	568	Laury, G.	Stove-grates and stoves (and Special Approbation).
United Kingdom	54	Lawrence, T. B.	Perforated zinc, &c.
——	665	Lea, W. and J.	Lock with bolts, &c.
France	1644	Lecocq, H.	Ornaments in stamped brass, hot-air stoves, &c.
Belgium	354	Lefebvre, V., and Co.	Wire nails and rivets.
——	381	Limelette, F.	Wrought nails.
United Kingdom	357	Lloyd, G. B., jun.	Iron lap-welded tubes for steam-boilers.
——	105	Longden and Co.	Cooking apparatus.
——	332	Love, J.	Gas stoves.
——	346	Lowe, J. and H.	Carriage lamps, &c.
France	1340	Mallat, J. B.	Metallic gilt pens, &c.
United Kingdom	370	Mappleback and Lowe	Cooking apparatus.
France	607	Marchand, J. B.	Bronzes (various) (and Special Approbation).
United Kingdom	510	Marr, W.	Safes.
——	363	Marrian, J. P.	Naval brass work.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	795	Marriott, W.	Weighing machine.
France	332	Marsaux and Legrand	Stamped copper for decoration.
United Kingdom	332	Martin and Gray	Carriage lamps.
——	416	Massey, W., and Co.	Brass flower-stand.
——	634	Masters, T.	Ice apparatus.
Switzerland	41	Mathey and Son	Cylinder of rolled steel for watch-springs.
Belgium	359	Mathys, J.	Strong box and polished stoves.
United States	20	M'Gregor and Lee	Bank lock.
United Kingdom	684	Mears, C. and G.	Bells.
France	630	Mène, P. J.	Bronzes of boar hunt, &c.
United Kingdom	340	Messenger, Samuel	Bronzed and lacquered lamps (and Special Approbation).
Austria	413	Metternich, Prince	Stove for hunting-seat.
United Kingdom	645	Miller, Geo. Alex.	Signal lamps, &c.
——	642	Milner and Son	Safes.
——	339	Mitchell, J.	Metallic pens.
——	328	Mitchell, W.	Metallic pens.
——	274	Moore, P., and Co.	Iron and brass hinges.
France	1666	Morel Brothers	Moulded cast-iron, &c.
United Kingdom	610	Morewood and Rogers	Galvanized tinned-iron sheets.
——	204	Mossman, W. (Cl. xxx.)	Brass candlestick.
France	934	Muel-Wahl and Co.	Chandeliers, fountains, &c.
United Kingdom	683	Murphy, J.	Bells.
——	338	Myers and Son	Metallic pens.
——	638	Naylor, J.	Lamps for pillars and wall brackets.
——	36	Newall, R. S.	Metal ropes.
——	87	Nicholson, W. N.	Anglo-German cooking-stove.
——	332	Nicklin and Sneath	Wire weaving.
——	491	Noirsain, J.	Ventilating stoves.
——	424	Paddon and Ford	Gas meter.
France	671	Paillard, F.	Copper and zinc frames for mirrors, &c.
United Kingdom	447	Palmer and Co.	Candle lamps.
France	942	Palmer, J. L.	Drawn wire.
Tuscany	116	Papi, Clement	Basket of flowers, cast from nature.
France	1379	Paris, E.	Galvanized sheet of iron, &c.
United Kingdom	659	Parkes, H. W.	Locks.
——	619	Patent Pointed Screw Company	Pointed screws cast out of malleable iron.
France	946	Paublan, —	Safes and locks.
United Kingdom	688	Perry and Co.	Metallic pens.
——	61	Perry, E.	Japanned ware.
Netherlands	78	Petit and Fritsen	Bells with suspending apparatus.
United Kingdom	371	Peyton and Harlow	Metallic japanned bedsteads.
——	107	Pierce, W.	Cottage grate.
France	963	Poirier, L.	Copying presses.
United Kingdom	323	Potts, W.	Bronzes and lacquered lamps, &c. (and Special Approbation.)
——	64	Purdy, C. W. (Main Avenue West)	Gothic ornament.
Belgium	356	Puissant, F.	Wrought-iron crucible and ornaments.
Wurtemburg	72	Rau and Co.	Japanned tin-plate.
Netherlands	99	Regout, P.	Chandeliers (2 large and 2 small).
United Kingdom	315	Reynolds, J.	Cut nails.
——	433	Rickets, C.	Gas stoves.
——	637	Riddle, W.	Apparatus for extinguishing fires in ships, signal lamps, &c.
France	1440	Robert, A., and Co.	Roll of tinfoil, &c.
United Kingdom	183	Robertson, Carr, and Steel	Stove grates.
Wurtemburg	73	Rometsch, C.	Metallic writing slates (and Special Approbation).
United Kingdom	278	Rowley, Charles	Buttons.
Austria	430	Salm, Prince.	Cast-iron statue of Radetzky, considered as a specimen of casting (and Special Approbation).
United Kingdom	343	Salt and Lloyd	Bronze and lacquered lamps.
——	270	Simonite, J.	Tin and enamel ware.
Spain	259	Sanchez Pescador	Bedstead of cast steel, with bronze ornaments (and Special Approbation).
Prussia	405	Schleicher, C.	Galvanized steel wire.
France	370	Schmautz, C., sen.	Letter-press rollers.
Prussia	644	Schmidt, Caspar	Kitchen stove.
Netherlands	98	Schutz, L. N.	Zinc castings.
United Kingdom	90	Shave, W. J.	Stoves and ovens.
——	243A	Sherwin, J.	Kitchen range.
——	66	Shoolbred and Co.	Japanned ware.
Russia	370	Shtange and Verfel	Bronze candelabrum.
United Kingdom	435	Siebe, A.	Rotatory syringe.
——	321	Simcox, Pemberton, and Sons	Brass work (various.)
——	295	Smith, Kemp, and Wright	Buttons.
Prussia	802	Sommermeyer and Co.	Iron safe, ornamented (and Special Approbation).
United Kingdom	60	Steele, W. and P.	Cooking apparatus.
——	-	Stirling, Morries J. D. (Main Avenue West.)	Alloy bell, for cheapness. Patent.
Prussia	199	Stobwasser, C. H., and Co.	Japan articles, &c.
United Kingdom	422	Stocker Brothers (Cl. v.)	Beer machine.
Wurtemburg	60	Stohrer, J. F.	Brass and steel wire, &c.
Prussia	779	Stollberg-Wernigerode, Count	Cast-iron Gothic vase, &c.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	443	Strode, W.	Gas stove.
France	1023	Susse Brothers	Bronze candelabra, fountains, &c.
United Kingdom	507	Tann and Sons	Safes.
——	622	Taylor, J.	Locks.
——	682	Taylor and Son	Bells (and Special Approbation.)
——	705	Thompson, T. H.	Sanatory trap, &c.
——	312	Timmins and Sons	Vices, hammers, &c.
——	55	Treggon, H. and W.	Zinc window blinds.
France	700	Trelon, Weldon, and Weil	Buttons and China knobs.
——	1512	Tronchon, N.	Iron articles of furniture, &c.
Spain	280	Trubia, The Royal Ordnance	Iron bust of King of Spain.
United Kingdom	550	Tupper and Carr	Wire fencing (galvanized iron.)
——	174	Turner, H. and W.	Fire-irons.
——	63	Tylor and Pace	Perforated metals.
——	401	Tylor and Son	Bronzed ware and baths.
France	1517	Vantillard and Co.	Tinned-iron pins, &c.
——	1705	Verstaen, L. N.	Strong boxes and safes.
United Kingdom	381	Wakefield, F.	Cooking apparatus.
——	29	Walker, E.	Perforated brass.
——	242	Walker, R. (Cl. VIII.)	Metallic pens.
——	62	Waller and Co. (Main Avenue West)	Monumental brass.
——	670	Walters, B. and P.	Locks.
——	69 & 701	Walton and Co.	Japanned ware.
——	798	Warner and Sons	Bronzed copper ware and bells.
——	290	Wells, J. T.	Buttons.
——	600	Wenham Lake Ice Company	Refrigerator.
——	667	Whitehouse and Co.	Iron tubes and fittings.
——	356	Whitfield, Samuel	Brass cornices and safes.
——	242	Whitmee and Chapman	Coffee mills.
——	30	Wilkins and Weatherly	Metal ropes.
——	490	Wilson, R. and W.	Baths (various).
——	668	Windle and Blythe	Locks and steel pens.
——	75	Wood Brothers	Chain cables.
——	664	Yates, H.	Locks.
——	384	Yates, Haywood, and Co.	Stove grates.
——	348	Zuccani, B. (Cl. XXX.)	Aviary.

HONOURABLE MENTION.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Prussia	214	Actien-Verein, Wilhelmshütte	Enamelled stoneware.
United Kingdom	687	Aldridge, J. M.	Door pivots.
——	253	Allday, W.	Bellows.
——	65	Archer, J. W. (Main Avenue.)	Monumental brass.
Austria	665	Arrer, J.	Pearl buttons.
United Kingdom	301	Aston, J.	Silk buttons.
——	681	Bamber and Son	Mortice night bolt.
Prussia	760	Baum, E.	Stove (as a man in armour.)
Austria	438	Beitl, F.	Two iron cash boxes.
United Kingdom	438	Biddell, G. A.	Gas burner, self-regulating.
——	297	Biddle, J.	Letter-clips, &c.
——	650	Bigford, H.	Lock.
——	267	Bird, A.	Hydrostatic siphon.
——	464	Black, B.	Ornamental carriage illuminator.
Prussia	623	Bleckmann, J. E.	Tools, locks, &c.
Wurtemburg	94	Blumhardt, H.	Fire-tongs.
France	769	Boche, M.	Powder-flasks, &c.
——	770	Boeringer and Co.	Door security bolt.
United Kingdom	426	Botten, C.	Protector gas meter, for preventing fire-damp.
France	433	Boulonnois	Various bronzes.
United Kingdom	575	Bradnack, J. R.	Knocker and letter-plate for door.
Prussia	621	Braunschweig, J. A.	Tools.
United Kingdom	500	Bray, C.	Cooking utensils, &c.
——	247	Burton, W. S.	Ornamental fenders.
France	1132	Carle, A. T.	Specimens of brass founding.
Prussia	655	Caron, J. M., and Co.	Samples of buttons, plated.
France	1135	Carrier-Rouge	Bronze, chandeliers, &c.
United Kingdom	592	Carson, —	Machine for preserving meat.
France	117	Charles and Co.	Machine of galvanized iron for washing.
——	449	Chauvin, G.	Purse trimmings.
Canada	151, 155 156, 159	Cheney, G. H.	Stoves, &c.
United Kingdom	11	Chopping, Thomas	Concave horse-shoe.
——	158	Cochrane, A. (Cl. VII.)	Lock and ventilator.
——	100	Collier and Son	Coffee-roasting apparatus.
——	573	Collinge, C., and Co.	Patent door-hinge.
——	16	Cook, Wm.	Improved horse-shoe for general use.
——	320	Cooksey, H. R.	Coffin furniture.
——	57	Crook, F. (Cl. XXX.)	Wrought-iron water-lily.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REAWRDED.
France	134	Cadrue, F.	Window-rod fasteners.
——	99	Cugnot, A.	Locksmith's work and ironmongery.
United Kingdom	754	Culverwell, W.	Portable vapour bath.
France	1168	Daniel, E., jun.	Ornamental steel purse.
United Kingdom	445	Debaufer, H.	Concentrating gas lamp, for the exterior illumination of shop-windows.
France	1582	De la Cour, L. F.	Bronze and cast-iron articles, &c.
Russia	324	Demidoff, Messrs.	Malachite vases.
France	145	Dervaux-Lefebvre	Chains, bolts, &c.
——	1483	De Sérionne, Loin, and Co.	Buttons, &c.
——	819	Deydier, Madame	Zinc dormer windows, &c.
——	824	Ducel, S. J.	Iron castings of statues, animals, &c.
Prussia	641	Dültgen Brothers	Pad and portfolio locks.
Jersey and Guernsey	9	Du Pre, W. H.	Wind guard, &c.
France	151	Duval and Paris	Bronze lamps, &c.
Austria	427	Eberstaller and Schindler	Iron and steel wire, &c.
United Kingdom	241	Edwards, D. O.	Atmopyre hoods and gas stove.
——	345	Edwards, E.	Inkstands, glass screws, &c.
Prussia	660	Eichelberg, H. D., and Co.	Window curtain, in frame of brass.
United Kingdom	86	Ellis, W.	Kitchen range and bath apparatus.
Austria	457	Ernst, P.	Nails (assorted).
United Kingdom	560	Farrow, C.	Machines for wine and other liquors.
Belgium	380	Fauconier-Delire (Widow)	Wrought nails.
United Kingdom	502	Faulding, J.	Portable vapour bath by spirit lamp.
France	1691	Faye, P. G.	Bronze clocks, &c.
——	1601	Fetu, J.	Bronze chandeliers, &c.
United Kingdom	508	Fisher, J. N.	Cash-box.
——	13	Fogarthy, J.	Horse-shoes.
France	508	Fondet, sen.	Warming apparatus.
United Kingdom	35	Fox, T. H.	Bird-cages.
France	513	Fumet, C. F.	Apparatus for artificial ice.
Prussia	193	Gaertner, A.	Parrot-cage, German silver.
France	225	Gaillard, jun.	Wire gauze, &c.
United Kingdom	556	Gidney, J. W.	Wire fencing.
France	849	Gillot, F.	Clocks, &c.
United Kingdom	238	Glenton and Chapman	Polished register stove.
Belgium	357	Gob, J.	Wrought-iron strong box.
United Kingdom	374	Gorton, G.	Stove grate and fender.
——	66	Gould, —	Monumental brass, inlaid steel figures.
Austria	469	Grabner, F.	Jews' harps.
France	1256	Grangoir, J. M.	Locks, &c.
United Kingdom	431	Grant, D.	Gas stoves.
Prussia	653	Greef, jun.	Samples of buttons.
France	252	Guinier, T.	Water-closets and cocks.
United Kingdom	4	Guy, S.	Horse-shoes.
——	432	Haldane and Rae	Water-closets, &c.
——	486	Hale, T., and Co.	Bells, kettles, &c.
——	612	Hampden, J., and Co.	Enamelled zinc.
——	263	Hands, J.	Brass-work, cornices, &c.
——	555	Harrison, W.	Enamelled frying-pans.
Sweden and Norway	11	Hedlund, J.	Padlock.
United Kingdom	271	Hickman and Clive	Coffin furniture.
——	65	Hill, E., and Co.	Patent bedstead, with iron pillars, &c.
——	355	Hill, J.	Stamped brass ornaments.
——	15	Hillman, J.	Improved horse-shoes.
——	450	Holgate, J.	Signal-lamps.
——	448	Holliday, R.	Gas-lamp.
——	12	Holmes, Capt.	Improved horse-shoes.
Prussia	648	Hosterey, G.	Samples of buttons (plated).
Austria	428	Hueber, F.	Iron and steel wire.
France	880	Huet, J.	Purse-trimmings, &c.
Prussia	632	Huth, Fried, and Co.	Vices, &c.
United Kingdom	406	Huxhams and Brown	Stoves.
——	236	Huxley and Heriot	Gas-stoves, hydraulic stoves, &c.
——	311	Jackson, W.	Tools for tin and copper ware.
France	887	Jaudin, A.	Tinfoil and coloured spangles.
United Kingdom	14	Jones, G.	Improved horse-shoes for frosty weather
——	407	King, S.	Stove-grates (ventilating principle).
Prussia	196	Kolesch, H.	Iron safe.
Canada	151A	Ladd, C. P.	Balance-scale.
France	288	Lang, L.	Wire-gauze, &c.
United Kingdom	506	Leadbeater, J.	Fire-proof safes.
——	108	Leale and Albrecht (Cl. XXIX.)	Cake-moulds and temple.
Prussia	197	Lehmann, A. F.	Iron crucifix, &c.
France	1315	Lemaire, A.	Brass curtain ornaments.
United Kingdom	673	Lewis, G.	Lock on circular levers.
——	503	Longfield, W.	Ornamental iron safe.
France	1332	Luce, P.	Mantelpiece, ornamented with a mirror.
Netherlands	100	Lurasco Brothers	Bronze statues, &c.
Belgium	378	Macquinay Brothers	Wrought nails.
United Kingdom	639	Machell, J. C.	Patent portable steamer-bath
——	261	Malin and Sons	Brass-work, cornices, &c.
——	313	Manly, J., jun.	Ornamental nails.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Belgium	120	Marcinelle and Couillet Smelting Company.	Samples of nails, &c.
France	614	Martin, O., and Very Brothers	Cast-iron ornamental work.
Austria	608	Metzner, W.	Pearl buttons.
United Kingdom	9	Miles, W.	Horse-shoes (various).
Austria	467	Mitterberger, J..	Shoe-tips and heels.
United Kingdom	669	Moreton and Langley	Lock, and general hardware.
France	931	Morisot, N. J.	Bronzes, &c.
United Kingdom	333	Morrall, A.	Needles.
——	104	Morton, J.	Fenders and cast-iron table.
——	493	Moss, P.	Copper vapour-bath by spirit-lamp.
Prussia	287	Müller, —	Ornamental castings in bronze.
United Kingdom	703	Murray, W.	Tabular filter.
——	285	Neal and Tonks	Buttons.
——	388	Nettleton and Son	Gothic church-ventilating stove.
France	662	Neuburger	Lamps, &c.
United Kingdom	640	Nixey, W. G.	Patent till.
——	249	Onions, J. C..	Bellows.
——	658	Osmond, G.	Sash-fastenings, &c.
France	683	Paul Brothers	Braziers.
United Kingdom	73	Perry, J.	Copying press.
France	954	Petithomme, L. A.	System of suspension for bells.
United Kingdom	281	Pigott and Co.	Buttons; naval buttons.
Austria	433	Pleischl, A.	Sheet-iron saucepans in non-metallic enamel.
United Kingdom	17	Plomley, W.	Model of an improved horse-shoe.
United States	414 & 434	Pond and Co.	Cooking stoves.
United Kingdom	243	Pope and Son	Double-action rarefying stoves.
——	230	Prideaux, J. S.	Grate, feeding at bottom; draining machine.
——	465	Pyrke and Sons	Bronze urns, &c.
France	975	Rebert, C.	Door-fastenings.
——	979	Regniaud, J..	Copper cake-moulds.
United Kingdom	449	Rettie and Sons	Signal-lamps.
Wurtemburg	62	Rexer, C..	Brass and steel wire and gauze.
Canada	150A	Rice, W.	Wire fencing.
Hamburg	50	Richter, J. M. S.	Brass parrot cage.
Prussia	639	Ritzel, L. (Widow).	Metallic buttons.
France	1447	Robin, L..	Bronze cups, &c.
United Kingdom	437	Roper, J.	Transparent gas-meter.
——	436	Ryan, J.	Transparent gas-meter.
Austria	429	Schedl, C.	Iron and steel wire.
Prussia	646	Schmidt, P. L.	Iron and brass wares.
Austria	470	Schwarz, C.	Jews' harps.
——	471	Schwarz, F., jun.	Jews' harps.
——	472	Schwarz, F., sen.	Jews' harps.
——	473	Schwarz, J.	Jews' harps.
United Kingdom	480	Searle, C., M.D..	Tubulated solid brick-heating stove.
Grand Duchy of Hesse	50	Seebass, A. R.	Cast-iron and steel ornaments.
United Kingdom	438A	Shears and Son	Patent dry gas-meter.
——	243A	Sherwin, J.	Economic range, hot closet, and bath.
Belgium	358	Sieron, L..	Nails, termed "Clous de Paris."
France	1017	Sirot, P., sen.	Copper and steel pegs for shoes.
United Kingdom	220	Skeltons, S. and R.	Shovels and spades.
——	452	Smiths and Co.	Carriage, rail, &c., lamps.
——	354	Souter, W.	Copper-bronzed urns.
——	430	Sparkes, J.	Cash-box for railways.
——	451	Squire, R..	Signal lamps.
——	7	Stevens, H. R.	Horse-shoes and plates.
——	252	Stokes, J. C.	Water-closet, brass taps, &c.
France	1497	Tachy, A., and Co.	Needles for blind peoples.
——	1039	Taillefer, A., and Co.	Galvanized needles and pins.
United Kingdom	251	Taylor, S.	Ornamental bellows.
Prussia	624	Thomas, Christian	Hardware.
Austria	419	Thurnschelz, Count Gevag	Steel and iron for nails.
France	703	True, —	Lamps, &c.
Prussia	636	Turk, P. C. (Widow)	Metal buttons.
United Kingdom	–	Turner, —	Post-office window, double-action fastenings.
——	279	Twigg, G. and W.	Naval buttons.
Prussia	355	Ullenberg and Schnitzler	Screws and wire.
Austria	460	Vingert, A.	Nails (assorted).
Belgium	355	Vandercamer, J. A.	Zinc vessels.
France	1531	Voizot, E.	Steel for jewellery.
United Kingdom	113	Wallace and Son.	Cooking apparatus.
——	248	Warriner, G..	Gas cooking stove.
Prussia	634	Wescher Brothers, and Strassmann	Buttons, &c.
United Kingdom	656	Whitley, J.	Wrought-iron hinges.
Jersey and Guernsey	12	White, George	Ventilator and guard.
United Kingdom	10	Whitehead, —	Horse-shoes.
Prussia	282	Winckelmann, J.	Electrotypes.
United Kingdom	525	Wiss, R.	Self-acting water-closet.
——	276	Wolverson, E.	Lock.
——	8	Woodin, D.	Horse-shoes (various).
——	33	Woods, W.	Hooks and eyes, chains.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	347	Wooldridge, J.	Brass fittings, &c.
Denmark	23	Wulff, —	Two brass tea-urns, executed by hand.
United Kingdom	442	Young, W.	Vesta lamps.
Frankfort-on-the-Maine	19	Zimmermann, E. G.	Iron and zinc wares.

CLASS XXIII.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	1	Elkington, Mason, and Co.	Artistic application of the electrotype.
France	1720	Froment-Meurice	Centre-pieces representing globe surmounted by deities.
United Kingdom	98	Garrard, R. and S., and Co.	Artistic plate and jewellery.
France	1619	Gueyton, A.	Variety of exhibits and electro-plating.
United Kingdom	112	Hancock, C. F.	Originality and taste in his exhibits.
——	97	Hunt and Roskell	Vase in repoussé by Vechte.
Russia	376	Kaemmerer and Zeftigen	Diadem, &c., in jewels.
France	304	Lemonnier, G.	Queen of Spain's jewels, &c.
——	331	Marrel Brothers	Seals, snuff-boxes, and smaller articles.
United Kingdom	117	Morel, J. V., and Co.	Enamels.
France	1465	Rudolphi, J. F.	Silver ornaments.
Russia	366	Sazikoff, Ignace	A centre-piece.
France	1530	Vittoz, G. T.	Gilt bronzes.
Prussia	840	Wagner, Emil, August, Albert	Large centre-piece.
United Kingdom	98	Wales, H.R.H. the Prince of (Main Avenue.)	Shield.
Prussia	412	Weishaupt, C. M., Sons	Chess-board and men.

PRIZE MEDAL.

United Kingdom	111	Angell, J.	Enamels.
France	1055	Aubanel, J.	Chimney decorations.
——	1052	Aucoc, son.	Dressing-cases.
——	11	Audot, L. D. J.	Silver ornaments and inlaid work of dressing-cases.
Sardinia	59	Bennati, J.	Filigree.
France	1107	Bouillette, Hyvelin, and Co.	Artificial stones.
——	70	Boyer, V. P.	Electro-gold.
Hamburg	54	Brahmfeld and Gutruf	Inkstand.
France	1119	Bruneau, L. A.	Articles of luxury.
——	1133	Caron, A.	Damascene pistols.
——	1562	Christofle, C., and Co.	Electro-plate.
United Kingdom	45	Creswick, T. J. and N.	Plated silver.
France	1575	Dafrique, F.	Cameos.
——	1186	Destontaines (Maison), Leroy, and Son.	Cast-iron clock.
United Kingdom	38	Dixon and Sons	Britannia metal.
Switzerland	43	Dubois, A.	Engraved gold.
France	1595	Durand, F.	Tea service.
United Kingdom	46	Durham Joseph B. (Cl. xxi.)	Chatelaine.
Switzerland	219	Dutertre, A.	Enamels.
Belgium	384	Falloise, J.	Damascene steel.
United Kingdom	83	Gass, S. H. and D.	Setting of stone.
Switzerland	220	Golay Leroche, A.	Enamels.
——	46	Grandjean Perrenoud, H.	Engraved gold.
Prussia	413	Haulick, G. F.	Flower, in stones.
United Kingdom	305	Heeley and Sons (Cl. xxii.)	Chatelaine.
——	323	Ibbetson, Capt. L. L. B. (Cl. xxx.)	Electrotypes.
Russia	322	Jahn and Bolin.	Setting of diamonds.
United Kingdom	121	Keith, J.	Chalices.
Prussia	888	Keller and Co.	Tea-service of coloured cornelian, and jewel-cases in green moss agate.
France	1284	Lacarrière, A.	Mutation of gilding.
——	1308	Lefaucheux, —	Carabine mounting.
——	1287	Lahoche, P. J.	Clock.
United Kingdom	102	Lambert and Rawlings	Vase.
France	1318	Lerolle Brothers	Bronzes, &c.
United Kingdom	44	Leuchars, W. (Cl. xxix.)	Dressing cases.
France	595	Levy Brothers and Co.	Mountings.
Sardinia	58	Loleo, J.	Filigree.
United Kingdom	104	Marshall, E. S.	Gold leaf.
France	646	Miroy Brothers	Imitation bronzes.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Spain	261	Moratilla, F.	Church service.
France	1364	Moutier le Page	Handle of hanger.
——	1671	Odiot, —	Table service.
——	1713	Paillard, V.	Gilt bronzes, &c.
——	1674	Payen, A. R., jun.	Jewellery and filigree.
——	1405	Poussielgue-Rusand, P.	Church service.
——	1681	Prélat, F.	Gilt arms.
Austria	577	Ratzersdorfer, H.	Looking-glass.
Netherlands	104	Romain, D	Setting of precious stones.
United Kingdom	118	Rowlands, C. and W.	Jewellery.
Prussia	271	Royal Prussian Iron Foundry	Inlaid silver.
France	1476	Savard, A.	Plated gold.
——	368	Savary and Mosbach	False stones.
Saxony	33	Strube and Son	Vase.
France	696	Thoumin, A.	Stamped brass.
——	1702	Thouret, F. A.	Electrotypes.
——	1045	Truchy, E.	Black pearls.
——	707	Valès, C.	False pearls.
——	1707	Villemsens, F.	Candelabra, &c.
United Kingdom	105	Watherston and Brogden	Vase.
——	15	West and Son	Irish brooches.
France	740	Weygand, A.	Vase.
Prussia	889	Wild and Robinson	Vases.
Spain	264 & 264A	Zuloaga, E.	Damascene arms.

HONOURABLE MENTION.

United Kingdom	88	Adams, G. W.	Tudor pattern silver.
——	293	Allen, F. (Cl. XXII.)	Vases.
——	103	Angell, G.	Vases.
——	113	Attenborough, R.	Tea service, &c.
——	26	Baird, W.	Ram's head.
Switzerland	236	Bautte, J. F., and Co.	Gold paper press.
Prussia	207	Bergmann, W.	Rich crystals.
United Kingdom	51	Biden, J. and F.	Seals, &c.
Prussia	–	Bolzau, Louis	Meerschaum pipes.
United Kingdom	79	Buss, H.	Arms of all nations, in enamel.
——	30	Cartwright and Hirons	Table silver.
——	34	Collis, G. R.	Plateau of silver.
France	95	Cornillon, J. H.	Toilet bottles.
Malta	24	Critien, E.	Filigree.
France	1588	Desjardins-Lieux	Statuettes, &c., in silver and bronze.
——	1589	Detouche and Houdin	Clock, style of Louis XVI.
Malta	25	Falson, S.	Filigree.
Portugal	1022 A to E	Franca, A., de	Silver ornaments and filigree.
Frankfort-on-the-Maine	20	Goldschmidt, M., and Son	Gold and enamel ornaments.
United Kingdom	64	Goodwin, C.	Jasper cup.
Austria	576	Grohmann, H.	Necklaces, brooches, &c.
United Kingdom	131	Henrys and Co.	Imitation of diamonds.
Prussia	440	Hoffmann, G. I.	Amber necklaces.
France	1628	Houllier, B.	Pistols inlaid with gold, &c.
Prussia	205	Jantzen, G. E.	Necklaces and brooches.
——	409	Jünger's, Jacob, (Widow)	Samples of enamels.
France	281	Kirstein, F.	Stags, in silver.
United Kingdom	27	Lister and Sons	Coffee and tea-pots, &c.
France	597	Maillot, F.	Ornaments for bottles.
Portugal	1022	Mamede, B. G.	Amethysts, &c., in filigree.
United Kingdom	23	Marshall and Sons	Chatelaine and bracelets, &c.
——	2	Martin, Baskett, and Martin	Gold chatelaine, &c.
——	95	Matthews, E.	Royal arms, engraved on metals.
——	14	Mayer, J.	Brooch, necklace, &c.
——	46	McGregor, M.	Ram's head.
——	116	Mott, W.	Gold and silver pencil-cases.
——	86	Nash, E.	Snuff-boxes.
Switzerland	44	Patton, J.	Engraved gold ornaments.
United Kingdom	87	Phillips Brothers	Silver statuettes.
Malta	23	Portelli, A.	Filigree.
France	1388	Pichard, A. F.	False stones, &c.
United Kingdom	3	Reid and Sons	Candelabras, &c.
——	24	Rettie and Sons	Bracelets, in granite.
France	1460	Rouvenat, L.	Sword mountings.
Grand Duchy of Hesse	51	Schreger, B.	Oxidised silver and jewellery.
United Kingdom	72	Seymour, E. and J.	Portraits, in enamel.
——	110	Smith, Nicholson, and Co.	Silver flower-holders.
——	20	Waterhouse, G. and S.	Irish brooches.
Prussia	325	Weber, Carl.	Pebbles.
United Kingdom	177	Wertheimer, S. (Cl. XXVI.)	Inkstand.
——	100	Widdowson and Veale.	Rings, &c.
——	44	Wilkinson, H.	Decorations for table.

CLASS XXIV.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	656	Maës, M.	Novelty of chemical application in the manufacture of optical and other descriptions of glass.

PRIZE MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	1540	Andelle, G., and Co.	French bottles.
United Kingdom	19	Bacchus and Sons	Cut glass—imitation of Venetian glass.
Belgium	390	Bennert and Bivort	Window glass.
France	53	Berlioz and Co.	Plate glass for mirrors.
Austria	600	Bigaglia, P.	Venetian glass.
United Kingdom	408	British Plate Glass Company (Cl. XXVI.)	Plate glass for mirrors.
United States	113	Brooklyn Flint Glass Company	Flint glass.
France	39	Burgun, Waller, Berger, and Co.	Watch glasses.
United Kingdom	47	Coathupes and Co.	Glass pipes. Curtain poles.
——	15	Davis, Greathead, and Green	Cut and coloured glass, Greek and Etruscan vases.
France	1187	Deviolane Brothers	French bottle glass.
——	1396	De Poilly and Co.	French bottle glass.
United Kingdom	32	Green, J. G.	Design—Form—Engraving on glass.
Austria	587	Harrach, F. E., Count Von	Bohemian glass.
United Kingdom	21	Harris, R., and Son	Cut glass—pressed, moulded, and coloured.
——	100	Hartley, J., and Co.	Rolled plate glass for roofs. Rough plate.
——	18	Lloyd and Summerfield	Cut glass—medallions.
Austria	595	Meyr's Nephews	Bohemian glass.
United Kingdom	13	Molineaux, Webb, and Co.	Cut glass, coloured or pressed.
——	20	Osler, F., and Co.	Cut glass, various—novelty of design in fountain, candelabra, &c.
France	674	Patoux Drion, and Co.	Glass.
United Kingdom	33	Pellatt, Apsley, and Co.	Cut glass—crystal imitation of Venetian glass, gems, &c.
——	31	Powell and Sons	Fine crystal (purity of colour, pipes, and joints.)
Netherlands	99	Regout, P.	Tubing and table glass.
United Kingdom	14	Richardson, W. H. B. and J.	Cut and crystal-coloured glass.
France	1445	Robichon Brothers and Co.	Crown glass.
Prussia	208	Schaffgotsch, Count	Bohemian glass.
United Kingdom	4	Swinburne, R. W., and Co.	Glass dome—plate glass. Pipes coloured.
——	399	Thames Plate Glass Company (Cl. XXVI.—Main Avenue West.)	Plate glass.
France	714	Van Leempoel de Colnet, and Co.	Bottle glass.
United Kingdom	27	Varnish, E.	Silvered glass.
——	17	Webb, T.	Cut glass.

HONOURABLE MENTION.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Austria	582	Abele, F.	Looking-glass.
Portugal	1023	Affonso, M. J.	Cut glass.
United Kingdom	6	Aire and Calder Bottle Company	Bottle glass.
Portugal	1044 to 1046	Basto, Pinto, and Co.	Sketched window glass.
Belgium	387	Capellemans, J. B.	Bottles.
United Kingdom	35	Claudet and Houghton	Glass shades (from Messrs. Chance).
——	2	Copeland, W. T., Alderman, M.P. (Cl. XXV.)	Table glass.
France	1157	Corderant, A.	Door handles, &c.
United Kingdom	37	Davies, G.	Imitation of marble.
Egypt	386	Egypt, H. H. The Viceroy of	Rose-water bottle.
United Kingdom	40	Ford, D.	Vitrum marmoratum.
——	12	Gatchell, G.	Glass centre dish.
——	41	Hall, J. W.	Ornamental cut-glass window.
——	46A	Hancock, Rixon, and Dunt	Cut-glass chandelier.
Bavaria	60	Hechinger, H.	Mirrors, &c.
——	61	Heilbronn, L.	Mirrors, &c.
Austria	588	Hegenbarth, A.	Bohemian glass.
——	589	Hellmich, F. A.	Bohemian glass.
——	590	Hofmann, W.	Bohemian glass.
Turkey	–	Indgir-keny, Imperial Glasshouse of	Venetian glass.
United Kingdom	11	Jones and Sons	Coloured glass.
——	3	Kidd, W.	Engraving and silvering on glass.
Austria	596	König, F. P.	Centre-pieces, fruit-dishes, &c.
United Kingdom	23	Lockhead, J.	Glass ventilators, &c.
——	30	Naylor, W.	Engraved, glass, &c.—various forms and patterns.
Bavaria	62	Neff, M. C.	Specimens of white crown glass.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Austria	597	Pelikan, J.	Glass goblets.
United Kingdom	36	Perry and Co.	Cut-glass chandelier.
France	981	Renard and Son	Plate glass.
Prussia	768	Röhrig, C.	Glass shades, &c.
United Kingdom	1	Ross, O'Connor, and Co.	Watch glasses.
Russia	293	Salivsky, Madame	Table glass, &c.
——	8	Shephard, J.	Glass tubing.
Frankfort-on-the-Maine	22	Vogelsang, J., Sons	Bohemian glass.

CLASS XXV.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	1	Minton, H., and Co. (Joint Medal with Class XXVII.)	New application and beauty of design.
France	1339	Sèvres Manufactory	High art.

PRIZE MEDAL.

United Kingdom	7	Alcock, S., and Co.	China.
France	409	Bapterosses, J. F.	Buttons. (Prize Medal and Special Approbation.)
Portugal	1047 & 1108	Basto, Pinto, and Co.	Porcelain.
Bavaria	64	Bavarian Porcelain Manufactory, The Royal	Porcelain.
Prussia	213	Berlin, The Royal Porcelain Manufactory at	Porcelain.
France	1086	Bettignies, M. De	Porcelain. (Prize Medal and Special Approbation).
United Kingdom	11	Boote, T. and R.	Parian vases.
——	35	Bourne, J.	Stoneware.
——	2	Copeland, W. T., Alderman, M.P.	Statuary porcelain (general excellence).
Denmark	33	Copenhagen, The Royal Porcelain Manufactory at	Porcelain.
United Kingdom	12	Dimmock, T.	Earthenware.
——	38	Finch, J.	Baths, &c.
Austria	618	Fischer, Moritz	Porcelain.
France	848	Gille, J. M.	Porcelain.
United Kingdom	125	Green, S., and Co. (Cl. XXVII.)	Chemical ware.
France	1630	Jouhanneaud and Dubois	Porcelain.
India	—	Madras Pottery, The	Terra cotta.
France	1342	Mansard, M.	Stoneware.
United Kingdom	9	Mayer, T. J. and J.	Earthenware.
——	10	Meigh, C., and Sons.	Earthenware.
——	5	Ridgway, John, and Co.	Earthenware.
——	47	Rose, J., and Co.	China.
Saxony	10	Saxon China Manufactory, Meissen, The Royal	Porcelain.
Russia	318	St. Petersburg, The Imperial China Manufactory at	Porcelain.
Prussia	206	Strahl, Otto	Earthenware.
France	395	Tremblay, A., Baron du	Drawings, by lithography, on porcelain or crystal.
Austria	615	Vienna, Imperial Porcelain Manufactory at	Porcelain.
Prussia	361	Villeroy and Boch	Stoneware.
United Kingdom	6	Wedgwood, T., and Sons	Earthenware.

HONOURABLE MENTION.

France	1051	Alluaud, —, sen.	Porcelain.
Prussia	778	Arnoldi, C. E. and F.	Porcelain.
France	1543	Avisseau, C.	Pallissy ware.
United Kingdom	26	Bell, J., and Co.	Earthenware.
——	53	Challinor, E.	Earthenware.
——	44	Chamberlain and Co.	Porcelain.
Turkey	—	Constantinople, Factory of Porcelain at	Porcelain.
United Kingdom	37	Edwards, J., and Sons.	Vase.
Austria	617	Fischer, C.	Porcelain.
France	1253	Gorsas and Perier	Porcelain.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom . .	46	Grainger, G., and Co.	Porcelain.
Austria	620	Haidinger Brothers	Porcelain.
France	877	Honoré, E.	Porcelain.
United Kingdom . .	4	Kennedy, W. S.	Porcelain letters.
——	14	Keys and Mountford	Parian.
——	48	Lee, J.	Letters.
——	58	Marsh, James	Designs of bust and vase.
Prussia	217	Mattschass, J. G. H. (Widow), and Son.	Earthenware.
France	659	Nast, H. J.	Porcelain.
——	1629	Petit, Jacob	Porcelain.
United Kingdom . .	22	Pratt, F. and R., and Co.	Earthenware.
——	36	Sharpe Brothers and Co.	Derbyshire ware.
——	29	Southorn, W., and Co.	Tobacco-pipes.
Prussia	219	Tielsch, Carl, and Co.	Porcelain.
United Kingdom . .	34	Wood, G.	Garden-pots.
Switzerland . . .	260	Ziegler-Pellis	Terra-cotta.

CLASS XXVI.

COUNCIL MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	1709	Barbedienne and Co. (Joint Medal with Cl. xxii.)	Ebony bookcase, mounted with bronze.
——	1715	Delicourt, E.	Paper hangings.
——	1231	Fourdinois, A. G.	Carved sideboard of walnut-wood.
Austria	633	Leistler, C., and Son	Carved furniture in four rooms.
France	1326	Liénard, M. J.	Clock case, and other articles.

PRIZE MEDAL.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Tuscany	74	Barbetti, A.	Carved coffer.
Bavaria	67	Barth Brothers	Lady's work-table.
Belgum	433	Beernaert, Antoine	Oak cabinet.
France	1077	Bellangé, A. L.	Inlaid buhl furniture.
——	1106	Bouhardet, C. P.	Carved billiard table.
——	778	Bourgery, Madame	Models (carton-pierre).
China	–	Braine, C. T.	Japanned screen
United Kingdom . .	4	Burroughes and Watts	Billiard table.
Sardinia.	64	Capello, G.	Inlaid table, chair, and pedestal.
United Kingdom . .	110	Cookes and Sons, of Warwick (Cl. xxx.)	Carved sideboard.
Belgium.	404	Couvert and Lucas	Mosaic floor and table.
France	1573	Cremer, J.	Marqueterie inlaid furniture.
——	810	Cruchet, V.	Carton-pierre and carving.
——	1579	Daubert and Dumarest	Cabinets, with mechanical action.
Belgium	406	De Keyn Brothers	Mosaic floor.
China	–	Dent, L.	Bedstead.
India.	–	Deonarain, Singh	Bedstead.
United Kingdom . .	122	Doveston, G.	Cabinet and chair.
——	404	Dowbiggin and Co.	Inlaid cabinet, ornamented with porcelain.
France	1207	Durand, E. P.	Cabinets, &c.
Bavaria	69	Fortuer, F. X.	Inlaid cabinet.
Russia	297	Gambs, —	Cabinet, ornamented with porcelain.
United Kingdom . .	186	Gillow and Co.	Writing-table.
Tuscany	117	Ginsti, P.	Carved frame.
Austria	631	Gröger, F.	Ebony cabinet, inlaid with marble, &c., and ornamented with carved figures.
Prussia	226	Gropius, P.	Carton-pierre figures, &c.
——	770	Hagen, A. von	Cabinet.
United Kingdom . .	344	Hayball, Arthur (Government School of Design, Sheffield).	Cabinet.
——	407	Holland, W., of Warwick	Table tops, in imitation of marble.
——	161	Holland and Sons, of London . .	Carved bookcase.
——	345	Hoyles, Henry (Government School of Design, Sheffield.)	Sideboard.
France	879	Huber, J.	Carton-pierre.
United Kingdom . .	261	Jackson and Graham	Carved sideboard, and other furniture.
France	889	Jeanselme, J. P. F.	Cabinet and sofas.
United Kingdom . .	187	Jennens and Bettridge	Papier-maché inlaid pianoforte.
——	10	Johnstone and Jeanes	Expanding table.
France	890	Jolly-Leclerc, —	Cabinet work.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	80	Jordan, T. B. (Main Avenue West)	Oak-screen, &c., carved by machinery.
——	1	Kershaw, T. (Cl. XXVII.)	Imitation of marbles and woods for house decoration.
France	282	Knecht, Emile	Carved figures.
Austria	632	Knill, J.	Billiard table and cues.
France	1283	Krieger and Co.	Card tables and mechanical furniture.
United Kingdom	128	Lane, T.	Paintings on pearl glass.
France	573	Lechesne, Auguste	Carved frame.
——	327	Mader Brothers	Paper hangings.
——	606	Marcelin, —	Inlaid mosaic table.
Tuscany	79	Marchetti, L.	Carved frame.
France	927	Mercier, P. E.	Ebony cabinet.
Russia	249	Miller, G., jun.	Inlaid floor.
Austria	738	Montanari, A.	Painted ceiling.
United Kingdom	164	Morant, G. J.	Decoration and furniture.
——	252	Moxon, C.	Imitation of inlaid marble for decoration.
Hamburgh	69	Plambeck, C. F. H.	Inlaid table.
France	1410	Pretot, L. H. E.	Collection of inlaid furniture.
India	–	Reade, C. W.	Carved box.
Russia	262	Rhan and Vetter	Paper hangings.
United Kingdom	207	Richardson, C. J.	Collection of furniture and designs.
France	1437	Ringuet-Leprince, E.	Carved cabinet for medals.
——	1439	Rivart and Andrieux	Furniture inlaid with porcelain.
United Kingdom	264	Rogers and Dear	Bedstead.
Austria	651	Spörlin and Zimmermann	Application of block-printing to illustrated works.
France	1556	Tahan, A.	Ornamental cabinet-work.
——	1499	Théret, J.	Inlaid cabinet.
Austria	641	Thonet, M.	Chairs (bent wood).
United Kingdom	17	Thurston and Co.	Billiard table.
——	318	Townsend, Parker, and Townsend	Paper hangings.
——	162	Trollope and Sons	Ornamental furniture.
——	160	Wills and Bartlett	Bookcase and candelabra.
Netherlands	96	Zeegers, F.	Japanned screen.
France	1536	Zuber, J., and Co.	Paper hangings.

HONOURABLE MENTION.

United Kingdom	303	Arthur, T.	Decoration.
France	1061	Bach Pérès	Transparent painted blinds.
——	1066	Balny, jun., J. P.	Chairs by mechanical process,
United Kingdom	166	Banting, W. and T.	Collection of furniture.
Austria	643	Becker and Kronick	Japanned screen.
United Kingdom	206	Caldecott, Messrs.	Sideboard.
Sardinia	68	Ciaudo, J.	Inlaid table.
United Kingdom	189	Clay and Co.	Articles in papier-maché.
France	1159	Cordonnier and Co.	Bookcase.
Belgium	421	Deruelle-Delevoye, François	Circular mechanical buffet.
France	815	Descartes, J.	Mechanical sofa.
Belgium	401	Devis, E.	Paper hangings.
France	1202	Dulud, J. M.	Embossed leather hangings.
United Kingdom	57	English, E. F.	Cabinet work.
Tuscany	84	Falcini Brothers	Chair.
France	1219	Faure, Jean Marie	Chairs.
——	1223	Florange, jun.	Bedstead, &c.
Switzerland	224	Fluekk, John	Carved table.
United Kingdom	24	Galli and Cotti (Bay M.)	Ceiling decorations.
France	1714	Genoux, F.	Paper hangings.
——	1254	Gradé, L.	Inlaid table.
United Kingdom	131	Halbeard and Wellings	Papier-maché toilet table, &c.
——	197	Hanson, S., and Sons	Carved mirror frame.
Cape of Good Hope	57	Hart, J.	Chair.
Bavaria	73	Hartmann, J. J.	Parquet floor.
China	–	Hewett and Co.	Collection of Chinese furniture.
United Kingdom	71	Heywood, Higginbottom, Smith, and Co.	Paper hangings produced by machinery.
——	310	Hinchliff and Co.	Paper hangings.
Prussia	773	Hoffmeister, T., and Co.	Sideboard.
United Kingdom	202	Hunter, W. J., R. and E.	Chairs.
——	321	Ingram, J. W. (Cl. xxx.)	Ornamented cabinet.
France	1276	Jeanselme, A., jun.	Chairs.
Spain	285	Jimenez, M.	Inlaid panel.
United Kingdom	70	Jones, A. J. (Cl. xxx.) (Fine Arts Court.)	Bog-yew furniture.
France	554	Kissel, J.	Mechanical bed.
Austria	645A	Kölbel, B.	Oval mirror frame.
France	1297	Laurent, François	Parquet floor and frames.
United Kingdom	63A	Leake, F., and Co. (Cl. xxx.) Fine Arts Court.)	Embossed leather hangings.
——	203	Levien, J. M.	Sideboard.
Tuscany	87	Maggiorelli Brothers	Inlaid table-tops.
France	600	Marguerie, —	Paper hangings.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Belgium	409	Menge, A. G.	Gothic canopy.
United Kingdom	211	Minter, G.	Invalid couch.
——	69	Nicol and Allen (Cl. XXVII.)	Imitation of woods.
——	54	Nye, E.	Wood mosaic table.
Austria	637	Palhüber, V.	Work table.
United Kingdom	74	Potter, C. H. and E.	Machine-made paper-hangings.
India	–	Pugh, D.	Indian carved furniture.
United States	193	Ragan, W.	Mechanical reclining chair.
Hamburg	70	Rampendahl, H. F. C.	Cabinet.
Belgium	419	Roulé, A. F.	Gothic sideboard.
United Kingdom	270	Simpson, W. B.	Decorations.
Sardinia	71	Speich, P.	Carved ebony table.
Austria	638A	Speluzzi	Buhl table.
United Kingdom	70	Spiers and Son	Articles of papier-maché.
——	108	Stalon, J. (Cl. XXX.)	Inkstand.
——	9	Taylor and Sons.	Cabinet furniture in cork.
——	178	Toms and Luscombe	Buhl pedestals.
Tunis	–	Tunis, The Bey of	Gates.
United Kingdom	320	Turner, H. N., and Co.	Paper hangings.
France	734	Vivet, E. T.	Wax painted cloths.
United Kingdom	175	Watson, G.	Inlaid work.
Switzerland	237	Wettli, M. L.	Carved table.
Wurtemburg	70	Wirth, T. F.	Writing table.
United Kingdom	332	Woollams, Jno., and Co.	Paper hangings.
——	309	Woollams, W., and Co.	Paper hangings.
——	19	Wynne and Lumsden	Carved oak chimneypiece.

CLASS XXVII.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Rome	15	Barberi, The Cavaliere	A table in Roman mosaic.
Russia	323	Demidoff, Messrs.	Malachite manufactured into various articles of furniture and decoration.
United Kingdom	86	Minton, H., and Co. (Joint Medal with Cl. XXV.)	Encaustic tiles.
——	124	Society for Improving the Condition of the Labouring Classes.	Sundry improvements in the construction of bricks, and the improvement of habitations for labouring classes.

PRIZE MEDAL.

France	405	Amuller, E. F.	Improved tiles.
Tuscany	119	Bianchini, G.	Table in Florentine mosaic.
United Kingdom	21	Blackburn, B.	Slate slabs.
——	92	Blanchard, M. H.	Materials and workmanship in terra cotta.
France	417	Borie Brothers	Tubular bricks.
Rome	17	Boschettii, Benedetto	Table in Roman mosaic.
France	773	Bossi, J. P.	Inlaid marble table.
Austria	726	Bottinelli, G.	Mantelpiece.
Belgium	399	Boucher, T.	Gas retort.
United Kingdom	104	Bowers, Challinor, and Woolliscroft.	Imitations of oak-carvings in porcelain.
——	117	Brown, Robert (Surbiton Hill)	Italian and other tiles.
Tuscany	118	Buoninsegni Brothers	Table in Florentine mosaic.
Prussia	235	Cantian, C.	Table and other objects in marble and granite.
United Kingdom	54	Cheesewring Granite Company (Outside West) E. Turner, agent.	Granite column.
France	119	Chenot, A.	Metallic pavement.
United Kingdom	18 & 19	Coates, E. J.	Combination of iron and glass in the decorative part of the manufacture of stoves.
——	112	Cowen, Joseph, and Co.	Gas retorts and other objects in fire-clay.
——	60	Cundy, S. (Main Avenue West)	Tomb of Queen Philippa, in alabaster.
Rome	19	Dallamoda, T.	Tazza of Oriental alabaster.
Malta	26	Darmanin, J., and Sons	Inlaid work in marble.
——	27	Decesare, P. P.	Carved Malta stone.
Portugal	232 & 247, &c.	Dejeant	A collection of worked and polished marbles of Portugal.
Tuscany	114	Della Valle Brothers	Table and vase in scagliola.
France	1184	Desauges, A.	Mantelpiece and pavement, in stone.
United Kingdom	45	Dolan, D.	A new kind of scagliola work.
——	23 & 95	Doulton and Watts, and Henry Doulton and Co. (Outside West.)	Articles in stoneware and porcelain.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
India	–	East India Company, The Hon. . .	Inlaid chess table.
Russia	326	Ekaterinburg, Imperial Polishing Manufactory of	Jasper vases.
United Kingdom . .	93 & 129	Ferguson, Miller, and Co..	Vases in terra cotta.
——	47	Francis and Sons	Parian cement.
——	14	Freeman, W. and J. (Outside West.)	Granite obelisk.
——	132	Gowans, J. (Cl. i.)	Carved sandstone.
——	127	Haywood, H. and R.	Tiles and other articles manufactured in metallic clay.
——	75	Hosken, R. (Outside West) . .	Granite obelisk.
——	28	Iles, C., and Co.	Pedestal, &c., of a new material resembling marble.
Bavaria	28	Kapeller, L., and Son	Graphite crucibles.
Russia	327	Kolyvan, Imperial Polishing Manufactory of.	Jasper vases.
Sweden and Norway .	118	Kullgren, C. A..	Granite cross.
United Kingdom . .	53	Lane and Lewis.	Niche, and statue of St. Peter, in Caen stone.
France	572	Lebrun, J. A., jun..	Chimneypiece.
Belgium.	425	Leclercq, Augustin.	Chimneypiece.
United Kingdom . .	81	Lomas, J.	Chimneypiece of black Derbyshire marble, introducing inlaid work in marble.
——	17	London Marble and Stone Working Company.	Various articles in sculptured marble.
——	74	MacDonald and Leslie.	Granite vases, pedestal, &c.
——	46	Magnus, G. E.	Enamelled slate.
——	91	Margetts, T. K., and Eyles, H. . .	Font in Caen stone.
——	7	Mayo and Co.	Vases for mineral waters.
——	141	Meredith, J. H. (Cl. i.)	Slabs of porphyry.
Austria	610	Miesbach, A.	Bricks and brick clay.
Rome	20	Moglia, Luigi	Works in Roman mosaic.
United Kingdom . .	533	Myers, Geo. (Cl. xxvi.)	Carvings in Caen stone.
——	491	Noirsain, Jules (Cl. xxii.) . . .	Polished marble chimneypiece.
——	85	Organ, J..	Font, obelisks, &c., of serpentine marble, from the Lizard, Cornwall.
——	36	Orsi and Armani	Various articles in cement.
——	123	Peake, T..	Tiles and other objects in terro-metallic.
——	75	Pearce, W.	Cornish granite and serpentine goods.
Russia	298	Peterhoff, Imperial Polishing Manufactory of	Jewel casket, with basso-relievo mosaic, in pietra-dura.
France	962	Poilleu Brothers	Cenotaph of greenstone basalt.
United Kingdom . .	108 & 216	Pullham, J. (Cl. xxx.)	Terra-cotta.
——	97	Ransome and Parsons	Artificial silica stone.
——	78	Redfern, G.	Inlaid marble table.
——	5 & 103	Robins, Aspdin, and Co. (Outside West.)	Illustrations of Portland cement.
——	435	Ruel, H. W. (Cl. i.)	Crucibles.
——	11 & 88	Seeley, J. (Outside West.) (Main Avenue West.)	Portland cement.
France	692	Séguin, A.	Marble mantelpiece.
United Kingdom . .	–	Seyssel Asphalte Company . . .	Pavement at the East Entrance.
——	88	Singer and Co.	Mosaic pavement.
——	121	Skinner and Whalley	Novel and useful invention of marble paste.
——	24	Stevens and Son.	Martin's cement.
——	209	Stirling, T., jun. (Cl. i.)	A collection of manufactures in slate.
Malta	33	Testa, F..	Carved stone.
France	1499	Theret, J.	Inlaid and other works in marble and pietra-dura.
Tuscany.	1 & 98	Tuscany, Royal Technological Institute of	Specimens of worked and polished marble.
United Kingdom . .	40	Vallance, J.	Inlaid marble tables.
France	732	Virebent Brothers	Manufactures in artificial stone.
United Kingdom . .	10 & 130	White, J. B., and Sons (Outside West—(Cl. i.)	Illustrations of Portland and other cements.
——	8 & 223	Willock, E. P., and Co. (Main Avenue West.)	Ladyshore terra-cotta.
——	39	Woodley, J.	Inlaid marble tables and other articles in marble and spar.
——	350	Woodruff, Thomas (Cl. xxx.). . .	Inlaid marble slabs.
——	116	Workman, J.	Waterproof bricks.

HONOURABLE MENTION.

France	2	Agombart, P.	Hydraulic cement.
United Kingdom . .	128	Ambrose, J.	Chimneys and bricks.
Prussia	778	Arnoldi, C. E. and F.	Crucibles, water-pipes, &c., of clay.
Austria	725	Benzoni, G.	Marble mantelpiece.
United Kingdom . .	22	Betts, E. L.	Terra-cotta vase.
France	1036	Bonnet, jun.	Crucibles.
United Kingdom . .	4	Bovey, J.	Chimneypiece and font in marble.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Van Diemen's Land	233	Boyd, J.	Marble from Maria Island.
United Kingdom	80	Bright, S.	Vases in black marble.
—	86	Brine Brothers, and T. Sharp (Main Avenue, West.)	Marble chimneypiece.
—	52	Brown, R., Great Russell Street	Monument in Caen stone.
—	29	Brown, Rusby, and Booth (Outside, West).	Paving in Yorkshire flags.
Portugal	275 to 278	Bulhoens, Manufactory at	Refractory bricks.
United Kingdom	106	Burnett, N. (Cl. I.)	Terra-cotta vase.
France	444	Caffort, J.	Collection of manufactured marbles from Languedoc.
United Kingdom	20	Carnegie, W. F. L.	Arbroath pavement.
—	158	Champernowne, H. (Cl. I.)	Columns of Devonshire marble.
Tuscany	109	Cherici, G., and Sons	A vase of alabaster.
France	1564	Colin, J. R.	Polished marbles.
Belgium	397	Coste, F.	Crucibles.
Austria	38	Cristofoli, A.	Paving blocks.
France	45	Debay, A.	Artificial stones.
—	427	De Boissimon, C.	Fire-bricks.
—	1466	De Ruolz	Cement.
United Kingdom	8	Delabole Slate Company (Old) by J. Carter (Outside, West).	Slate cistern.
—	61	Dench, E. (Outside, West).	New construction of roof for a greenhouse.
Belgium	16	Desmanet de Biesme, Viscount C.	Marble pilaster.
Malta	23	Dimech, F.	Stone carvings.
France	485	Dufour, J. B.	Asphalte pavement.
Egypt	1, 4	Egypt, His Highness the Viceroy of	Table-tops of Oriental alabaster.
United Kingdom	116	Enniskillen, Earl of (Cl. I.)	Draining tiles.
Portugal	248	Figueiredo, J. J., de	Marble slabs.
France	1228	Forton, Duponceau, and Co.	Slate billiard-table.
—	1232	Fox, J. F.	Glass and terra-cotta tiles.
United Kingdom	19	Furse, T. W. (Outside, West.)	Waterproof artificial stone.
France	233	Garnaud, jun.	Ornaments of white terra-cotta.
Austria	724	Gottl, B.	Vase.
United Kingdom	99	Grangemouth Coal Company	Terra-cotta.
Greece	22	Greek Government	Specimens of puzzolano.
United Kingdom	185	Grissell, T. (Cl. I.)	Carvings in magnesian limestone.
Belgium	423	Guislain, C.	Marble slabs.
United Kingdom	114	Haddan, J. C.	Rhomboidal bricks.
—	37, 38	Hall, J. and T., and Tennant, J.	Sundry objects in marble and alabaster, and inlaid work, chiefly from Derbyshire.
Canada	118	Hammond, R.	A polished stone table.
United Kingdom	119	Harper and Moore	Fire-bricks.
France	259	Heiligenthal, J. J., and Co.	Ornaments in putty stone.
—	876	Holstein, J. P.	Terra-cotta mouldings.
United Kingdom	161	Hutchison, John. (Cl. I.)	Bust and pedestal in blue Peterhead granite.
Rome	48	Jones, W.	Bagnivola of lapis lazuli.
Belgium	457	Joostens, G.	Stone pinnacle.
United Kingdom	62	Kent, A. (Outside, West.)	New mode of glazing greenhouses.
—	136	King, T. (Cl. I.)	Ornamental carving in stone.
—	70	Lambert, A. C.	Two tables of Connemara marble.
France	230	Larivière, C.	Angers slate.
United Kingdom	87	Lovelace, The Earl of	Ornamental bricks.
—	111	Luff, J.	Brick chimney-shaft.
Prussia	240	March, E.	Stoneware chemical apparatus.
Rome	13	Marchesi and Ossoli	Bricks and tiles.
France	608	Marga, E.	Chimneypieces carved in white marble.
United States	180	Maryland Soap-stone Company	Articles made of soap-stone.
Prussia	9	Milch, A.	Bricks.
Rome	21	Moglia, Domenico	Works in Roman mosaic.
United Kingdom	72	Monteagle, Lord	Irish statuary marble.
—	161	Montefiore, Sir M. B. (Cl. XXX.)	Two vases carved out of sandstone.
Austria	723	Motelli, G.	Marble mantelpiece.
India	–	Nattore, H. H. the Rajah of	White marble garden-seats.
United Kingdom	–	Nelson, Thomas and James (Cl. XXII.)	Chimneypiece.
Tuscany	91	Nobili, Cav.	Marble column.
Prussia	418	Noé, O.	Model of a chandelier in gypsum.
United Kingdom	122	Pease, J. (Cl. I.)	Fire-bricks.
—	63	Phillips, C. (Outside, West)	Flower-pots.
—	110	Ramsay, G. H.	Fire-bricks, gas-retorts, and other works in fire-clay.
France	1427	Régny, L., and Co.	Hydraulic cement.
Rome	22	Rocchigiani, Antonio	Works in Roman mosaic.
Tuscany	118	Romoli, L.	Inlaid table in scagliola.
United Kingdom	63	Rowlands, Isaac	Slate inkstand.
—	71	Royal Dublin Society	Pedestals of Irish marble.
Prussia	780	Rübeland, Ducal Foundry Inspection of	Marble table-tops.
United Kingdom	89	Rufford, F. T.	Fire-bricks, porcelain bath, &c.
United States	203	Salt and Mear	Water vase of fine brick-clay.
United Kingdom	130	Sealy, J.	Bath bricks.
—	137	Sim, W. (Cl. I.)	Granite pavement.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom . .	13	Sinclair, J. (Outside, West) . . .	Forss Rockhill pavement.
Belgium	398	Smal-Werpin, A.	Fire-bricks.
Malta	29	Soler, J.	Carvings in stone.
Sardinia	88	Spanna, J., and Co.	Artificial marble.
Wurtemburg	69	Staib Wasserot, —	Terra-cotta window.
United Kingdom . .	158	Stevens, G. H. (Cl. XXX.)	Candelabra, table-tops, &c., in glass mosaic.
Malta	30	Testa, S.	Carvings in stone.
Prussia	241	Ungerer, C.	Porcelain water-pipes.
Sweden and Norway .	47	Wallis, P. W. P., Elfdahl's Porphyry Works.	Jasper vase.
United Kingdom . .	140	Waun, Thomas Williams	Garden-seat of parrot coal.
—	43	Wright, J.	Polished granite headstone.
Spain	51	Ysasi, M. de	Wine jar (Tinaja).
Belgium	136	Zaman and Co.	Paving-stones.

CLASS XXVIII.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United States . . .	378	Goodyear, C.	India rubber.
United Kingdom . .	85	Gutta Percha Company, The . . .	Gutta percha.
—	76	Mackintosh and Co.	India rubber.

PRIZE MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	1063	Badin, J. C. F.	Feather baskets.
Canada	86	Bailey, J.	Pails.
Mauritius	5	Balkfield and Co.	Straw and shell work.
Russia	265	Bardoffsky, T.	Felt jugs.
United Kingdom . .	49	Brown, H.	British ivory.
—	246	Chatwin and Sons (Cl. XXII.) . . .	Pearl work.
Switzerland	228	Claraz, Ambroise	Straw work.
United Kingdom . .	18	Crummack, E.	Tortoiseshell combs.
Prussia	244	D'Heureuse, C.	Straw work.
Canada	119	Dunn, W.	Chair (porcupine quill).
France	492	Duprat and Co.	Cork in sheets.
Prussia	242	Engeler, H. M., and Son	Painting brushes.
United Kingdom . .	125	Esdailes and Margrave	Cork veneer.
Switzerland	229	Faessler, J. A.	Milk tubs.
France	202	Fauvelle-Delebarre, —	Tortoiseshell combs.
United States . . .	111	Fenn, J.	Comb.
Sardinia	77	Fino, J.	Brushes.
Prussia	813	Foese, G.	Brushes.
United Kingdom . .	178	Forster, Thomas	Waterproof cloaks.
—	181	Frinneby, F. A.	Brushes.
Nassau	13	Geismar, L., and Co.	Carving in ivory and bone.
Spain	189	Gerona, The Province of	Cork in sheets.
Bahamas	–	Greig, Misses	Cornucopia, &c., of shells.
Mauritius	1	Grey, The Countess	Basket and wreath of flowers.
France	856	Grossmann and Wagner	Articles in India rubber.
Spain	188	Guinart, J.	Corks and bungs.
Wurtemburg	79	Haas, F. P.	Straw plaitings.
Austria	376	Habenicht, A.	Ivory combs.
United Kingdom . .	90	Hancock, C., (West Ham Gutta Percha Company.)	Articles in gutta percha.
United States . . .	294	Hayward Rubber Company	India-rubber shoes.
Prussia	662	Höltring and Höffken	India-rubber braces.
United Kingdom . .	232	Holtzapffel and Co. (Cl. VI.) . . .	Turning in ivory.
—	103	Horan, H. (Cl. IV.).	Prepared whalebone.
Belgium	343	Julin, N.	Shell cameos.
Switzerland	242	Kehrli Brothers	Articles carved in wood.
Bavaria	77	Lang, G., Heirs of	Toys carved in wood.
France	12[illegible]6	Laurençot, E.	Painting and other brushes.
—	313	Leunenschloss, M.	India-rubber braid.
Belgium	430	Loncke-Haeze, C. L.	Brushes.
United States . . .	424	Loring, G.	Water pails.
United Kingdom . .	146	MacGregor, J. W.	Casks.
Spain	235	Manilla, The Economical Society of.	Cigar cases.
Belgium	414	Marin, J. E.	Spa-wood boxes.
Canada	–	Marshall, R.	Dinner mats.
France	615	Massue, L. J.	Ivory combs.
United Kingdom . .	28	Maunder, J.	Turning in ivory.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United States	534	Moulton, S. C.	India-rubber goods.
United Kingdom	78	Nickels, C., and Co.	Articles in India rubber.
Bahamas	–	Nicolls, Miss	Shell work.
France	666	Noël, —, sen.	Ivory combs.
Austria	350	Pattak, G.	Brushes.
France	680	Philip, —.	Tortoiseshell combs.
——	1397	Poinsignon, —.	Imitation tortoiseshell combs.
United States	–	Pratt, Julius, and Co.	Ivory veneer.
Portugal	1120	Rangel, A. P.	Wine cask.
United Kingdom	144	Rendall, J.	Straw work.
——	58	Rigby, E. R.	Brushes.
Austria	684	Schwarz, J.	Mother-of-pearl ornaments.
United Kingdom	164	Shaw, C.	Mechanical sculpture.
China	–	Shea, Captain	Carved coal and pearl.
United Kingdom	55A	Smith, A.	Painting brushes.
——	172	Smith, T.	Truck baskets.
Belgium	265	Somzé-Mahy, H.	Floor brushes.
United Kingdom	252	Staight, D., and Sons (Cl. XXIX.).	Ivory veneer.
——	109	Staight, T. (Cl. IV.)	Carved ivory and pearl.
——	152	Stevenson, J. and J.	Combs.
Austria	657	Tandler, S.	Straw flowers.
United Kingdom	47	Taylor, B.	Tower of vegetable ivory.
Sweden and Norway	44	Thesen, N. P.	Carving in wood.
Austria	97	Tomassia, L.	Willow plait.
France and Algiers	333	Trancart, A. A.	Tortoiseshell combs.
United Kingdom	39	Treloar, T.	Mats, &c., of cocoa-nut fibre.
Turkey	–	Turkey, H. H. The Sultan of	Collection of horn and ivory.
United Kingdom	75	Wansbrough, J.	Waterproof cloth in imitation of velvet.
——	104	Westall and Co. (Cl. IV.)	Manufactures in whalebone.
——	40	Wildey and Co.	Mats, &c., of cocoa-nut fibre.
——	163	Williams, H.	Eccentric ivory turning.
Switzerland	259	Wirtz, J.	Wood carving.
France	744	Wolf, —	Ivory carving.

HONOURABLE MENTION.

United Kingdom	77	Bunn, L., and Co.	Specimen of India-rubber in the various stages of manufactures.
——	115	Burke, W. H. (Cl. IV.)	India-rubber manufactures.
France	786	Cabirol, J. M.	Surgical apparatus, &c., in gutta percha.
United States	382	Church and Chittenden	India-rubber shoes.
United Kingdom	82	Cording, J. C.	Waterproof capes, &c.
——	29	Dow, A.	Brushes.
France	502	Fauquier, L. F.	Brushes.
United Kingdom	196	Hinde, J. G.	Brushes.
——	72	Hodges, R. E.	Mechanical application of India-rubber.
Switzerland	213	Isler and Otto	Straw work.
Belgium	412	Misson, E. and L.	Spa-wood boxes.
Canada	84	Nelson and Butters	Brooms.
France	1377	Paillette, P.	Brushes.
Tuscany	35	Pastorelli, D.	Brooms of Indian corn straw.
United States	431	Warner, R., and Co.	Brooms.

CLASS XXIX.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	94	Constantin, J., Marques	Flowers, in cambric.
——	644	De Milly, L. A.	Invention of practical methods of using lime in the manufacture of stearic candles, and the use of boracic acid in the preparation of wicks.

PRIZE MEDAL.

Brazil	1	Adamson, O. G.	Feather flowers.
Bavaria	66	Adt Brothers	Snuff-boxes in papier maché.
United Kingdom	180	Ainge and Aldred	Fishing tackle, and archery weapons and accoutrements.
France	750	Allard and Claye	Fancy soaps.
——	6	Allix, A. J.	Wax figures for hair-dressers.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Spain	177	Alvargonzalez, R.	Preserved fruits.
Austria	39	Apollo Stearine Candle Company	Stearic candles.
United Kingdom	270	Archer, T. C.	Collecting and arranging the cabinet of Liverpool imports.
France	402	Arnavon, H.	Common and Marseilles soap.
Austria	666	Astrath, C.	Meerschaum cigar tubes, and amber mouth-pieces.
France	1059	Aucler (Widow) and P. Ledoux	Confectionary.
United Kingdom	24	Barclay and Son. (Cl. iv.)	Wax, stearic, and other candles.
——	291	Bartlett, A. D.	Taxidermy.
Wurtemburg	87	Baur Brothers	Confectionary ornaments of gum tragacanth.
Switzerland	236	Bautte, T. F.	Mechanical singing bird.
United Kingdom	26	Bawwens, L. F. (Cl. iv.)	Fat acids recovered from waste suds of woollen, silk, and cotton manufactures.
United States	36	Bazin, Xavier	Fancy soaps.
Spain	245 & 246	Bert, J. J., and Co.	Stearic candles, by the processes of saponification and distillation.
France	430	Bontems	Mechanical birds.
Netherlands	70	Brandon, N. D.	Stearic candles.
United States	510	Cadwell, Payson, and Co.	Soap.
Belgium	436	Campenhoudt, C., Van, and Co.	Stearic candles.
Portugal	422 to 426 428 to 433, & 438	Castellar, F.	Preserved fruits.
France	108	Cazal	Umbrellas and parasols.
——	1139	Chagot, A., sen.	Flowers in cambric.
——	1144	Charageat, E.	Umbrellas and parasols.
——	121	Chevet, jun.	Preserved fruits.
Austria	43	Chiozza, C. L., and Son	Fancy soaps and floating soap.
Sardinia	68	Ciaudo, Joseph	Walking sticks.
United Kingdom	20	Cleaver, F. S.	Toilet soaps.
Portugal	417	Coimbra, The Nunnery of	Preserved fruits.
France	458	Coletta-Lefebvre	Snuff-boxes.
Sardinia	83	Comba, F.	Taxidermy.
Tuscany	23	Conti and Son	Soaps.
United Kingdom	19	Cowan and Sons	Soaps.
——	245	Cowper, E.	Models for the use of schools.
Spain	282	Cubero, J.	Three terra-cotta figures.
United Kingdom	197	Dark, M., and Sons	Articles used in the game of cricket.
——	198	Dark, R.	Articles used in the game of cricket.
——	77	Dorvell, Elizabeth	Flowers in wax.
Hamburg	92	Douglas, J. S., and Sons	Toilet soaps.
United Kingdom	191	Duke and Son	Articles used in the game of cricket.
France	1593	Dumortier and Co.	Stearic candles.
——	495	Duvelleroy, P.	Fans.
United Kingdom	89	Edwards, T. J.	Dressing cases.
Bavaria	80	Eichner, G.	Mechanical toys.
Prussia	858	Farina, J. M. (opposite the Jülichs Place, Cologne).	Eau-de-Cologne.
India	–	East India Company, The Hon.	Clay figures, representing the various Hindoo castes and professions, manufactured in Kishnagur.
France	199	Félix, A.	Fans.
United Kingdom	130	Field, J. C. and J. (Cl. iv.)	Stearic acid.
Austria	670	Flöge, G.	Amber for pipes, and pipe tubes and bowls.
United Kingdom	74	Foster, Son, and Duncum	Flowers in cambric.
——	25	Freeman, E. (Cl. iv.)	Spermaceti candles.
Austria	671	Friedrich, J.	Meerschaum pipe bowls, and cigar tubes.
France	492A	Fürstenhoff, Emma	Artificial flowers and materials.
——	842	Gaudet du Fresne	Artificial flower leaves.
——	845	Gellé and Co.	Toilet soaps made by the cold-process.
United Kingdom	305A	Gibbs, D. and W.	Common and toilet soaps.
——	13	Grossmith, J.	Artificial essences and perfumery.
Spain	281A	Gutierrez de Leon, R.	Three terra-cotta figures.
Turkey	–	Hadji Mihran Duzoglou	Amber mouth-pieces for pipes.
Austria	652	Haller's, J. (Widow) and Son-in-law	Toys.
United Kingdom	320	Hancock, J.	Taxidermy.
France	863	Harand, E.	Flowers in cambric.
Austria	675	Hartmann, L.	Meerschaum pipe bowls; sticks, and umbrella handles.
United States	4	Hauel, J.	Toilet soaps.
Wurtemburg	92	Hedinger, C.	Walking canes.
United Kingdom	10	Hendrie, R.	Toilet soaps and perfumery.
Prussia	439	Hoffmann, C. W.	Manufactures in amber.
Austria	644	Hofrichter, C.	Cheap snuff boxes.
United Kingdom	131	Holland, Henry	Hollow metallic frames for umbrellas.
——	290	Hull Local Committee	Hull imports.
France	273	Jaillon, Moinier, and Co.	Stearic candles.
Sweden and Norway	17	Johansson, J.	Stearic candles.
France	1282	Jumeau, Pierre	Dolls' dresses.
United Kingdom	25	Kendall and Co.	Toilet soaps.

Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Austria	653	Kietaibl, F.	Automaton toys.
United Kingdom	8	Knight, John	Soaps.
France	564	Laurent, F.	Dressing and ornamental cases.
—	1295	Lefort, sen.	Materials for flowers.
—	908	Leistner, G. L.	Perfumery.
United Kingdom	174	Little, G., and Co.	Fishing tackle.
United States	7	Louderback, M. J.	Preserved peaches.
United Kingdom	125	Lumsden, Miss J. (Cl. xxx.)	Flowers, in wax.
Prussia	425	Martin, M. C.	Eau-de-Cologne, and Melissa water.
France	1346	Masse, Tribouillet, and Co.	Stearic candles, by the process of distillation, and fat acids recovered from waste lyes.
Russia	305	Matisen, A., and Co.	Stearic candles.
France	1658	Mercier, C. V.	Tortoiseshell and horn snuff-boxes.
Hamburg	86	Meyer, H. C., jun.	Walking canes.
United Kingdom	140	Meyers, B.	Collection of sticks.
—	29	Miller, T. J. (Cl. iv.)	Large block of refined spermaceti, and specimens to illustrate the process of spermaceti refining.
France	929	Milliau, jun.	Marseilles soap.
Austria	40	Milly Stearin Candle Company	Stearic candles, by the processes of saponification and distillation.
United Kingdom	70	Mintorn, J., H. H., Elizabeth and Rebecca.	Flowers in wax.
—	122	Montanari, A.	Dolls.
—	224	Montanari, N. (Cl. xxx.)	Figures illustrative of Mexican life.
—	306	Morland, J., and Son	Umbrellas and parasols.
Prussia	262	Motard, A.	Stearic candles, by the processes of saponification and distillation.
United Kingdom	150	Muir, P.	Archery weapons, &c.
Turkey	–	Naim Effendi	Amber mouth-pieces for pipes.
France	939	Oger, J. L. M.	Fancy and common soaps.
United Kingdom	139	Ogleby, Chas., and Co.	Stearic, sperm, and composition candles.
France	1374	Oudard, L., Son, and Boucherot	Preserved fruits.
Prussia	263	Palis, A.	Tallow, oil, and palm soap.
United Kingdom	30	Paris Chocolate Company (Cl. iii.)	Chocolate and syrups.
France	952	Perrot, Petit, and Co.	Flowers, in cambric.
—	956	Philippe and Canaud	Preserved fruits.
Russia	307	Pitansier	Stearic candles.
France	1678	Piver, L. T.	Toilet soaps and perfumery.
Wurtemburg	107	Plouequet, H.	Taxidermy.
United Kingdom	83	Price's Patent Candle Company (Cl. iv.)	Invention of improved methods of distilling fatty bodies, and for candles made of distilled fat.
Belgium	431	Quanonne, C. and J.	Stearic candles.
United Kingdom	66	Randolph, Wilhelmina	Flowers of undyed feathers.
Wurtemburg	98	Rock and Graner	Toys.
France	992	Rödel and Sons	Preserved fruits.
India	–	Royle, J. F.	Collection of animal, vegetable, and mineral substances.
Spain	–	St. Pelayo (Oviedo), The Nunnery of	Preserved fruits.
United Kingdom	136	Sangster, W., and J.	Alpaca umbrellas.
Portugal	–	Santa Clara (Funchal), The Nunnery of	Feather flowers.
Prussia	255	Sarre, H., jun.	Soaps.
—	593	Schulz, C.	Walking-sticks.
United Kingdom	280	Smith, W., and A.	Scotch snuff-boxes.
Prussia	265	Söhlke, G.	Tin toys.
United Kingdom	126	Spurin, E. C.	Toys.
—	252	Staight, D., and Sons	Manufactures from Cheverton's artificial ivory.
Russia	364	Stier, H.	Soaps.
Sardinia	80	Strauss, J.	Pipes.
United Kingdom	63	Strickland, Maria	Flowers, in wax.
—	62	Sugden, Borras, and Co.	Flowers, in cambric.
—	5	Taylor and Son	Soaps and perfumery.
United States	292	Taylor, H. P., and W. C.	Toilet soap.
France	698	Tilman	Flowers, in cambric.
Belgium	434	Touche-Gillès, E.	Toilet and olive-oil soaps.
Tunis	53 to 57	Tunis, The Bey of	Distilled perfumed waters (various).
Turkey	–	Turkey, His Highness the Sultan of.	Collection of pipes, soap, candles, & confectionary.
Prussia	20	Weill, C.	Preserved fruits.
United Kingdom	4	Williams, J., and Son	Toilet and common soaps.
Prussia	204	Winterfeld, J. A.	Manufactures in amber.
Wurtemburg	82	Wittich, Kemmel, and Co.	Carved ivory toys and cane handles.
United Kingdom	106	Wotherspoon, J., and Co.	Lozenges and comfits made by steam machinery.
Prussia	250	Wunder, L.	Soaps.
Austria	687	Zeitler, J.	Pipe-bowls of Massa.

HONOURABLE MENTION.

Austria	664	Alba, S.	Amber cigar mouth-pieces.
United Kingdom	50	Asprey, C.	Desks.
France	403	Aubert and Noel	Maraschino and other liqueurs.
United Kingdom	36	Austin, G.	Irish bog-yew dressing-cases.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	1123	Bagré	Canes of rams' horn.
Austria	667	Beisiegel, P.	Amber for pipes, and pipe tubes.
France	1091	Bleuze, H.	Toilet soaps.
United Kingdom	146	Boss, J. A.	Improvement in umbrella frames.
——	124	Bouchet, A.	Toys.
France	1112	Breteau, C.	Flowers, in cambric.
United Kingdom	90	Brien, C.	Mould tallow candles.
South Australia	–	Burford, W. H.	Soap.
Austria	700	Bürger, Josefa	Artifical flowers.
Frankfort-on-the-Maine	2	Busch, P. A.	Cognac oil.
United Kingdom	78	Chisholme, Emma	Flowers, in wax.
France	158	Delacretaz and Fourcade	Stearic acid and stearic candles.
——	141	Delage-Montignac, F.	Fishing lines.
Spain	243	De Leon y Rico, E.	Soap made by the cold-process.
United Kingdom	91	Dixon, G.	Composite and mould tallow candles, also soap.
France	478	Donneaud and Co.	Stearic acid and stearic candles.
——	149	Ducrot and Petit	Fans.
——	176	Dumeril, Sons, and Co.	Clay pipe.
United Kingdom	18	Ede and Co.	Perfumery.
——	75	Ewart, Henrietta	Flowers, in wax.
——	21	Farina, Jean Marie (Cologne, and Salter's Hall Court, London).	Eau-de-Cologne.
Prussia	426	Farina, John Maria (Cologne)	Eau-de-Cologne.
Austria	748	Farina, J. M.	Eau-de-Cologne.
United Kingdom	176	Farlow, C.	Fishing tackle.
——	181	Farlow, J. K.	Fishing tackle.
France	211	Fiolet, Louis.	Clay pipes.
United Kingdom	80	Fisher, Joseph	Flowers, in cambric.
——	22	Fisher, T. W., and Co.	Perfumery.
France	1224	Florimond	Flowers, in cambric.
Grand Duchy of Hesse	61	Frank, J. G.	Walking canes.
United Kingdom	73	Gatti, A. and G.	Materials for flowers.
Spain	244	Giró, J.	Castile soap.
United Kingdom	202	Gordon, C.	Taxidermy.
Austria	673	Grünhut, J., jun.	Pipe.
United Kingdom	99	Hale, W. S.	Stearic and composite candles.
Canada	187	Henderson, —	Clay pipes.
Denmark	27	Holmblad, L. P.	Stearic candles.
United Kingdom	184	Jefferies, I.	Tennis racquets.
——	182	Jones, J.	Fishing tackle.
France	1290	Landon and Co.	Aromatic vinegar.
United Kingdom	55	Langdale, E. F.	Artificial essences.
Prussia	658	Lipp, Van F.	Dusseldorf water.
——	796	Lux Brothers	Meerschaum and other pipes.
United Kingdom	185	Makepeace, Eliza (Cl. xxx.)	Flowers, in wax.
Spain	289	Mata Aguilera, J.	Model of a bull-fight.
Austria	44	Melzer, D.	Toilet soap.
Nassau	10	Müllenbach and Thewald	Clay tobacco-pipes.
Austria	654	Müller, C. A., and Co.	Toys.
France	945	Paroissien, A.	Artificial leaves.
Austria	611	Partsch, A., jun.	Clay pipes.
United Kingdom	24	Pears, A. and F.	Transparent soap.
France	1399	Poisat (Uncle) and Co.	Stearic acid.
United Kingdom	3	Rimmel, E.	Perfumery.
Tuscany	118 & 119	Romoli, L.	Carved pipe-stick.
Sardinia	6	Rossi and Schiapparelli	Stearic candles; oleic-acid soap.
Wurtemburg	89	Roth, W., jun.	Confectionary.
Prussia	441	Roy, W. Von	Cabinet of amber.
Portugal	1298	Russel, Vincente	Artificial orange-tree.
Turkey	–	Said Aga	Amber mouth-pieces for pipes.
India	–	Sainte and Co. (Kozipore)	Stearic candles.
Russia	309	Sapelkin, V.	Wax candles.
United Kingdom	114	Schooling, H.	Confectionary.
——	42	Strudwick, T.	Dressing cases.
Prussia	41	Tessler, C. L.	Amber.
France	1701	Thollon	Artificial essences.
Tuscany	102	Tonti, L.	Canes.
Wurtemburg	91	Tröglen, G.	Confectioners' sugar ornaments.
Cape of Good Hope	35	Volsteedt, J. P.	Preserved fruits.
United Kingdom	27	Weatherley, H. (Cl. iii.)	Confectionary.
Prussia	257	Wigdor, M.	Umbrella and parasol sticks.
Nassau	9	Wingender Brothers	Clay tobacco-pipes.
Hamburg	89	Wöbke, H.	Clay tobacco-pipes.
United Kingdom	2	Yardley and Statham	Toilet soaps.

CLASS XXX.

COUNCIL MEDAL.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
France	–	Gobelins and Beauvais Tapestry, Government Manufactory of. (Joint Medal with Cl. XIX.)	Originality and beauty of design of the different specimens exhibited for furniture, and the extraordinary excellence of execution of most of the productions exhibited.
Prussia	279	Kiss, A.	The Amazon, cast in zinc and bronzed.
United Kingdom . .	76	Marochetti, Baron (Outside, West.).	Richard Cœur de Lion, in plaster.
France	1407	Pradier, J.	Phryne, in marble.
United Kingdom . .	103	Wyatt, The late Richard J. (Main Avenue, East).	Glycera, in marble.

PRIZE MEDAL.

United Kingdom . .	274	Appel, R.	Anastatic printing.
——	6 & 7	Baily, E. H. (South Transept) . .	A youth resting after the Chase, and a Nymph preparing for the Bath, in plaster.
——	28 & 53	Bell, John (North Transept, Main Avenue, West).	Statue of Lord Falkland; Eagle Slayer, in bronze.
Rome	16	Benzoni, Gio. Maria	Statue, in marble, of Gratitude.
France	1369 & 97	Béranger, Antoine (Main Avenue, East).	Head, on porcelain; and Portrait of Prince Albert, in china.
——	55	Berrus Brothers	Designs for shawls.
Austria	737	Bertini, G.	Painted window representing Dante and some of of his ideas.
Prussia	785	Boesche, J. C.	Fountains; model of Magdeburg Cathedral.
France	1369	Bonnet	St. John, in enamel.
Saxony	176	Bucker, H.	Painting on porcelain.
Rome	23	Castellini, Raffælle, Royal Manufactory at St. Peters.	Copy, in mosaic, of medallion of Boniface II., also of Head of John the Baptist.
France	1146	Chebeaux, J.	Designs for cotton print and calico.
United Kingdom . .	194	Cheverton, B.	The Theseus, as exemplifying the reduction by machinery of statues.
France	799	Clerget, C. E.	Designs and works in ornament.
——	1709	Collas, A.	Works exemplifying reduction of sculpture.
——	1566	Couder, A.	Shawl designs.
United Kingdom . .	80	Day and Son (Fine Arts Court) . .	Chromolithography and lithography united.
France	45	Debay, Auguste	The "Premier Berceau," in marble.
——	–	Debay, Jean (Main Avenue East) .	Death of the Stag, in bronze.
United Kingdom . .	10	Designs, Government Head School of (Fine Arts Court).	Designs.
France	818	Devers, J.	Holy Family, on lava.
——	1369	Dieterle, J.	Painting on china, in the Sèvres manufactory.
Prussia	273	Drake, Professor F.	Cast, in plaster, of part of pedestal to monument of Frederic William III. of Prussia.
France	1369 & 96	Ducluzeau, A., Madame, (Main Avenue, East).	Painting of Holy Family, and of Her Majesty, on china.
United Kingdom . .	241	Essex, W.	Collection of enamel paintings.
France	1215	Etex, A.	Various works of sculpture in plaster and marble
Prussia	281	Fischer, K.	Medals.
United Kingdom . .	47 & 19	Foley, J. H. (North Transept—Sculpture Court).	Youth at a Stream; and Ino and Bacchus, in plaster.
Austria	710	Fraccaroli, Innocenzo	Statues, in marble, of Achilles wounded, and David slinging the Stone.
Belgium	465	Fraikin, C. A.	Psyche carrying off Cupid, in plaster.
France	1235	Fratin	Group of eagles, in bronze.
Bavaria	91	Fuchs, J. N. von	Fresco, exhibited by J. Muhr.
Austria	711	Galli, Antonio	Statue in marble, Susannah.
Belgium.	466	Geefs, G..	A lion in love, in plaster.
——	450	Geerts, C.	Carving in oak.
France	231	Gérente, A.	Stained glass.
United Kingdom . .	95	Grantham, John, Secretary Liverpool Local Committee (Main Avenue West).	Model of Liverpool.
France	1369	Hamon	Enamelled casket.
United Kingdom . .	64	Hanhart, M. and N. (Fine Arts Court).	Chromolithography.
——	532	Hardman, J., and Co. (Cl. XXVI.) .	Painted glass window.
——	14	Hogan, J. (Sculpture Court) . . .	Drunken faun, in plaster.
——	71	Hullmandel and Walton (Fine Arts Court).	Chromolithography.
France	271	Jacobber	Paintings of flowers, on china.
——	1369	Jacotot, Madame	Head of Raphael.
United Kingdom . .	81	Jennings, B. (Sculpture Court) . .	Statue of Cupid, in marble.
Denmark	39	Jerichau, J. A.	Group, in plaster, hunter and panther.
United Kingdom . .	54	Jones, Owen (Fine Arts Court) . .	Chromolithography.
Bavaria	86	Kellner, S.	Glass painting of window in St. Lorenz Church, Nürnberg.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Russia	318	Korniloff, N.	Painting on porcelain.
France	291	Laroche, E.	Designs for shawls, barèges, muslins, &c.
——	1369	Laurent, Madame Pauline	Three enamels on copper.
United Kingdom	22	Lawlor, J. (Sculpture Court)	Marble statue of a bather.
France	573	Lechesne, Auguste (Main Avenue, East).	Two casts in plaster, child protected from a snake by a dog.
——	–	Lemercier, R. J.	Lithography and chromolithography.
——	–	Lequesne, E. L. (Main Avenue, East).	Dancing Faun, in bronze.
United Kingdom	24	Leighton, John, jun. (Cl. XVII.)	Variety of designs.
Rome	18	Macdonald, Lawrence	Iconic statue, in marble.
United Kingdom	22, 23, & 24	Macdowell, P. (South Transept).	Cupid, in marble, and Eve, in plaster; girl at prayer, in marble.
France	329	Marechal and Guynon	Painting on glass.
United Kingdom	15	Marshall, W. C. (Sculpture Court)	Sabrina, in marble.
Austria	746	Monti, Raffælle	Marble statue of Eve.
Spain	271A	Perez and Co.	Inlaid wood table.
United States	522	Powers, Hiram	Statue of the Greek slave, in marble.
France	1419	Ramus, J. M.	Group in marble, Cephalus and Procris.
Saxony	185	Rietschel, Ernst.	Plaster group "La Pieta"; bas-reliefs, in marble.
United Kingdom	353	Rogers, W. G.	Cradle, carved in Turkey boxwood.
France	1689	Roucou, J.	Inlaid work.
United Kingdom	221	Salter, S. (Cl. VII.)	Model of St. Nicholas Church, Hamburg.
France	1369	Schilt	Painting on a vase.
United Kingdom	20	Sharp, T. (Sculpture Court)	Statue, in marble, of boy and lizard.
France	374	Silbermann, G.	Chromotypography.
Belgium	464	Simonis Eugène.	Plaster statue of Godfrey de Bouillon, and other works.
Austria	713	Strazza, Giovanni	Marble statue of Ishmael.
United Kingdom	56 & 58	Thrupp, F. (Sculpture Court)	Boy and butterfly, and Arethusa, both in marble.
Belgium	456	Tuerlinckx, Joseph.	Marble statue of Giotto.
Austria	362	Vienna, Imperial Printing Office of.	"Paradisus Vindobonensis," in chromolithography.
United Kingdom	89	Wallis, T. W. (Fine Arts Court)	Carvings in wood.
——	60 & 81	Watson, the late M. L. (Sculpture Court—Main Avenue, West).	Statue of J. Flaxman, in marble; and Eldon and Stowell group, also in marble.
Prussia	306	Winckelmann and Sons	Colours and lithographic prints.
——	307	Wolff, Albert	Marble group, Innocence.
Bavaria	92	Wustlich, O.	Portrait of Charles IX., on china.
United Kingdom	30	Wyatt, M. Digby (Fine Arts Court).	Good taste in designs generally.
——	286	Wyon, L. C.	Medals and medallion portraits of the Royal children.

HONOURABLE MENTION.

Prussia	309	Afinger, I. Bernhard	Medallions.
United Kingdom	10	Alldridge, W. (Government Head School of Design)—(Fine Arts Court).	Designs.
——	10	Ashworth, Susan (Government Head School of Design)—(Fine Arts Court).	Designs.
Austria	616	Bagatti-Valsecchi, Pietro	Painting on glass.
United Kingdom	115	Baxter, G.	Oil-colour picture printing.
——	54	Behnes, W. (Sculpture Court)	Marble statue of a startled nymph.
——	249	Bell, W. C.	Enamel painting.
Tuscany	78	Bigotti, L.	Ivory carving.
Denmark	38	Bissen, H. W.	Orestes, in marble, and other sculptures.
United Kingdom	238	Bone, H. P.	Enamel painting on gold.
France	64	Bonnassieux, —	Cupid cutting off his wings, in bronze.
——	1554	Boyer, V. P., and his artist, Mariette de Chassagne.	Painting on china, after H. Vernet.
United Kingdom	2	Bradley, — (Cl. XXV.)	Painting of ducks, on china.
France	72	Braun, C.	Designs in calico.
United Kingdom	10	Carter, J. (Government Head School of Design)—(Fine Arts Court).	Designs.
Oldenburg	1	Cassebohm, J. H.	Model of Heidelberg Castle.
United Kingdom	60	Chance Brothers and Co. (Cl. XXIV.)	Painted church windows.
——	246	Chesters, S.	Enamel painting on porcelain.
France	451	Clesinger, T.	A bacchante.
United Kingdom	10	Collins, Florence (Government Head School of Design)—(Fine Arts Court).	Designs.
France	460	Cordier, C.	Head of a Negro, in bronze.
Tuscany	–	Costoli, A.	Marble statue of a dying gladiator.
United Kingdom	63	Cottingham, N. J. (Main Avenue West).	Spandril for Hereford cathedral.
	10	Cuthbert, J. S. (Government Head School of Design)—(Fine Arts Court).	Designs.

NATION.	No. in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Russia	362	Dreger, F.	Chromolithography.
France	820	Didier, F.	Design for shawls.
United Kingdom	90	Dunhill, Thomas (Cl. VII.)	Model of a metropolitan cattle market, with abattoir.
——	51	Duppa, B. E. (Cl. XXVII.).	Designs burnt on tiles.
——	140	Eckelmann and Wüstiah (Cl. XXIII.) (Main Avenue West).	Portraits on china; Her Majesty and the Prince of Wales, and Prince Albert.
——	15	Engel, J. (South Transept)	Group of Amazons.
Tuscany.	110	Freccia, P.	Marble statue of Psyche.
France	228	Galimard, N. A.	Designs for stained glass.
United Kingdom	83	Gass, S. H. and D. (Cl. XXIII.)	Silver gauntlet niello bracelet.
Belgium	451	Geefs, J.	Plaster statue, The Faithful Messenger.
Prussia	166	Grünthal	Berlin wool designs.
Bavaria	83	Hagen, Michael	Goblet of ivory.
——	85	Hanfstängel, F.	Galvanography.
United Kingdom	244	Harris, J.	Imitation of ancient typography.
Belgium	441	Hart, L. J.	Medals.
United Kingdom	197	Harvey, J. K. (Cl. XIX.)	Designs for carpets.
——	237	Haslem, J.	Enamel paintings.
Prussia	772	Henneberg, F. E., and Co.	Painting on porcelain.
Grand Duchy of Hesse	75	Heyl, C. W.	Goblet of carved ivory.
United Kingdom	63	Holland and Son (Cl. XXIV.)	Stained glass, Life of Christ.
——	67	Howe, J. G. (Cl. XXIV.)	Imitation of ancient painted window glass.
——	10	Ireland, Edwin, (Government Head School of Design)—(Fine Arts Court.)	Designs.
Belgium	461	Jaquet, Jos.	Cupid disarmed, plaster.
——	447	Jehotte, Constant	Bronze medals.
Denmark	34	Klingsey, C. G.	Ivory casket.
United Kingdom	10	Kyd, J. (Government Head School of Design)—(Fine Arts Court)	Designs.
France	295	Lautz, L.	Ivory carved vase.
Bavaria	89	Leeb, J.	Marble statue, Girl carrying a nest of Cupids.
Switzerland	258	Leemann, J.	Nuremberg Fountain, in wood.
United Kingdom	306	Lucas, R. C.	Carvings in ivory.
France	565	Lusson, A.	Painted glass.
Austria	716	Marchesi, L.	Statue in marble, Eurydice.
France	638	Meynier, —	Designs for shawls.
United Kingdom	98A	Miller, F. M. (Main Avenue, East.)	The Orphans, in marble.
Prussia	292	Möller, C.	Two groups, in bronze.
France	625	Naze and Co.	Designs for cotton prints.
Tuscany	108	Nencini, Prof. L.	Marble statue of Bacchus.
Austria	615	Nigg, —. (Imperial Porcelain Manufactory, Vienna.)	Flower-piece, and Holy Family, on china.
United Kingdom	65	O'Connor, M. and A. (Cl. XXIV.)	Painted glass.
France	1660	Pascal, Michel	Model, in marble, of a Friar presenting the Crucifix to Two Children.
Prussia	286	Pfeuffer, C.	Medals.
France	347	Picard, E.	Designs for woollen, cotton, and other printing.
United Kingdom	10	Rawlings, J. (Government Head School of Design)—(Fine Arts Court.)	Designs.
Rome	22		
Austria	722	Rocchigiani, Antonio	Mosaic—Temple of Pæstum.
Rome	24	Sangiorgio, A.	Bust of the poet V. Monti.
United Kingdom	10	Saulini, Thomas	Shell cameos.
		Slocombe, C. P. (Government Head School of Design)—(Fine Arts Court.)	Designs.
——	2	Stephens, E. B. (North Transept.)	Plaster group, Deer-stalker and Dog.
——	28	Stuart, W. (Cl. VII.)	Limestone model of Plymouth Breakwater.
——	13, 59, & 79	Theed, W. (Sculpture Court.)	Sculptures, in marble and plaster.
——	34	Thornycroft, T. and Mary. (Sculpture Court.)	Royal Children, in plaster.
Spain	266	Toledo, The Royal Ordnance of	Inlaid arms.
Russia	328	Tolstoy, Count	Medals.
United Kingdom	10	Town, A. (Government Head School of Design)—(Fine Arts Court.)	Designs.
——	75	Truefitt, G. (Fine Arts Court.)	Design of iron tomb.
France	1504A	Turgan, Madame	Painting on porcelain.
United Kingdom	77	Underwood, T. (Fine Arts Court.)	New process of lithography.
——	97	Vechte, A. (Cl. XXIII.)	Designs for silver works.
Wurtemburg	108	Wagner, T.	Statue in marble, Magdalen.
United Kingdom	73	Wailes, W. (Cl. XXIV.)	Painted glass for York Cathedral.
Saxony	177	Walther, G.	Enamel painting on china.
United Kingdom	21	Weekes, H. (South Transept.)	A Sleeping Child and Dog.

MONEY AWARD.

Prussia	785	Boesche, J. C.	Model of Magdeburg Cathedral, £30.

LIST OF AWARDS—LADIES' JURY.

PRIZE MEDAL.

Class.	Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Class XII .	United Kingdom	172	Tetley, Mrs.	Quilt.
Class XIX. .	Sweden . . .	42	Alner, Anna	Portrait of Queen Victoria.
,,	United Kingdom	382	Brayshaw, J.	Mosaic needlework.
,,	——	108	Bridges, W.	Last Supper.
,,	——	135	Cook, W.	Table-cover.
,,	——	136	Copeland, Fanny	Sofa pillow.
,,	——	152	Ditl, Madame	Tasso's return.
,,	——	49	Davies, Mrs.	Chess-board.
,,	——	159	Ellis, Sophia A.	Tatting.
,,	——	378	Fancourt, Catherine	Quilt.
,,	——	164	Flower, Ann	Flags of all nations
,,	Sweden . . .	28	Hamén, Sophie	Embroidered needlework.
,,	United Kingdom	195	Harttree, E. and G.	Peter the Hermit.
,,	——	330	Hayes, E. J.	Pictures of seed.
,,	——	204	Hill and Co.	Tintern Abbey.
,,	Sweden . . .	29	Horn, Mrs.	Embroidery.
,,	United Kingdom	224	King, Miss	Mediæval embroidery.
,,	——	229	Lambert, Elizabeth	Embroidery.
,,	Sweden . . .	96	Lindgren, Constance	Portraits of King Oscar and Duke of Wellington (in silk).
,,	United Kingdom	–	Parr, Captain	Embroideries by a Spanish lady residing in Madeira.
,,	——	278	Robinson, Miss	Group of flowers.
,,	——	283	Roome, Ann	York Cathedral.
,,	——	298	Shuldham, Harriet	Lace scarf.
,,	——	–	Stokes, S.	Embroidery.
,,	——	90	Sturmy, Maria	Table-cover.
,,	——	309	Sutherland, Janet	Table-cover.
,,	——	391	Tawton, Mary	Child's cloak.
,,	——	324	Veevers, Letitia	Articles manufactured from the fibres of plants and flowers (with Special Approbation.)
,,	——	329	Vokes, F.	Table-cover.
,,	——	334	Ward, Anne	Giant's Causeway.
,,	——	347	Whitney, E.	Embroidered aprons.
,,	——	356	Woolcock, Catherine	Screen.
Class XX. .	——	174	Linklater, Jeremiah	Shetland knitting.
,,	——	86	Solomon, Sarah	Ball dress.
,,	——	213	Standon, Ann	Quilt.
,,	——	154	Tollet, G.	Articles made of feathers (Honourable Mention in Class XVI.)

HONOURABLE MENTION.

Class.	Nation.	No. in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Class XII. .	United Kingdom	172	Clark, J.	Table-cloth.
Class XIV .	——	12	Adams, Jane	Needlework.
Class XIX .	——	389	Barclay, Helen	For the wool only.
,,	——	103	Blackburn, M. A.	Lincoln Cathedral.
,,	——	146	Conerding, Mrs. Ida Von	Knitting.
,,	——	161	Evans, S. A.	Death of Douglas.
,,	——	174	Gardner, M. A.	Berlin wool-work (exhibitor blind).
,,	——	198	Hayter, F. S.	Carpet.
,,	——	178	Heyn, Emma	Vase of flowers.
,,	——	223	Kettlewell, Mary	Knitting.
,,	——	234	Digges, La Touche, Miss	Lace flounce.
,,	——	230	Lanchenick, Jane A	Table-cover.
,,	——	228	Mowland, C. G.	Wreath of flowers.
,,	——	266	Pearse, Clara	Quilt.
,,	——	273	Pickthorn, Esther	Hearth-rug.
,,	——	373	Prior, Rev. H. E.	Irish lace.
,,	——	299	Sibthorpe, F. L.	Death of Douglas.
,,	——	144	Viall, S. A.	Infant's robe.
,,	——	47	Vischi, A. M. J.	Artificial flowers, in wool.
,,	——	112	Wilson, Charlotte	Quilt.
,,	——	113	Brooks, E.	Handkerchief embroidered.
Class XX. .	——	72	Gates, L. C.	Lady's dress with elastic sides.
,,	——	148	Haywood, Mary	Shawl.
,,	——	218	McCra, —.	Knitted shawl.
,,	——	169	Poore, J. B.	Articles made of feathers.

CLASS I.

REPORT ON MINING, QUARRYING, METALLURGICAL OPERATIONS, AND MINERAL PRODUCTS.

The figures after the Names (between parentheses), refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

Sir HENRY DE LA BECHE, C.B., F.R.S., *Chairman*, 28 Jermyn Street, Piccadilly; Director General of the Geological Survey of the United Kingdom.

DUFRENOY, *Deputy Chairman and Reporter*, France; Member of the Institute of France, Inspector-General of Mines, &c.

M. FARADAY, D.C.L., F.R.S., Royal Institution, Albemarle Street; Professor of Chemistry in the Royal Institution.

C. J. M. GERNAERT, Belgium; Engineer-in-Chief of the Corps of Miners.

W. E. LOGAN, F.R.S., Canada; Director of the Geological Survey of Canada.

FERDINAND SCHRIEBER, Zollverein; Mining Engineer.

RICHARD TAYLOR, F.G.S., 6 Queen Street Place, Upper Thames Street, and Truro; Mineral Surveyor to the Duchy of Cornwall.

Professor TUNNER, Austria; President of Imperial Mining School, Leoben, Styria.

Associate.

GABRIEL KAMENSKY, Russia; Councillor of the Administration of Finances. (Juror in Class XXV.)

THE mineral kingdom, which plays so important a part in modern industry, furnishing raw materials for our manufactures and tools for our works, and supplying fuel for our steam-engines, the invention of which has centupled the power of man, cannot be satisfactorily represented in an Universal Exhibition.

Its products possess immense utility, and yet offer but little brilliancy of appearance. Deprived of all that gratifies the eye by elegance of form and varieties of colour, they can scarcely neutralize these disadvantages and arrest attention, unless by research into their peculiar conditions, their singular and strange forms, and their colossal dimensions, which excite surprise from the great difficulties overcome * in their preparation. But such sources of interest are essentially fugitive, and generally barren of result, and the interest thus excited is no adequate reward for the labour, care, and expense that have been incurred in producing them, and they rarely introduce new outlets for the industry which has been displayed in forwarding them.

These difficulties are inherent. An exhibition, moreover, of metalliferous minerals cannot afford, as is the case with agricultural and manufacturing products, a complete comprehension of the ingenious and powerful methods which have either obtained or simplified their extraction, or the multiplied labours by which they have been procured.

Agriculture ameliorates and increases the products of the earth: the skill of the weaver is shown in the beauty of his fabrics, and it is easy for the observer, however inexperienced, to render an account of it, either to himself or to the public. For minerals, on the contrary, an attentive and prolonged examination often only affords a somewhat incorrect idea of their real value, and of the advantages which may arise from their 'exploitation.' The beauty of the specimens is often only a deceitful guide.

If it be true that the importance and commercial value of an 'exploitation' depend upon the riches of the raw material, and the facility of its extraction, it is only in the works themselves, or in the mine, that this double condition of its value can with any certainty be appreciated.

Certain mines of copper afford a good illustration of this fact. Most of the specimens obtained from these mines yield as much as 60 per cent. of metal; but still they are not worked to profit, owing to the small quantity of the ore irregularly distributed through veins of which the greater part is barren.

The mines of Cornwall, on the contrary, the ores of which afford only about 8 per cent. of metal, even after dressing, are very profitable to the adventurers.

The abundance of these ores is so great, that they furnish nearly two-thirds of all the copper obtained from the mines of the whole world.

These remarks appear useful at the commencement of this Report, as explanatory of the numerous omissions which have to be regretted in the Great Exhibition, in reference to the products of the mineral kingdom. Without casting blame on the great establishments of Europe, and elsewhere, which have rendered themselves remarkable by their absence, they constitute the best eulogium of those who have had the courage to sacrifice all personal considerations to the honour of the industry they represent. Without expecting any considerable benefit, without any prospect of opening new markets, they have been, nevertheless, desirous of offering their disinterested tribute, and of adding to the effect of an event which will form an epoch in the history of the industry and civilization of the world.

The exhibition of the various productions of the mineral kingdom presented in the Crystal Palace is therefore very incomplete. Saxony and the Hartz, those cradles of mining, which for so long alone in Europe enjoyed the honour of possessing mining schools, have sent none of their products. Sweden and Norway, likewise very rich in mines, are chiefly represented by magnificent specimens of native silver, as remarkable for their dimensions * as for the beauty of their crystallization.

Spain, which supplies so large an amount of mercury to the whole world, and of which the lead mines were once sufficiently important, in the abundance and richness of the ore, to govern the markets of Europe, has only sent a few detached specimens, so that the exhibition from this country gives no evidence of the mineral wealth of the Peninsula. The Jury have thus been unable to award to the Spanish exhibitors more than a single Prize Medal and a few Honourable Mentions. Even these have been given for the manufacture of iron and steel, and the working of marble,—classes of industry which are but of secondary importance in that kingdom.

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* We may refer to specimens of lead ore consisting of cubes nearly 3 feet across, and blocks and obelisks of granite more than 40 feet high. Messrs. Bagnall and Jesson (63, pp. 113—117), exhibit a sectional column of the South Staffordshire thick coal nearly 40 feet high, showing the whole thickness of the seam.

* These specimens (exhibited as No. 34, Sweden) are 34 in number, and we have particularly noticed four amongst them, viz.:—1. A specimen weighing two ounces, having very distinct and well-formed cubical crystals. 2. One in cube-octahedral crystals, weighing 67 ounces. 3. One in octahedrons, weighing 48 ounces; and 4. one weighing at least 10 lbs. composed of large twisted fibres.

We ought here to remark, that the prizes have been awarded entirely on the examination of the objects exhibited. They do not, therefore, in any way represent the industrial position of the countries which have obtained them, and often indeed give no indication of the real importance of the establishments to which they have been awarded. These apparent anomalies, which every one may discover with regard to works with which he is himself acquainted, are the result of this necessary condition of a Universal Exhibition, where the members of the Jury cannot have a personal knowledge of the establishments whose products they examine, and are therefore unable to admit, in forming that opinion, any considerations derived from without the Exhibition.

Several of the numerous copper-works of Russia, and also the gold washings of that vast empire, perhaps as rich as those which now attract attention in California, are unrepresented by any collection. The only important objects sent by Russia, belonging to this Class, consist of specimens of pig, bar, and rolled iron from the Imperial and other manufactories, with specimens of copper in cake and in sheets; some of them being accompanied by ores and slags of the furnaces in different states. These interesting collections give a sufficiently complete idea of the mode of treatment adopted in the different works whence they are forwarded, and permit a comparison with the methods employed in the other metalliferous districts of Europe.

The mineral industry of Austria, Belgium, France, and of Germany within the Zollverein, or Customs' league, although very imperfectly represented in the Exhibition, includes objects of the greatest interest. Each of these countries has obtained the Council Medal, and a considerable number of Prize Medals.

The Exhibition of Great Britain is sufficiently complete in those objects that have reference to the production of metals of daily usage, especially iron and steel, the series representing these important branches of industry, including in most cases the ores of iron, and their products in different states, while in a few the collections are accompanied by models of the furnaces in which the metal is reduced. There exist also several collections of ores valuable for instruction, amongst which we may notice especially that exhibited by Mr. BLACKWELL (pp. 143—152), of Dudley, who has sent a series comprising specimens of all varieties of iron ore worked in Great Britain. The study of this collection is equally interesting to the mineralogist and the geologist, as well by the different nature of the ores as by their mode of occurrence.

Notwithstanding the omissions so much to be regretted, and which we have just alluded to, the exhibition of objects in this Class still possesses the greatest interest, and is in the highest degree instructive; and it results from it, on a careful investigation, that in all parts of the world, in Europe, as well as America, the mineral has everywhere followed the development of other industries. The difference of price of the raw material, or, to speak more accurately, the abundance of fuel, and its more or less favourable distribution, regulate in each country the cost of manufacture, although it is chiefly with regard to smelting operations and the working of iron that this influence shows itself on the largest scale. The methods of working are everywhere acquiring a certain uniformity of system, the old processes, where human labour was so largely introduced, being replaced by modern contrivances which diminish the amount of manipulation and the general expense. The only remark that one can venture to make is, that wherever fuel is abundant it is more wastefully used; and that the countries where smelting operations and iron are the dearest, are perhaps, on the other hand, those where economy of fuel is carried to the greatest extent, and where the work has really attained the greatest perfection.

The Royal Commission which presided over the Exhibition had the happy idea of including geological maps among the objects which ought to appear in it, as one of the most useful means of advancing mineral industry. Many of these maps have been distinguished by the Jury, and will be honourably noticed in the summary description of objects that have obtained rewards. The most important of all, however, that of England, prepared under the superintendence of Sir HENRY T. DE LA BECHE, Director-General of the Geological Surveys, could not receive any award in this class, that gentleman being the Chairman of the Jury; and it is, therefore, necessary to speak of it in this short preliminary sketch of the *ensemble* of the Exhibition. It is executed on the Ordnance map prepared and published by Government. The scale of this map (1 inch to a mile, or 1 in 63,360) is sufficient to represent in detail the outline or the boundary of all the geological formations, and it even allows the direction of the principal metalliferous and other veins to be indicated when they are known for any distance. This great work, at present the only one of its kind, is a model which we may hope will be imitated by the principal Governments on the Continent. Science may then, within a limited time, be enriched by a complete geological map of the whole of Europe. It is true that France already possesses a geological map, which I may be allowed also to cite; and there are also a number of departmental geological maps, many of which are executed with great talent; but these are not all on the same scale, and the details are not of the same kind, so that there are certain discrepancies which prevent our being able to unite them all in a single sheet, and thus form a complete result. The new map of France, which is in no respect inferior to the Ordnance map of England, either in accuracy or execution, furnishes the groundwork for a geological map equal to that which has been prepared by Sir H. De la Beche and the officers of the Geological Survey. England, which laid the first foundation of the true study of stratified deposits by the sections of W. Smith, and the important map of Mr. Greenough, has still the honour of giving to the world a model for the execution of a detailed geological map, applicable at once to industrial researches and agricultural improvement.

Before commencing the detailed description of objects which have obtained Medals or Honourable Mention, we feel bound to mention also the interesting collection from Canada, procured by Mr. LOGAN (pp. 958—961), Director of the Geological Survey of that Colony, and a series of copper ores, with model of a mechanical preparation of working these ores, exhibited by Mr. RICHARD TAYLOR, Mineral Surveyor of the Duchy of Cornwall. These two gentlemen, being both of them members of the Jury, they, as well as the Chairman, Sir H. De la Beche, are of necessity excluded from receiving honorary awards in this class.

The collection from Canada is accompanied by a geological map, which will, we hope, be very soon published.

The model, showing the mechanical preparation of copper ores, of which Mr. Taylor is the exhibitor (434, p. 161), presents remarkable differences when compared with the methods generally employed in Cornish mines. The method is more especially intended for the poorest ores, called *Halvans*, and admits of a larger proportion of the copper being obtained than is the case with any other methods now in use.

The Jury have considered that they are not justified in adjudging any reward to those who have exhibited objects of Natural History, unless these have been obtained by special researches on the part of the exhibitor.

In consequence of this decision, isolated minerals and geological specimens not connected with distinct operations have been excluded from competition; but we consider that it will be useful to science if we append, as a note to the above general *resumé*, a notice of such specimens as are extraordinary for their dimensions or for the perfection of their forms.

Amongst such specimens must be mentioned, as of the first class in point of interest, a magnificent crystal of emerald, the property of the Duke of DEVONSHIRE (14, p. 122), obtained from New Granada. It is a regular six-sided prism, perfectly well formed. Two of the parallel faces are more developed than the others, so that the hexagonal base of the crystal has one side larger than the rest. The dimensions of the base are 2·36 inches by 1·97 inch, and the height of the prism 0·165 inch. Notwithstanding these dimensions, almost gigantic for this kind of mineral, this emerald, which is of a fine green colour, is perfectly clear in the upper part. The lower part, which is attached to the rock, presents many flaws, probably the result of a blow by which it was detached from the veinstone.

The Duke of Devonshire is also the exhibitor of two crystals of quartz, attached by one of the vertical faces, the crystals being each of them 2½ feet high by 8 inches in diameter. The pyramidal summits of these crystals, which rise nearly a foot above the prism, are completely transparent, but the prisms are cloudy. These magnificent crystals were obtained from the Alps, having been discovered during the formation of the road over the Simplon, in a cutting made through the old rocks.

In a series of minerals sent by the Royal Technological Institute of Tuscany, we cannot pass over a specimen of granite rock from Elba, measuring about 19 inches by 13, having one side covered with magnificent crystals of felspar, upwards of a hundred in number. These crystals, which occupy a fissure or small vein in the rock, are entirely detached. They measure 2·36 inches in height by 1·77 across between the faces g^1; their form, extremely well defined, is a six-sided prism, composed of the four primitive faces M and the modifications g^1; they are terminated by the base P, and the angle $a^{\frac{1}{2}}$ and a^1. The enlargement of the base of the faces $a^{\frac{1}{2}}$ and g^1, gives to these crystals a peculiar arrangement observed in the large-grained granites of the centre of France, especially in those of La Lozère and Le Forez.

Don Francisco Ignacio Ossa, Don Miguel Gallo, and Don Ramon Goyeneche, have exhibited together a magnificent specimen of native silver, weighing 154 lbs. obtained from the mine of Descubridora, near Chanarcillo, in Chili. It was found in this mine in 1850, at a depth of 200 feet, in the vein called Augusta. The dimensions of this specimen make it an object very remarkable in natural history; but it is especially interesting by its structure, being formed of successive layers folded on each other like some of the beds of the coal measures. These layers do not appear to be due to successive concretions, as is the case with kidney-shaped nodules of native arsenic.

The only other objects we shall refer to are a specimen of a lead vein from the Laxey mines, and a magnificent lump of galena from the mines of Snailbatch, near Shrewsbury.

The fragment from Laxey represents the total thickness of the lode, which amounts to 23¼ inches, nearly. The specimen is about 5 feet long by 30 inches wide. It consists of five solid veins of galena separated by thin bands of sulphate of barytes; and the specimen, which is one of the finest that we have seen, gives a complete idea of a metallic vein. The owner has presented it to the Museum of Practical Geology, where it will be of great interest as illustrating the formation of veins.

The specimen from Snailbatch mines is still more curious. It is composed of an assemblage of large cubes of galena, measuring 3·15 inches a side, and of rhombohedral crystals of violet-coloured calc spar 9½ inches long, the edges being replaced by large facets belonging to the obtuse scalenohedron b^2: these are smooth and bright, but the faces of the rhombohedron are, on the contrary, bristled with high points consisting of the ordinary metastatics arranged in their natural position relatively to the axis of the rhombohedron, so that the faces of all these points are parallel. This specimen, remarkable both for the dimensions of the cubes of galena and the crystals of carbonate of lime, measures about 55 inches by 43¼ inches, its thickness being about 14 inches.

On the Prizes Awarded and the Motives by which the Jury have been Influenced.

The examination of all the objects relative to mines, quarries, and metallurgical operations, and the collection of mineral products exhibited in the Crystal Palace, was carried on simultaneously by different members of the Jury. To give greater authority to their decisions, they obtained the assistance occasionally of persons whose special knowledge might assist them. This assistance they availed themselves of, especially with regard to the various specimens of iron; for the determination of which, they called in four qualified persons, whose practical knowledge afforded every guarantee of a just and due appreciation. After this circumstantial examination, the Jury divided the list of those whom they consider worthy of reward into three classes; the rewards being as follows:—

1. Council Medals, for such objects as, according to the terms originally decided on, exhibit either novelty in the mode of obtaining or applying raw materials and produce, or skill and excellence in known modes of obtaining, applying, or adapting them.
2. Prize Medals for comparative excellence in the quality obtained, combined with utility.
3. Honourable Mention of those objects which, without attaining the superiority required for the Prize Medal, offer notwithstanding, great merit of execution or the application of new and ingenious methods still requiring the sanction of long experience.

This last class has been divided into two; but it would be difficult to define very accurately the difference between them. To explain the difference, it may, however, be sufficient to say that the Jury have sometimes had doubts as to whether several of those in the First List of Honourable Mentions ought not to have been rewarded with the Prize Medal. Difficulties of this kind have never presented themselves in drawing the line between the Honourable and Ordinary Mentions, and the opinions of the Jurors have been in all cases unanimous with regard to the latter.

Council Medals.

The Council Medals having been awarded in the manner above indicated, for novelty in the mode of obtaining and applying raw materials, sanctioned by experience, or for undoubted superiority in manufacture, we begin by giving some details on the methods or kinds of industry that have merited them. With regard to the Prize Medals and Mentions, a general account will afterwards be given of them in the order of the respective countries to which they belong.

Manufacture of Black-lead Pencils by Mr. W. Brockedon. (65, p. 128.)

Drawing pencils of the first quality, known in commerce as "Brookman's," are made with small prisms sawn from pure massive graphite, and placed in grooves in wood. Pieces of graphite sufficiently large to be thus used are very rare, and the mine of Borrowdale, in Cumberland, whence they have been obtained, is almost entirely exhausted. Mr. Brockedon was long occupied in seeking for some method which might enable him to employ the powder of pure graphite without cementing it by any substance, which inevitably injures the quality. He endeavoured to render the powder coherent by submitting it to enormous pressure; but the different machines and apparatus he at first made use of for this purpose, however strongly they were made, were broken under the pressure, and his endeavours were thus unsuccessful, until the happy idea suggested itself of operating in a vacuum. But it was extremely difficult, if not impossible, to introduce under the receiver of an air-pump an apparatus for compressing the powder of graphite. Mr. Brockedon overcame this difficulty by an arrangement as simple as it is easily executed, for after having compacted the graphite powder by moderate pressure, and thus reduced it to a certain size, he enclosed it in very thin paper, glued over the whole surface. He then pierced it in one place with a small round hole, permitting the escape of the air from within, when the block thus prepared was placed under an exhausted receiver, and the air having been removed, the orifice was closed with a small piece of paper, and in this state it was found that it might be left for 24 hours without injury. Being submitted then to a regulated pressure once more, the different particles became agglomerated, and a block of artificial graphite was produced by simple pressure, as solid as the specimens obtained from the mine. From such blocks the exhibitor was able easily to obtain small prisms for use, which have yielded pencils equal in quality to those manufactured from the purest specimens from Borrowdale.

The objects exhibited by Mr. Brockedon are as follows, viz.:—

1. Specimens of graphite from Cumberland, India, Greenland, Spain, Bohemia, and several other localities.
2. Compressed powdered graphite.
3. The same powder in the form of artificial blocks, prepared in the manner just explained.
4. The graphite in small solid cylinders for Mordan's pencil-cases, and other specimens of pencils for various purposes, especially for drawing.

Method adopted by Mr. H. L. Pattinson, of Newcastle-on-Tyne, for Separating Silver from Lead. (480, p. 166.)

Most of the ores of lead contain a small proportion of silver, which may be obtained from them by cupellation. This operation consists in oxidising the lead, and transforming it into litharge, during which the silver collects in the bed of the cupel, and remains unaltered; but it costs so much in fuel, labour, and loss of lead, that it can only be applied economically when the lead contains at least 20 ounces of silver to the ton. By means of Mr. Pattinson's method, lead containing only 3 ounces of silver to the ton may be cupelled with profit. This important discovery in metallurgy, which dates back as far as 15 years, has been adopted during that period in various lead-works in England, and within the last three or four years has been introduced into France, Spain, and Prussia: it has, therefore, the sanction of experience, and its application has enabled some lead mines to be worked to profit which must otherwise have been neglected. The method is founded on the property which bodies possess to separate from each other during crystallization, and become to a certain extent purer by its intervention. It consists in fusing the argentiferous lead in a large vessel, and when the fusion is complete, arranging the temperature to the point, so that the crystallization of pure lead commences. The crystals of pure lead are then removed as soon as they are formed by a large iron ladle pierced with holes, and the silver is concentrated in a smaller portion of lead, becoming gradually more and more rich, until it is by successive operations brought to such a state that its further separation can be made with greatest advantage by cupellation.

The objects exhibited by Mr. Pattinson to illustrate the process, include—

1. A drawing, representing the whole of an establishment where the work is carried on. There are here seven adjacent pots, heated by the same furnace, in which the lead is brought to contain, by degrees, 1½, 2½, 5, 10, 20, 40, and even 70 to 75 ounces of silver per ton.
2. A large cake of silver obtained by cupellation from the enriched lead.

Manufacture of fine Sheet-iron, called Iron Paper, from the Works of the Baron Von Kleist, at Neudeck in Bohemia. (Austria, 424, p. 1031.)

The Baron von Kleist has exhibited a series illustrating the various states of iron manufactured in his works at Neudeck in Bohemia. It consists of iron ores, pig-iron, and several specimens of iron in bar and in sheet, and tin-plate.

These products are all of excellent quality, but that which has chiefly attracted the attention of the Jury, and even of those who are most technically familiar with iron, is a particular kind of sheet-iron mentioned in the Catalogue as "Iron-paper," a name completely justified by the specimens. It is remarkable for its extreme thinness, flexibility, and strength, and is entirely without flaws.

According to Professor Tunner, the Austrian Member of the Jury, this material is used for making buttons, but it is equally applicable for any objects that are stamped. It takes a high polish after being worked.

This sheet-iron, of which the method of manufacture is not known to the Jury, but which is altogether peculiar from its beauty, is an ordinary object of commerce.

Products of the Mines and Manufactures of Zinc, exhibited by the Vieille Montagne Company.* (Belgium, 26, p. 1152.)

Thirty years ago, the uses to which zinc was applied were very limited, and the operations of the Vieille Montagne Company have greatly assisted in extending them by the numerous applications of the metal which they have introduced: the earliest and most important of these resulted from a method of rolling sheet zinc, which at first presented considerable difficulties. Within this period the works of the Company have continued at the head of the same branch of zinc industry, having introduced successively into commerce, very flexible and thin sheets, zinc stamped for a variety of uses, mouldings manufactured by drawing, nails and spikes of various kinds and all sizes, wire of great flexibility and of all numbers. They have recently employed zinc for castings of large size, and we may mention especially the statue exhibited of Her Majesty Queen Victoria, which, with the pedestal cast of the same material, presents a total height of 21 feet.

The Vieille Montagne Company has also applied the oxide of zinc to replace white lead in house painting, and for this purpose has recently opened two establishments for the manufacture of the white and grey zinc; one at Anières, near Paris, and the other at Valentin-Coq, near Liege. The works of this Society have continued to increase, notwithstanding the formation of several new Companies for working calamine and blende. At the present time it has 80 reducing furnaces at work, and employs 2640 workmen. The production in 1850 was 11,500 tons of zinc.

We may add, as justifying the high distinction awarded to the Vieille Montagne Company, that its zinc is of the best quality, and that the methods of working adopted differ essentially from those pursued in Silesia and England. The objects exhibited are very numerous, as well in the Belgian as in the French department, but it is not thought necessary to enumerate them after having indicated the uses to which this Company has applied it; we merely repeat that they are remarkable both for quality of material, and for excellence of workmanship.

Purifying Apparatus of M. Bérard, for separating from Coal any foreign Substances which it may contain, such as Pyrites or Schist. (France, 51, p. 1173.)

The washing of coal, a system introduced into France within the last three or four years, is a branch of industry of the highest importance, permitting the use of coal which by its mixture with schist would not be otherwise employed. It may also be applied with advantage to certain coals, considered to be of good quality, but containing a quantity of ash, which diminishes the value. They are purified by this method in such a way as to allow of the manufacture of a coke from these coals, not containing more than three or four per cent. of ash. The Great Northern Railway of France has recognized the efficiency of this method, and a considerable part of the coke which it consumes is manufactured of washed coal: there result from its employment a marked economy of fuel, and a greater durability of the locomotives.

The expenses of washing, which are considerable by the ordinary method, are reduced to ten or twelve centimes (about a penny), per metrical ton† of fuel by means of M. Bérard's method. A very important desideratum may, therefore, be considered as obtained.

The apparatus consists of three parts, viz.:—

1. An *elevator*, formed of an endless chain with buckets,

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* These Exhibitors were also awarded a Council Medal by the Jury of Class XXII.—I. W

† The metrical ton is equal to 1,000 kilogrammes or nearly an English ton, and contains 10 metrical quintals.—I. W.

which lifts from a trough or pit where the coals are placed a certain quantity, regulated by means of a valve.

2. A *separator*, into which the fuel is thrown by the elevator. This is composed of a long box, divided into compartments, and containing perforated plates, in stages, the size of the perforations being smaller and smaller by stages from the upper to the lower, so that by the shaking which this box undergoes, the coal is at once divided into four sizes. The finest powder falls to the bottom, and each of the three sizes of lumps being thrown out through openings in the sides of the box, into separate fixed sieves, called "bancs à lavage," which form the third part of the apparatus.

3. These "bancs à lavage" are long frames measuring 9 feet 2 inches by 4 feet, of which the bottoms are pierced with holes, the diameter of which is smaller than that of the pieces of coal thrown into them. They are entirely filled with water, and divided in the interior into three parts. In one of these is a piston, which is worked up and down, and gives considerable motion to the water, which being communicated to the materials thrown on the bottom of the tank, these arrange themselves rapidly, in the order of their density, the heaviest being at the bottom. The pure coal alone comes to the surface, and by a current of water proceeding from a trough above, it is carried beyond the tank, and falls directly into the waggon, whence it is conveyed to its destination. The substances heavier than coal, such as schist, or pyrites, are deposited on the perforated bottom of the tank, which has a slight inclination towards a trap, and thus constantly advance towards an exit. By a peculiar arrangement, the rubbish is thus made to carry itself into a compartment prepared in the inside of the tank, whence it is removed by the mere opening of a valve.

It will be seen from this description, that the work is continuous throughout, and requires no manual assistance. According to the declaration of M. Bérard, the quantity of coal that can be cleaned in an hour by a machine, the total cost of which would be 10,000 francs (400*l.*), is ten to twelve metrical tons. The working of such a machine would not require more than about 2000 gallons of water per day (8 to 10 cubic metres).

The various specimens exhibited are as follows:—

1. Coals classed in four sizes, and the foreign matters that have been separated from them.
2. Two specimens of coke; one made from coal as it comes from the mine, and the other from "washed coal." The first contains 26 per cent. of ash, the second only 2½ per cent.
3. A drawing of the apparatus.

The specimens are from an establishment founded by M. Bérard, at Molenbeck St. Jean, near Brussels.

M. Bérard states that his apparatus has been adopted by the mining companies of the Loire, Creuzot, Epinac, &c., in France, and that, at the present time, there is one being erected at Newcastle.

Various Objects in Brass, exhibited by Messrs. Estivant, Brothers, of Givet (Ardennes). (France, 1214, p. 1235.)

The Messrs. Estivant have forwarded a complete collection of their manufactures in brass; and the numerous objects which are included in it are all remarkable for admirable workmanship. We here mention only those which have attracted the attention of the Jury by their extraordinary dimensions, and difficulty of execution.

1. A sheet of rolled brass, measuring 15 feet 9 inches by 3 feet 7 inches, and less than a quarter of an inch (·2362 inch) in thickness; weight 561 lbs.
2. A sheet measuring 51 inches by 49 inches, nearly 2 inches (1·93) thick, weighing 1466 lbs.
3. A round bar of hammered brass, 8 feet long, and 4·88 inches in diameter, weighing 550 lbs.
4. A square bar of rolled brass, 11 feet 7 inches in length by 4·75 inches square in the section, weighing 920 lbs.
5. Two pans of hammered brass, each 7 feet 7 inches in diameter, and 15·75 inches high. The weight of the one is 101¼ lbs., and of the other 110 lbs.
6. A rolled sheet of Dutch metal (tombac), measuring 80·75 inches by 26·33 inches, and weighing 7 lbs. 11½ ounces.
7. Brass wire of different sizes, one specimen less than the twentieth of an inch (1¼ millemetre) in diameter, measuring 3691 yards in length, perfectly uniform throughout, and weighing 105 lbs. 10 ozs.
8. A book of extremely fine Dutch leaf, very strong and very tough, and without flaws.

All these are objects of ordinary manufacture. The large pans are employed in dyeing, and in the manufacture of glue; the large bars are used in ship-building; the fine leaves are intended for plating and coating wood; the large rolled sheet has only been smoothed on one side, to show that the others are as they were run out, and the same is the case with the square bar, of which one end has been sawn. The dimensions of these specimens involve great difficulty of execution, both in first casting, and subsequently manufacturing: with regard to the former, Messrs. Estivant, although using nearly the ordinary proportions of copper and zinc for the brass, adopt special precautions to render the alloy homogeneous. All brass manufacturers are able to cast slabs of about a hundredweight, and roll them into sheets weighing upwards of half that weight, but few of them are able to cast such masses as those exhibited here, without flaw, and roll them into sheets without flaws, even to the edges. This establishment, therefore, completely fulfils the conditions imposed by the regulation, which requires for the Council Medal "excellence in known modes of obtaining, applying, or adapting the raw material."

The annual make of Messrs. Estivant exceeds 1800 tons, and represents a value of about 80,000*l.*

Separation of Gold from Arsenical Pyrites, by W. Guettler, according to Plattner's method. (Prussia, 6, p. 1048.)

The mines of Reichenstein, in Silesia, abandoned for more than five centuries, have been recently opened with advantage, in consequence of the application, on a large scale, of a method invented by Professor Plattner, for separating gold from the waste of arsenical ores.

The ore at Reichenstein is an arsenical pyrites, containing about 200 grains of gold in the ton. The ore is roasted in a reverberatory furnace, surmounted by a large condensing chamber, in which the arsenious acid is condensed as fast as it is volatilized. There then remains, on the floor of the furnace, oxide of iron mixed with a certain quantity of arsenic, together with the whole of the gold. This is placed in a vessel so arranged that a current of chlorine can be passed through it, by which the gold and iron are taken up, and afterwards separated from the residuum, by the aid of a certain quantity of water, and the gold is afterwards precipitated from this solution by sulphuretted hydrogen. To prevent the admixture of iron at this stage, a small dose of hydrochloric acid is added to the solution before the sulphuretted hydrogen is introduced. The auriferous compound having been separated from the liquor, is washed and heated in an open porcelain crucible, to drive off the sulphur, by which the gold is reduced to the metallic state by fluxing it in the usual manner.

This simple and ingenious method, which has made it worth while to re-open the Reichenstein mine, is equally applicable to the vast quantity of refuse accumulated near many other old works. In awarding the Council Medal, the Jury have desired in this case to associate the name of Professor Plattner, the inventor of the method, with that of M. Guettler, who has brought it into operation on a large scale.

Steel Works of F. Krupp, at Essen, near Dusseldorf. (Prussia, 649 & 677, pp. 1086, 1087.)

This establishment, which has been erected at great cost and heavy sacrifices by its founder, is distinguished for the superior quality of the cast steel made there, and yet more by the large dimensions of the objects produced. The Jury is not acquainted with the methods adopted by

M. Krupp for obtaining pieces of all dimensions, which appear, however, to differ in many respects from those pursued either in England or Germany. Of the objects exhibited the Jury have remarked a pair of cylinders for rolling steel; a rough cylinder, nearly four feet long, and weighing 4,300 lbs.; the axle of a railway carriage, weighing 100 lbs.; and a cylinder 15 inches in diameter, broken across the middle. The last magnificent specimen has chiefly attracted the attention of the Jury on account of the fineness and homogeneity of its grain throughout. The Exhibition does not show from any other country a bar of cast and forged steel of such large dimensions and of equal beauty. The members of the Jury do not remember to have seen anywhere a similar example.

M. Krupp has also exhibited cuirasses and carriage springs, to show both the strength and elasticity of his steel.

PRIZE MEDALS AND HONOURABLE MENTIONS.

Most of those who have obtained these medals, or who are honourably mentioned, have exhibited objects of ordinary manufacture, but of good workmanship. Concerning these it has been thought sufficient to prepare a very short notice; but we have given more extended details in the case of those who have introduced a new principle, or a new application of known principles; and we have also dwelt at some length on those objects which are instructive, and on collections from countries little known, their study offering a great interest in geological researches, and in the development of the industry connected with minerals. It is to be regretted that these collections are only accompanied by a few isolated notes, which give but very imperfect information as to the nature of the formations, and the position of the rocks which contain them.

We propose, as mentioned in the beginning of this Report, to enumerate those exhibitors who have obtained Medals or Honourable Mention, the respective countries to which they belong following in the same order as in the Official Catalogue of the Exhibition.

THE UNITED KINGDOM OF GREAT BRITAIN AND IRELAND.

Great Britain is the most favoured country in the world for the development of mineral industry. Fuel, the indispensable agent in the treatment of metalliferous ores, and the most powerful element in the production of motive force, is distributed unequally throughout the three countries of England, Scotland, and Ireland. The coal formation in these three divisions of the British empire occupies rich and widely-spread basins, several of which, especially those of Newcastle-on-Tyne, Scotland, and Wales, being situated near to the sea which surrounds the whole country, are enabled to export the coal to those places where the metalliferous ores exist in abundance, but where, as in Cornwall, the absence of fuel renders their being worked both difficult and costly. The ores of iron, abundantly distributed in several of the coal basins, add greatly to the value of these. Each one so circumstanced has become the centre of a metalliferous district, where numerous works produce iron at a price so moderate, that no nation can compete with this manufacture with any chance of success. The insular position of Great Britain, which allows the coal to be conveyed almost for nothing wherever it is wanted, is equally important in enabling the iron to be conveyed by its ships throughout the world. These highly favourable conditions have given great development to the operations of coal mining and the manufacture of iron, and this has been especially felt since the application of cast iron for purposes of construction and the formation of the great lines of railroad.

The quantity of cast iron produced in England is as follows:—

In 1836	. . . .	1,000,000 tons.
1840	. . . .	1,396,400 „
1844	. . . .	1,210,000 „
1845	. . . .	1,512,500 „

In the following years, owing to certain important fiscal alterations, the trade received a great stimulus, and the make rose—

In 1848	to	1,998,568 tons.
1849	„	2,000,000 „
1850	„	2,250,000 „

and in 1851 to an amount probably more than double the quantity made in 1844—seven years previously.

The quantity of coal raised in 1840 is not accurately known; but in 1850 it is estimated at 34,750,000 tons. The increase must have accompanied that of the make of iron, of which it is one of the most essential elements.

The average price of coal at the pit mouth in England is estimated at 5*s.* 7*d.*, and that of pig iron at 48*s.* The produce of these two branches of industry amounts therefore to the annual value of upwards of 15,000,000*l.*, viz.:—

34,750,000 tons of coal at 5*s.* 7*d.* per ton .	£9,701,050
2,250,000 tons of pig iron at 48*s.* „ .	5,400,000
	£15,101,050

Of this vast production about one-half of the iron and one-fourth part of the coal are exported to the colonies or to foreign countries.

These sources of wealth in coal and iron, which are alone sufficient to place a country at the head of mineral industry, are not the only ones possessed by England. Nature, liberal to profusion towards this favoured country, has given it mines of copper, of tin, and of lead, also of great richness. Perhaps some day a formidable competition may arise in the case of copper, by the working of enormous masses of native copper discovered on the shores of Lake Superior; but at present the Cornish mines furnish, as we have already remarked, two-thirds of the whole of the copper consumed throughout the world. With regard to tin, England divides with Saxony and the Indian Archipelago the monopoly of the trade in Europe.

The annual production of copper in Cornwall may be estimated at about 12,000 tons,* the value of which amounts to upwards of 800,000*l.* sterling. The quantity of tin *ore* obtained annually may be estimated at 11,000 tons, the average yield of which is 65 per cent., or about 7,000 tons of metal: this, at 90*l.* per ton, would amount to 560,000*l.*

It is often supposed that England, so rich in regard to iron, copper, and tin, is comparatively poor in lead, or at least that the lead-mines are of secondary importance. This is an error arising from the fact that the production of lead, instead of being concentrated like that of copper in one or two districts, is spread over a great number of mines. Some, like those of Alston Moor in Cumberland, of Snailbatch in Shropshire, or of Wanlock in Dumfriesshire, are indeed well known, but most of the others are comparatively unknown. Their number notwithstanding is considerable, owing to the wide extent of palæozoic rocks in Great Britain, and they raise the total of production in this metal to an amount which may perhaps place England also at the head of supply in this respect. Spain is at any rate the only country that can come into competition with her.

We were not fully aware of these results when the subject first came before us; but they have been communicated to us by Mr. Robert Hunt, who is well acquainted with the mineral industry of Great Britain. According to his statement it appears that the production of lead in England is distributed in the following manner among the principal metalliferous districts:—

	Ore. Tons.	Lead. Tons.
Cornwall and Devonshire	12,328	7,945
Cumberland, Durham, Northumberland, and Westmoreland.	29,803	20,850
Derbyshire, Shropshire, & Somersetshire	10,016	6,776
Yorkshire	7,906	5,596
Wales	19,711	13,389
Ireland	2,739	1,653
Scotland	1,421	957
Isle of Man	2,826	1,535
	86,750	58,701

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* To this quantity must be added 6,913 tons of copper from foreign ores, 1851, the value of which is 522,590*l.*

In this statement of the value of the lead in England we have retained the account of the quantity of ore raised. The comparison of the two columns establishes the fact, that only 68 per cent. of metal is obtained after the mechanical preparations are completed, this being the average yield of the ores of lead in England; whilst, on the other hand, as much as 75 to 80 per cent. is obtained on the Continent. This difference in the yield of the ores is the result of the low price of fuel in England.

The brief account of the mineral wealth of Great Britain which we have here given previously to making known the results of the Exhibition, is sufficient to prove how great an interest the subject would possess if the statement could be made more complete. We greatly regret on our own account that, for the reasons given in the commencement of this Report, so many persons have declined sending contributions to the Crystal Palace. In consequence of this there are many blanks which prevent our being able to form a satisfactory idea of the immense development of mineral industry in the British Islands; and the existence of such blanks render it impossible to make a systematic classification of the objects exhibited, which would be of great use in the statement we are about to make of the rewards decreed by the Jury. This difficulty induces us to describe in succession the several establishments which have obtained Medals and Honourable Mention. In each of these groups we shall combine the objects which offer the closest analogies.

PRIZE MEDALS.

COLLECTION OF ORES OF IRON, ILLUSTRATING THE GENERAL IRON-MAKING RESOURCES OF THE UNITED KINGDOM. (427, pp. 150—159.)

The production of iron in England, which was only 30,000 tons in 1750, suddenly increased to 180,000 tons on the important discovery by Mr. Cort of the process of puddling with coal. It is now 2,250,000 tons. This vast production is distributed nearly as follows:—South Wales and Monmouthshire 700,000 tons, Staffordshire and Shropshire 600,000, Scotland 600,000, and the remainder in different proportions among the other coal districts of England.

One of the chief causes of the development of the iron trade in England has been the occurrence of iron ores in layers amongst the coal measures, so that the ore and coal for smelting it are found in the same spot, while not unfrequently the coal measures also contain the refractory clay used in the construction of the smelting furnace, and the limestone needed as a flux occurs at no great distance.

Mr. S. **Blackwell** (427, p. 150), in the interesting collection which he has exhibited, has placed this important fact in the strongest light. He has brought together the materials used in supplying each principal group of iron works, carefully indicating the exact localities whence these materials are obtained. We may thus see that the ores are not carried far, except when there is great facility of transport by canal or railroad.

The ores from the coal measures furnish, as has been just remarked, the larger part of those used in the iron works; but the resources of Great Britain are far from being limited to such ores, and Mr. Blackwell's collection furnishes with respect to this matter very interesting facts which we think it right to quote, and which the Jury fully considered in adjudicating to him a Prize Medal.

The carboniferous or mountain limestone of Lancashire, Cumberland, Durham, the Forest of Dean, Derbyshire, Somersetshire, and Wales, contains important veins of hæmatitic iron. This ore is worked in large quantities at Ulverstone, Whitehaven, and the Forest of Dean. The brown hæmatite and carbonate of iron exist in large quantities in Alston Moor and Weardale, but these ores are not at present extensively worked. In the old rocks of Devonshire and Cornwall are found veins of hæmatite, of which a large quantity is exported to the coal districts of England, and especially to Newcastle-on-Tyne. The Forest of Dartmoor is rich in magnetic oxide of iron. The lias and the oolite contain thick beds of argillaceous carbonate of iron, which are just now the object of extensive operations.

COLUMN REPRESENTING A COMPLETE SECTION OF THE THICK COAL OF STAFFORDSHIRE. (Outside 53, pp. 116, 117.)

The coal formation of South Staffordshire and Dudley has a thickness of about 315 yards, and 11 beds of coal are known. That which occupies the sixth place in descending is designated as the "main coal," and is the principal object of working. It has a thickness of 10 yards 1 foot 6 inches, and is found near the town at a depth of about 120 yards. It is usually regarded as a single bed of coal, but really consists of 12 beds, separated by thin layers of schist called *partings*. The presence of these schistose portions, and the difference that can be traced in the quality and appearance of the coal, leaves no doubt about the matter. Messrs. **Bagnall** and **Jesson**, of West Bromwich, near Birmingham, have thought that it would be interesting to show the whole of this enormous thickness of coal, and have prepared a column of the total height in which the schistose partings are carefully preserved. In order to strengthen it in its position and preserve it from injury, the column has been placed in a large box with one side open, and covered with a shed, within which is placed a sectional drawing marking the name and the thickness of each seam, and the use to which the different varieties of coal are commonly applied. Considered as an object of instruction and information, the bringing together these different materials is a work of great interest.

COLLECTION OF TURQUOISES. (20, p. 122.)

In the year 1849, Major C. **Macdonald** made a journey into Arabia Petræa, with the intention of studying the geology of the country, as well as those antiquities of whose existence he had convinced himself in a previous journey in 1845. In the course of his investigations he discovered in the country of Soualby, sixteen days' journey S.E. of Suez, five or six localities in which turquoises existed, all included within a range of about forty miles. They are situated on the further side of a chain of mountains having an east and west direction, and having a mean elevation of five or six thousand feet.

Major Macdonald collected most of his specimens of turquoise from the ravines descending this chain, but he found some *in situ*. These latter are still attached to the parent rock, which is a reddish sandstone composed of quartz grains. It resembles in appearance the old red sandstone of Brecon, and some schistose portions confirm us in the opinion that the rock belongs to the palæozoic series.

The colour of the turquoises discovered by Major Macdonald differs in the shade of blue from that of the turquoises of Persia, but agrees exactly with those brought from Abyssinia by M. Rochet d'Héricourt. Both exhibit small globular concretions, whose hardness is equal to that of agate. The nodules of turquoise form groups almost like currant-seeds in the sandstone. The intensity of the colour of adjacent lumps is different; and when the groups are of tolerably large dimensions, zones of different tints may be observed. We have remarked in this fine collection of Major Macdonald—which contains more than 200 specimens cut and polished—one stone, *en cabochon* (polished without cutting), divided into three zones in which the colour varies from an intense blue to a bluish white.

This collection also presents, besides the small concretions, veins of turquoise from a tenth to a twentieth of an inch thick, which cut across the bedding of the sandstone like small threads.

Major Macdonald experienced many difficulties and great fatigue in his journey through the desert country. The temperature was often as high as 110° Fahr. Besides those forming his escort, he employed for some days more than 300 Bedouins in his mineralogical and geological researches; and in addition to the fine collection of turquoises, of which we have just given some details, he brought away several specimens of iron and copper ore, which, from their nature, support the opinion we have offered as to the age of these mountains of red sandstone.

The analogy of external characters in the case of the turquoises from Arabia and Abyssinia is a remarkable fact. It would be interesting to compare the chemical composition of both with that of the Persian turquoises.

Hones, Grindstones, and Polishing Stones.
(84, p. 130.)

Mr. **C. Meinig** is the proprietor of one of the most important establishments in England for the preparation and sale of hones, grindstones, and polishing stones, and he obtains his materials from all parts of the world. We notice especially among the hones (oil stones) which he prepares, those of Turkey, Persia, the Arkansas, the banks of the Niagara, Spain, Peru, Ireland, and Wales. All these stones, notwithstanding the difference of locality whence they are obtained, possess very remarkable analogies. They are of a yellowish-white colour, fine-grained, and all appear to belong to altered argillaceous schists of the palæozoic period.

The grindstones offer greater variety than the hones, not only in the different localities whence the materials have been obtained, but in their respective uses. The establishment of Mr. Meinig has exhibited more than 200 kinds of grindstones, varying in size from half an inch to 24 inches, and adapted to all purposes, from the cutting of diamonds to the shaping of swords and bayonets. All of them are quartzose sandstones, of various degrees of fineness, according to the purposes for which they are intended.

Specimens of Cornish Porphyries. (141, p. 136.)

Mr. **James Henry Meredith**,* of Cornwall (141), has exhibited a collection of porphyry slabs, remarkable for the beauty of their polish. They include—

1. A black porphyry slab, polished on both faces.
2. A red porphyry slab, also polished on both faces.
3. A green porphyry slab, polished on one face.
4. A porphyry table, in which are inlaid 54 specimens of rocks, from the parish of Withiel, in the county of Cornwall.

These various slabs have been cut and polished in the granite-cutting works of Fowey Castle Mine, in the parish of Tywardreath. They are frequently used as paving-stones in the entrance-halls of large public buildings or private mansions. The mechanical contrivances used in polishing render the price very moderate.

Collection of English Granites, Marbles, and Building Stones (160, p. 137), and Cornish Granite Obelisk. (Outside, 14, p. 114.)

Messrs. **W. and J. Freeman**† have exhibited a collection of granites and marbles, as remarkable for their varieties of colour as for the beauty of their polish; and the machines that they employ for cutting and polishing stones and marbles permitting them to supply them at a moderate price, it results that the slabs and paving-stones of granite and porphyry, which were formerly employed only in public edifices and but for decorative purposes, on account of their great cost, are now to be seen frequently in private houses and for purposes of utility. As an example of the power of the machines which they employ in quarrying hard stones, Messrs. Freeman have exhibited an obelisk too large to be admitted into the interior of the Crystal Palace, and which is placed on the south side of the West façade. This obelisk is constructed of a large-grained granite from the Lamorna quarries, in Cornwall: its height is 22 feet 4 inches, and its weight 21 tons. It is placed on a pedestal of another granite worked in the Carnsew quarry, weighing 31 tons. The working of blocks of granite large enough to furnish these two magnificent specimens offers difficulties so considerable, that the Jury have thought it right to mark their sense of them by awarding a Prize Medal to Messrs. Freeman.

Slates from the Festiniog Quarries, N. Wales.
(210, p. 141.)

These slates, which are of superior quality, are chiefly in use for covering buildings. They are also employed as walls for cisterns intended to hold water; but in this case large slabs are required. Several such slabs are exhibited some of which are more than 15 feet by 8 feet. Most of them are dressed to a rough polish, but one is in the state in which it came from the quarry. Dendritic markings may be observed on its surface. The Jury have awarded a Prize Medal to Mr. **John W. Greaves**, who is the proprietor of the quarries at Festiniog, and superintends the works.

Method of Condensing the Sulphur Fumes produced in the Reduction of Lead ores. (509, p. 176.)

From the chimneys of the roasting furnaces in lead works there escape sulphurous vapours injurious to the health of the workmen, and producing great destruction to the vegetation in the neighbourhood. To obviate this mischief, the Duke of **Buccleuch** has caused to be erected at his works at Wanlock, in Dumfriesshire, a large condenser, in which the deleterious vapours are collected. His Grace has exhibited a model of his furnaces and of the products obtained at his works.

The *condenser*, constructed about 100 yards from the smelting furnaces, consists of a solidly-built rectangular block of masonry, about 30 feet high. It is divided by a partition into two chambers, the first of which, the *condensing chamber*, receives the fumes from the furnaces directly through a large pipe; while the second, called the *exhausting chamber*, communicates with a very lofty chimney constructed in the form of a tower.

The condensing chamber is itself divided into two distinct compartments by a pair of vertical walls placed only two feet from each other, and forming a kind of flat pipe, open at the top, of the whole width of the chamber, and constantly receiving water falling in drops like rain. The water is thus broken into rain by passing through a filter of pounded coal placed in the upper part of the flat pipe at a height of six feet. Four horizontal partitions, or floors, divide the condensing chamber into five compartments, each six feet high, the last exactly corresponding to a bed of coal which forms a filter for the smoke, as the one already described does for the water. The smoke, at its entrance into the condensing chamber, is obliged, in order to reach the exhausting chamber, to pass in zig-zags across the five compartments, and then go through the bed of coal. The opening which conducts the smoke from the exhausting chamber into the chimney is placed in its lower part, so that the smoke has to pass through the whole of the exhausting chamber before reaching it, and in its course it meets an abundant shower of rain, which sweeps down all the insoluble portions which are deposited along the walls of the exhausting chamber.

To obtain this shower in a regular and uniform manner, the following contrivance has been adopted in the upper part of the chamber. The top is covered with a large iron lid, having twelve grooves about an inch wide, giving it the appearance of a gridiron. On this lid is a slide, having openings of the same size, and moving upon it so as to open or close the grooves in the lid, and a current of water being conducted from the upper part of the chamber, falls at intervals through the openings, and produces a copious shower in the empty chamber.

The atmospheric pressure acts on each movement of the slide with a force resembling that of the blast of an iron furnace, and produces an action sufficiently powerful to mix the impure vapours with the water, so that the smoke at length passes into the atmosphere deprived of its injurious properties. The saturated water proceeding from these chambers is afterwards conducted into a reservoir, where it deposits the particles of lead salts that the fumes had carried off.

Models of the Furnaces, &c., of the Ebbw Vale Company. (412, p. 149.)

This Company makes use of the gases escaping from the smelting furnaces to supply a steam-engine, and has exhibited a model (on the scale of an inch to the foot) of a part of their establishment, consisting of two furnaces. The gases conveyed from these furnaces between six and seven feet below the top are conducted into a small chamber, where they are mixed with hot air, and are thence conducted under the boilers of the steam-engine they are intended to feed. According to the statement of the exhibitors, no other fuel is needed for a sixty-horse engine; and they add, that the current of gas being regulated, the heat is uniform, and the boilers last much longer than when heated with coal, which they attribute to the absence of those irregularities of temperature produced when coal is used, and the doors of the furnace are constantly being opened and shut. The exhibitors have added to this model samples of the pig and other iron produced at their establishment: these are of very good quality.

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* This Exhibitor was awarded a Medal by the Jury of Class XXVII., in whose Award List his name appears.—I. W.

† This firm was awarded a Medal by the Jury of Class XXVII., in whose Award List its name appears.—I. W.

Model of a Contrivance for Opening and Shutting the Ventilating Doors of Mines by means of a System of Levers. (418, p. 150.)

Mr. Robert Mills has introduced into the coal-mines of Foxhole, near Swansea, an arrangement of levers by which the doors connected with the ventilation of the mine are opened and closed by the mere passage of the waggons through them. During 22 years that this method has been in use, there has not been a single explosion in the Foxhole mines. The Jury, considering that this arrangement provides against the negligence of workmen, ensures good ventilation by keeping the doors regularly closed, and is an important improvement in practical mining, have awarded a Prize Medal to this exhibitor.

Safety Fuse for Mining Purposes. (424, p. 150.)

The safety fuses here exhibited by Messrs. Bickford, Smith, and Davey, consist of a small thread of fine gunpowder twisted into the middle of a rope, of which the strands have been separately tarred, the whole rope being afterwards also tarred. The different kinds of safety fuse vary according to the coating employed to enable them to resist the pressure of water.

Safety fuses, invented 15 or 16 years ago, have since then been of great service, not only on account of the accidents they have prevented, but by the facility with which they allow of shots being fired in mines, under water, and in ice. They are lighted in the usual way, and communicate with the charge after an interval determined by the length of the fuse. They are not injured by exposure to wet, and effect a saving in the quantity of powder required.

Apparatus for Changing the Direction of Rotation in Machinery. (472, p. 166.)

The model of stamping machinery applied to crushing copper and tin ores in Cornwall exhibits a peculiar method for reversing the direction of rotation, the invention of Mr. R. Hosking, to whom the Jury has adjudged a Prize Medal.

Obelisks of Coal and Building Stone, &c. (430, pp. 459—461.)

The carboniferous system in Wales contains a very compact fine-grained grit, which furnishes an extremely solid freestone, resisting the action of fire. The Abercarn and Gwythen Collieries Company has exhibited an obelisk of this stone (Abercarn), having the faces differently worked, in order to show the grain of the stone and the manner in which it may be cut.

The same exhibitors send also the different varieties of coals from their locality, and the tools used in quarrying the Abercarn stone, as well as a description of the methods adopted by them in deepening the shafts of mines. Several of the tools are of novel shape, and some appear to be well adapted for use. The mode of deepening shafts has also attracted the attention of the Jury as reducing the cost of this operation. This double reason has induced them to award a Prize Medal to Mr. Ebenezer Rogers, who represents the Abercarn and Gwythen Company.

Separation of Wolfram from the Oxide of Tin in the Preparation of Tin Ores. (485, p. 172.)

Mr. Robert Oxland, of Plymouth, who has invented this method of separating wolfram from the oxide of tin, has exhibiting a complete collection illustrating the successive operations of which it consists.

Wolfram having a specific gravity of 7 to 7·5, and therefore but little greater than oxide of tin, which is about 6·5, it is wellnigh impossible to separate the two minerals by washing, and all that can be done by the usual modes of mechanical preparation of tin ores is to bring them to a state in which they are mixed with wolfram only.

After determining by analysis the proportion they contain, a sufficient quantity of sulphate of soda is added to ensure an excess of soda relatively to the tungstic acid, and the whole is then mixed with charcoal dust to decompose the sulphuric acid, and pass the sulphate of soda into the state of sulphite. The mixture is placed in a reverberatory furnace, of which the bed is of cast iron, and is first exposed to a smoky or reducing flame; but afterwards to complete the operation it is necessary to have an oxidising flame.

The sulphate of soda being transformed into sulphide, the tungstate of iron is decomposed, and the tungstic acid combines with the soda, leaving the iron in the condition of a very fine powder. The tungstate of soda is afterwards dissolved out, and the oxide of tin separated from the oxide of iron by washing. The solution of tungstate of soda is evaporated, and the salt, obtained in a crystalline state, is sold as a mordant for dyeing purposes, replacing with advantage the stannate of soda. The tungstic acid may also be obtained, and the value of these products are sufficient to repay the cost of the process, at the same time raising the value of the ore, so that a sample which had been only worth 42*l.* per ton was sufficiently improved to be worth 56*l.* There is, therefore, a great improvement in the preparation of the ores of tin, for which a Prize Medal has been awarded by the Jury.

Collection illustrating the Manufacture of Lead. (494, p. 173.)

Mr. Joshua Byers, proprietor of a lead mine in the county of Durham, worked by himself, has exhibited a series of his products, which includes the lead ores as obtained from the Grass-hill Mine, the ores prepared for smelting, the lead in pig, sheet lead, and lead piping. There is also a cake or button of silver, and the different qualities of litharge obtained during cupellation.

The slags which accompany the common and refined lead illustrate the successive conditions through which the ore has to pass in obtaining the various merchantable commodities.

Collection illustrating the Iron Trade. (411, pp. 148, 149.)

Messrs. W. Bird and Co. exhibit an extensive collection of specimens of iron, illustrating the makes of different localities, from the lowest-priced "pig," manufactured from black-band by the use of the "hot-blast," to the more expensive, made from the argillaceous ores by "cold-blast." Also specimens of these severally decarbonized into refined metal, and manufactured into the different descriptions of bar-iron in Staffordshire, Wales, and Scotland. The several stages of the manufacture are illustrated by exhibits of railroad bars, boiler-plate, chain-cables, tin-plates, terne-plates, boiler-tubes, wire, &c.

This collection gives a very correct and instructive exemplification of the extent and variety of the iron manufacture of Great Britain, the descriptions exhibited being those of the sorts in every-day demand for home consumption and for export. It represents an annual make of not less than 500,000 tons.

Forming part of the collection are two articles deserving of special notice:—the one a round bar of iron, rolled at the works of John Bagnall and Sons, of West Bromwich, 20 feet 1 inch long, 7 inches in diameter, and weighing 2,644 lbs.; the other a cylindrical iron tube, 12 feet long and 7 inches in diameter, drawn by a patent process at the works of Selby and Johns, of Smethwick. The Jury award a Prize Medal to Messrs. W. Bird and Co. for their well-arranged and extensive collection, and to Messrs. J. Bagnall and Sons and Messrs. Selby and Johns, respectively, for the excellence of their productions.

Specimens of Sheet Iron coated with Tin, Zinc with Lead, &c., by the Galvanic Process. (436, p. 161.)

These specimens, exhibited by Messrs. Morewood and

ROGERS * (patentees), are good illustrations of the process peculiarly employed in their manufacture. The Jury being satisfied that the objects exhibited are of fine quality, and that some of them are difficult of execution, especially the sheets of galvanized tin-plate, which are of unusual size, measuring 8 feet by 3, have awarded them a Medal.

SPECIMENS OF RARE METALS AND METALLIC COMPOUNDS. (477, p. 166.)

Messrs. JOHNSON and MATTHEY, chemical manufacturers, have exhibited a complete collection illustrating the manufacture of platinum; consisting of crucibles, capsules, and a large pan of that metal. But that which has chiefly interested the Jury, and has induced them to grant a Prize Medal to these exhibitors, is the series of products, including palladium, iridium, rhodium, and uranium.

SHEFFIELD STEEL.

The steel of Sheffield has long enjoyed an European reputation. Almost every country is a tributary to its works; and notwithstanding that manufactures of steel have risen up in different parts of the Continent within the last twenty years, Sheffield has not ceased to develop its beautiful industry. Six firms have sent contributions to the Crystal Palace, and the Jury, after having made a careful examination, have decided to give a Medal to each of them; and notwithstanding that two have sent a more numerous and more neatly-arranged collection than the others, they are thus all placed on the same footing. These respective firms are—

JOHNSON, CAMMELL, and Co. of the Cyclop Steel Works (XXII., 109, p. 605.)

COCKER, S., and SON, Porter Steel Works. (XXII., 115, p. 606.)

TURTON and SONS (XXII., 190, p. 614), and

EYRE, WARD, and CO.,† (XXII., 203, p. 615).

The objects exhibited by these two firms represent the same manufactures.

BUTCHER, W. and S.‡ (XXII., 192, p. 614.)

NAYLOR, VICKERS, and Co. (XXII., 199, p. 615.)

These different manufacturers have exhibited various samples of steel in ingot and bar, and adapted for all purposes.

Two manufacturers, Messrs. Johnson, Cammell, and Co., and Messrs. Naylor and Co. (p. 605), have also exhibited models of their works. That of Messrs. Johnson is rather a general plan than a true model, but Messrs. Naylor (p. 615) have forwarded a model complete in all the furnaces, on a scale of an inch to a foot. It is finished with much care; the furnaces are so contrived that they can be opened, thus showing their internal arrangement as well as their external form. The works of Messrs. Naylor contain eight converting furnaces, nine melting furnaces with 90 "holes," or 180 crucibles. They employ 150 workmen, and produce annually 2,300 tons of steel. This is about a sixteenth part of the whole quantity of steel made in Sheffield, which may be taken at 35,000 tons, of which 18,000 are cast steel.

Besides the instruction which the study of Messrs. Naylor's model is calculated to afford, the exhibition of their products is remarkable for an arrangement which admits of the different processes of steel making, from the cementation to the final production of bars for sale, being examined.

We must also mention, as amongst the objects exhibited by Sheffield, two ingots of steel which may bear comparison in size with the fine specimens exhibited by M. KRUPP, of Dusseldorf (649, p. 1086). One of these, from the establishment of Messrs. Cocker and Son (115, p. 606), weighs 6 cwt. 3 qrs. 18 lbs. The other, called the monster ingot, weighs 2,688 lbs. It is 5 ft. 11 in. long, and nearly 14 in. in diameter, and was manufactured at Messrs. Turton's works. (190, p. 614.)

MANUFACTURE OF PIG AND BAR-IRON. LOW MOOR IRON WORKS (XXII., 85, p. 601), AND BOWLING IRON COMPANY. (XXII., 83, p. 600.)

The Jury has awarded a Medal to each of the establishments mentioned above, which have both exhibited their products, consisting of ores of iron, pig-iron, slags, coal, and bar-iron of different kinds, most of the specimens of the latter being bent and twisted, illustrative of the uses to which they may be applied, and of their respective qualities.

Although the Jury have placed these fine establishments together, it is only right to say that the exhibition of the Low Moor Works belonging to Messrs. Hird, Dawson, and Hardy (p. 601), is the more complete of the two. They have added to the raw materials and the iron, several objects manufactured in cast iron, especially a gun of very large calibre, solid and other shot, and cylinders or crushing rollers used in sugar mills.

GALVANISED IRON AND COPPER WIRE ROPES. (XXII., 30, p. 595.)

Messrs. WILKINS and WEATHERLY * have exhibited various samples of their manufacture of metal ropes and cables made according to Mr. Smith's patent. The Jury have recognised the excellent workmanship of these cables by awarding a Prize Medal to the manufacturer.

COAL TRADE OF NORTHUMBERLAND AND DURHAM. (273, pp. 146, 147.)

The COMMITTEE of the Coal Trade of Newcastle-on-Tyne has exhibited several instructive documents on the geology of their district and the methods adopted in working the mines. These include—

1. A map of the coal field of Durham and Northumberland, on which are marked the position of each shaft, the railways connected with each, the faults and other remarkable accidents which have disturbed or removed the beds.
2. Two sections of the field, one from north to south and the other from east to west, showing the relative position and thickness of all the beds.
3. A synopsis affording explanatory details of the map and sections.
4. A model, or relief plan of one of the principal mines in Northumberland, in which the mode of working and ventilating the mines of the district is indicated in detail.
5. Safety lamps used in the Durham and Northumberland mines, and models of apparatus employed in raising the coal to the pit mouth, and conveying it to the place of embarkation.
6. Lastly, a complete collection illustrating the coal formation, including all the varieties of coal found in this important field, the rock associated with them, and specimens of the vegetable markings. We have noticed in this splendid collection, containing 36 well-marked specimens of *Ulodendron majus* and *Ulodendron minus*, fossils extremely rare in many coal fields.

This collection affords, therefore, a most useful series for instruction, by completely illustrating the most important coal field of England, which gives employment to 26,000 workmen, and annually supplies about eight millions of tons of coal.

COLLECTION OF LEAD ORES AND LEAD MANUFACTURE. (484, pp. 168—172.)

Mr. THOMAS SOPWITH, F.R.S., has exhibited a complete series illustrating the production of lead, consisting of ores from several mines in the north of England, and specimens showing the different mechanical preparations and smelting processes for obtaining merchantable lead. These specimens are placed in cases with the products obtained, so as to show at a single glance everything belonging to the establishment.

To render this collection more interesting, and really a means of instruction, Mr. Sopwith has added sections of the Allenheads mine in Northumberland, and of Alston Moor in Cumberland, while the faults and disturbances of the beds in the districts where these mines exist are represented in models which Mr. Sopwith has had made after a method invented by himself.

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* These Exhibitors receive a Medal in Class XXII., in whose Award List their names are inserted.—I. W.

† These Exhibitors receive Medals in Class XXI., in whose Award List their names are inserted.—I. W

‡ These Exhibitors receive Medals in Class XXI., in whose Award List their names are inserted.—I. W.

* These Exhibitors were awarded a Prize Medal by the Jury of Class XXII., in whose List their names appear.—I. W.

The collection includes—

1. Sections of the strata at Allenheads and Alston Moor.
2. Models to illustrate mineral veins, &c.
3. Minerals associated with lead ores.
4. Examples of the various stages of progress from the mine to the market.
5. Lead and silver prepared for sale.

This interesting collection illustrates almost completely the lead veins of the north of England; and if similar collections existed of the copper and tin mines, these, with Mr. Blackwell's (p. 150) fine collection of iron ores, would form a complete series illustrating the chief metalliferous districts of England. This collection is highly interesting for the purposes of instruction, and the Jury have awarded a Prize Medal to Mr. Sopwith.

Honourable Mentions.

Grindstones from the Ardsley Oaks Quarry, near Barnsley. (Outside, 22, p. 115.)

These grindstones, exhibited by Mr. James Haywood, which are of excellent quality, are chiefly in use in Lancashire and Yorkshire, where they are employed in cutting certain parts of machines, and in grinding and mending tools. The sandstone of the quarries also furnishes a good building material.

Blocks of Coal, etc.

We mention here, together, the columns and blocks of coal placed outside the Exhibition Building along the South Side of the Western End, and numbered 34, 41, 47, and 48, namely:—

No. 34, exhibited by Mr. Edward Oakeley (p. 115), from the Coed Talon Mines, near Mold in Flintshire, North Wales.

No. 41, exhibited by Mr. Richard Barrow (p. 116), of Staveley Works, near Chesterfield, Derbyshire. This block of coal, of which the weight is estimated at 24 tons, was extracted from a depth of 454 feet.

No. 47 is a block of coal from the Brymbo Mines, near Wrexham, North Wales, and is exhibited by the Brymbo Company, working the mines.

No. 48 is a column intended to give a complete section of the thick coal of the Barnsley Mines. The different nature of the coals is here indicated, especially those for steam engines, manufactures, and domestic use. This column, which is from the Elsicot Colliery, is exhibited by the Earl Fitzwilliam.

Collection of Mineralogical Specimens and Fossils for Educational Purposes. (14.)

Mr. J. Tennant has exhibited one tolerably complete collection of minerals, and several smaller collections, to promote the study of mineralogy in colleges, and for general educational purposes. The principal collection contains rather a large number of specimens remarkable for their fine state of preservation, and for the distinctness of the crystals, and is carefully arranged and catalogued. The small collections offer on a smaller scale the most common minerals, and those of which the knowledge is most useful for the study of geology, and its application to agriculture.

Natural and Artificial Crystals of Sulphur, and the Extraction of Sulphur from its Ores. (23, p. 122.)

Mr. Samuel Highley, jun., has exhibited a series of specimens of native sulphur, and the ores (such as pyrites) from which this substance is generally obtained. He has added the different products obtained in the preparation of sulphur, and also some crystals of sulphur, produced artificially in the following ways:—

1. By fusion.
2. From solution in bisulphide of carbon.
3. From solution in camphine at various temperatures from 170° to 280° Fahr.
4. From sulpho-pentachloride of phosphorus.

These crystals, which correspond to the two forms obtained by M. Mitscherlich, possess a true scientific interest.

Collection of Gems. (24, pp. 122, 123.)

The owner of this magnificent collection, Mr. H. F. Thistlethwayte, has chiefly had in view in its formation to exhibit the great variety of colours presented by each kind of gem, and the close resemblance of tint found in stones of very different kinds, as in corundum, zircon, and spinelle.

The cut gems, to the number of upwards of 200, are accompanied by some crystals. We may mention particularly those of the diamond, which present a great variety of forms, and furnish very interesting materials for study to the mineralogist.

Phosphate of Lime, as employed for the Improvement of Soils. (36, pp. 124, 125; 46, p. 125.)

It is now twenty years since there were discovered in the marls of the lias and in the lower beds of the cretaceous series, nodules of phosphate of lime due in great part to coprolites. These nodules are tolerably plentiful in the gault of Surrey, and it has been attempted to make use of them both in the production of phosphorus, of which a large quantity is now consumed, and for agricultural purposes. It appears that the large proportion of bone phosphate which they contain, reaching sometimes to 70 per cent., produces a valuable manure. At the same time, there are no sufficient data at present with regard to the cost of this substance, which requires to be reduced to a fine powder in order to mix uniformly with the tillage soil, to enable us to determine whether it can be regarded as an available source of improvement.* Experiments on a sufficiently large scale have been undertaken within the last two or three years, and the Jury, wishing to hasten the solution of this important question, have made Honourable Mention of the following exhibitors:—

1. Mr. John M. Paine, of Farnham (36, p. 124), who has exhibited a varied collection of nodules containing phosphate of lime from the county of Surrey, and samples of the same substance prepared for the market.
2. Mr. J. C. Nesbit, of Kennington (46, p. 125), who has exhibited the phosphate in powder as used for manure.

Stourbridge Clay. (91, pp. 130, 131.)

The Stourbridge clay, obtained from the coal measures is one of the most refractory clays known, and it has long been employed almost alone in the manufacture of bricks used for lining smelting furnaces. For some years past similar clays have been found in several of the English coal-fields, and Mr. Logan, who has made a special study of the coal measures, has observed, that the beds in contact with the coal, and especially those designated *black band*, generally yield refractory clays. That of Stourbridge has thus lost part of its importance, but the facility with which it is worked makes it still very much sought after.

Messrs. King and Co. (p. 130) have exhibited specimens of the raw clay, bricks, and different objects manufactured of the clay, and a model of a glass-house, the interior of which is constructed of refractory bricks.

Porcelain and Pottery Clays from the Morley Works, Plympton, Devonshire. (101, p. 131.)

These clays, exhibited by Mr. W. Phillips, are obtained from a large deposit recently opened on an extensive scale a few miles from Plymouth, and in the southern extremity of Dartmoor. The granite of Dartmoor is in some places decomposing, and the china clay has been obtained, as in Cornwall, from a natural process of washing. The quality is extremely good; and there are exhibited with the raw material numerous objects in porcelain manufactured of it in Staffordshire.

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* Phosphatic nodules are found mixed up with fossil bones in Norfolk and Suffolk, in large beds irregularly distributed in the Red Crag, one of the lowermost beds of the upper tertiaries. They contain, on an average, about 55 per cent. of phosphate of lime, and are sold at the rate of 25s. to 30s. per ton, being used extensively in the manufacture of artificial manures. In the lower greensand of Surrey they are also met with, but their occurrence is neither in such large quantities, nor do they contain so regular a quantity of phosphate, which, consequently, render them of less commercial importance.

Sand Employed in the Manufacture of Glass. (125, p. 133.)

The greensand formation at Stone, near Aylesbury, contains a tolerably thick deposit of loose sand, in the middle of which is a bed remarkable for its whiteness. It is composed of transparent quartz sand almost pure, and yields a very valuable material for the manufacture of crown and flint glass. Dr. Lee (125, p. 133), the proprietor of the pits, has exhibited specimens of the sand, besides prisms and two spheres of flint glass, in which the sand is an essential element, and whose beauty is a proof of the purity of the material.

Collection of Ores of Tin and Copper. (468, 469, 473, pp. 165, 166.)

The **Local Committees** of **Truro**, **St. Austell**, and **Swansea** have exhibited specimens of tin and copper ore from the principal Cornish mines, and have rendered the collections more complete by including the products obtained by the mechanical preparation and fusion of the ores.

The study of these collections will give an idea of all the operations which the ores of tin and copper undergo, from the time when they are detached by the miner from the parent rock to their actual metallurgical treatment. They thus afford considerable instruction to the student, and this has induced the Jury to grant them severally Honourable Mention.

In the first of these collections there may be observed an interesting object, consisting of an ingot of tin found by Mr. J. N. Simmons in the mines of Ladock, near Truro. Its presence in the old and abandoned works have suggested the probability that this tin was cast by the Phœnicians at the time when they carried on a commercial intercourse with Cornwall.

Specimens of Lead Ore from Snailbatch, near Shrewsbury. (495, p. 173.)

We have given in the commencement of this Report (*ante*, p. 6) some details concerning the magnificent specimen obtained from these mines, and exhibited by Messrs. **Thomas**, **William**, and **George Burr**. We may add that its weight is no less than twelve hundredweight.

Ores of Zinc from Alston Moor, Cumberland. (506, p. 175.)

Mr. **John Grey** has exhibited a series of ores of zinc from Alston Moor, including specimens of several varieties of calamine and blende. He has added samples of sheet zinc obtained by the treatment of these ores. The Jury has granted an Honourable Mention to Mr. Grey, on account of the good quality of the zinc, and some improvements in the method of obtaining it.

Patent Fuel Company. (230, p. 143.)

The patented invention known as "Warlich's Patent Fuel" has for its object the manufacture of bricks made with coal-dust, and thus affords the means of rendering available a material which is otherwise of very little value. These bricks measure 9 inches in length by 6¼ and 5 inches, and weigh about 12 lbs. They are dense, give little smoke, and require a certain time for ignition. Those made with Welch coal, contain 90 per cent. of carbon, 6 per cent. of hydrogen, and 8 per cent. of ash. The specimens exhibited were made at Deptford, of coal from different localities, especially from Swansea and Middleborough-on-Tees.

Model of a Coal-Mine, worked by the Hetton Company at Newcastle. (431, p. 161.)

Mr. J. **Wales**, of Newcastle, has exhibited a model, on the scale of an inch to a foot, of the machines placed above ground connected with one of the pits worked by the above Company, consisting of the steam-engine with its boilers, the lifting apparatus, the waggons for conveying the coal, &c. The arrangements for loading the coal are also represented with accuracy. All parts of this model, even to the ropes, are executed with much fidelity and care.

Mechanical Preparation of the very poor Ores of Copper, called "Halvans." (434, p. 161.)

Mr. **Richard Taylor**, Director of the Tywarn-haile mines in Cornwall, belonging to H.R.H. the Prince of Wales, has introduced important modifications in the mechanical preparation of copper ores. These modifications, chiefly applicable to the poor ores called *halvans*, have rendered available certain ores hitherto regarded as worthless, and have even obtained from them a considerable per centage of metal. Mr. Taylor has exhibited a model of this mode of preparation, executed with much care; and to render it more complete he has added specimens of the ore in different stages, from the state in which it is brought from the mine to the ore ready for smelting.

It would be almost impossible without a plan to explain the details of an operation so complicated as the mechanical preparation of copper ores. We shall give a mere sketch.

The ore, after being picked by the hand, is submitted to a crushing mill, different in some respects from that generally made use of. It is then arranged in sizes, and washed on a very long table, where, in a series of sieves shaken by an oscillatory movement, a kind of horizontal broom turning on an axis lightly sweeps the surface of the ore, and removes the finer parts which are at the surface. The action of this broom united with that of the water, completes the cleansing of the ore; and this apparatus, which the Reporter had not before seen in any mining establishment, has a useful effect, and constitutes a marked improvement in the washing of copper ores. Mr. R. Taylor being a member of the Jury, cannot receive a Medal, as has been stated in the commencement of this Report, but the Jury have thought it right to make a special mention of his contrivance.

Apparatus for Adapting the Pistons of Pumps in Mines. (462, p. 165.)

Mr. J. **Arthur** has remarked, that often in mines the pumps do not produce all the effect required, in consequence of the wearing out of the pistons, thus occasioning a serious loss of power; and to remedy this inconvenience, he has proposed an arrangement which has for its object to force the leather furniture of the pistons to be in constant close contact with the body of the pump in which they work. According to the small model exhibited and referred to above, this arrangement consists of a copper cone fixed on the piston rod, and extending along its whole length. The piston is also provided inside with five or six iron rods arranged horizontally, and which slide on each other in the way of a latch. The pressure of the cone, which enters in close contact with the piston, acts on the rods and forces them out; these then press on the leather furniture and force it to take the exact form of the body of the pump. There can thus be no interval between the piston and the body of the pump, even if the latter has lost its true cylindrical shape by the action of corrosive waters, such as often exist in mines.

Production of Pig and Bar Iron and Steel.

We insert under this title the Honourable Mention granted by the Jury to six establishments which are similarly circumstanced, and of which the products, all of excellent quality, are the result of ordinary methods. These are—

The **Butterley Iron Company**, of Alfreton, Derbyshire (400, p. 147).

Crutwell, Allies, and Co., Blaina Iron Works, Abergavenny (402, p. 147).

Solly and Co., Seabrook Iron and Steel Works, Tipton, Staffordshire (410, p. 148).

Wingerworth Iron Company, Derbyshire (416, p. 150).

Monkland Iron and **Steel Company**, Lanarkshire (426, p. 150).

Beecroft, Butler, and Co., of Leeds (415, pp. 149, 150).

These establishments have combined with their products, consisting of pig iron, iron, and steel of different qualities and various samples, the raw materials which they employ, as the ores of iron, coal, and flux.

The series of products exhibited by the Butterley and Monkland Works are more complete than the rest. The proprietors of the former have added a considerable number of fossil remains of plants from the coal-field to their collection, taking care to specify the different beds in which they are most frequently found.

CWM AVON WORKS, GLAMORGANSHIRE. (417, p. 150.)

Mr. JOHN BIDDULPH, manager of these works, has exhibited a series of specimens of pig and bar iron and tin-plate, which are of excellent workmanship. The tin-plate has specially attracted the attention of the Jury by the evenness of the tin coating, its lustre, and the quality of the sheet-iron which forms the basis.

IRON AND TIN-PLATE OF CARMARTHENSHIRE. (500, p. 174.)

Messrs. PHILLIPS, SMITH, and Co., of Llanelly, have exhibited a collection of tin plate, remarkable for the beauty of its manufacture. It is accompanied by sheet iron manufactured with wood fuel, and especially intended for this purpose.

COLLECTION OF ALLOYS. (487, p. 172.)

Mr. C. JORDAN, of Manchester, has exhibited a series of several metals, and the alloys that may be obtained by mixing them, viz., gold, silver, platinum, nickel, lead, copper, tin, zinc, bismuth, antimony, arsenic, cobalt, manganese, iridium, cadmium, and palladium. Each of these metals and its alloys is represented by a small button with polished faces, and even by broken specimens, to show the lustre and texture. For scientific and industrial purposes, this collection offers much interest.

A notice accompanying the collection states the composition of the different alloys made by Mr. Jordan, and the temperatures at which they are obtained.

REDUCTION OF ARSENIC. (488, p. 173.)

The ores of tin are mixed with rather a large proportion of arsenical pyrites. The arsenic is separated by a preparatory roasting, and deposited in the state of white oxide in the condensing chamber above the furnace. Mr. T. GARLAND, of Redruth, who has devoted himself to the manufacture of arsenic, has exhibited a series of specimens of his products. He has arranged them in such a way as to show the different processes employed for obtaining the pure oxide and metallic arsenic.

GEOLOGICAL COLLECTION OF THE BRISTOL BASIN.
(29, p. 123.)

The Bristol basin offers examples of all the geological formations from the upper oolite to the lower palæozoic deposits belonging to the Silurian system. To give a real interest to his collection, Mr. T. HOWARD has accompanied it with a detailed geological map of the district, and with sections which show the position of the different beds and their relations with each other.

Ores of iron, zinc, and lead, and specimens of coal, complete this interesting collection; they are arranged according to the formation, so as to present the useful minerals peculiar to each geological group.

SECTIONS OF THE SCOTCH COAL-FIELDS. (220, p. 142.)

Mr. D. LANDALE has exhibited four sections of the Scotch coal-fields of Ayrshire, Lanarkshire, Mid-Lothian, and Fifeshire, respectively. These sections are not the result of direct observations, but they have been constructed by comparison of the different mines or natural sections observed along the coast, or in the numerous escarpments always existing in mountainous countries.

According to Mr. Landale's observations, the Mid-Lothian coal-field, in which Edinburgh is situated, contains 36 seams of coal, and the Fifeshire field 37.

These sections are the most complete that are known of the district. They illustrate the whole coal basin of Scotland, one of the largest and richest found in the British islands. They possess, therefore, much interest for the geological study of Scotland, and may in certain cases be referred to as affording a useful guide in working the coal.

We may state here once more that Ordinary Mention, or a special notice, has been given for productions of good workmanship, but which have not attracted the attention of the Jury by any unquestionable superiority or novel process of manufacture.

However, not to lengthen out this Report unnecessarily, we shall simply mention the objects thus noticed:—

BLOCK OF SERPENTINE (p. 113), from the Lizard Rock, Cornwall. Exhibited by Mr. JOHN ORGAN, of Penzance (Outside, West, 1).

SLATES (p. 114). Exhibited by the OLD DELABOLE SLATE COMPANY (Outside, 8), and by Mr. T. STIRLING, jun., of Lambeth (Outside, 9).

Specimen of ANTHRACITE (pp. 115, 116), weighing several hundredweights, from Cwmllyn-fell in the Swansea Valley, South Wales. Exhibited by Messrs. JAMES and AUBREY (Outside, 37).

Specimens of ANTHRACITIC COAL (p. 147), from Gwendraeth, Llanelly, South Wales. Exhibited by A. WATNEY (p. 276). This coal is entitled to notice, from the fact of its being the coal selected for the use of the boilers in the Machinery Department of the Exhibition.

MARBLES of IRELAND. Exhibited by Mr. P. L. FRANKLIN (Outside, 28, p. 115), and Mr. MANDERSON (148, p. 136).

IRISH STONES employed in decorative sculpture. CORNICES and other objects manufactured of them. Exhibited by Mr. J. C. E. LONG (78, p. 129).

PURBECK MARBLE, from the Woodyhide Quarries, used in decorative architecture. Exhibited by Mr. J. VOSS (135, p. 135).

Collection of BUILDING MATERIALS, from the county of SUSSEX (152, p. 136).

PORPHYRY, described as ELVAN STONE, from the quarries of New Quay, in Cornwall. Exhibited by Mr. JOHN NICHOLLS (162, p. 137).

Very fine EMERALDS, in the veinstone. From the Muso Mine, in NEW GRANADA. Exhibited by Mr. J. NELSON BONITTO (4, p. 120).

Collection of ORES of COPPER, LEAD, and ARGENTIFEROUS LEAD, from various mines in PERTHSHIRE. Exhibited by the MARQUIS OF BREADALBANE (7, p. 120).

The specimens from the Tyndrum Mines are remarkable for their large size, and for the beauty of the crystals of galena, which form the principal mass. The Marquis of Breadalbane, the owner of these mines, has added to the ores, specimens containing rocks and various minerals that accompany them. This interesting collection offers, therefore, an almost complete history of the lead and copper veins of Perthshire.

Specimens of JET from WHITBY, in YORKSHIRE (11, p. 121).

The jet of Whitby, specimens of which are exhibited by Messrs. SLATER and WRIGHT, forms part of a thick bed of lignite found there in the upper lias marls. It differs in this respect essentially from the jet worked in France and Spain, which is found in irregular veins in the lower marls of the cretaceous series corresponding with the gault of Sussex.

Collection from the SALT MINES of CHESHIRE, with the products, as purified. Exhibited by Mr. W. WORTHINGTON, of Northwich (57, p. 127).

Collection of different kinds of SOILS, from the neighbourhood of NEWBURY, in Berkshire (60, p. 127).

The town of Newbury is situated in a basin of lower tertiary beds reposing directly on the chalk. The nature of the soil is greatly varied by the mixture of London clay, plastic clay, and sand, associated together. The collection, exhibited by Mr. J. W. ROAKE, possesses an agricultural importance which is recognized by the Jury.

Collection of SANDS from CORNWALL, employed for building or agricultural purposes. Exhibited by Captain ROUSE and N. WHITLEY, Esq., of Truro (79, p. 130).

FINE and COARSE POTTERY CLAY, from the ISLE of PURBECK, in DORSETSHIRE (102, p. 132).

The English manufacturers in earthenware possess a high celebrity, which the Great Exhibition has brought into yet more prominent notice. A plastic clay is used in the manufacture, which forms thick beds in the small peninsula called Purbeck Island; Messrs. W. and J. PIKE, the proprietors and workers of these pits, have exhibited samples of different qualities of the clays, especially those adapted for fine earthenware, stone ware, and drainage pipes.

CRUCIBLES for metallurgic purposes (118, p. 133), exhibited by S. ANSTEY.

These crucibles are employed by copper and brass-founders. Long experience has proved their excellence of manufacture, and the quality of the clay of which they are made.

MATERIALS used in the manufacture of POTTERY and GLASS, from the county of CORK, IRELAND (121, p. 133).

Mr. J. DEERING, of Middleton, has exhibited a collection of clays from the Rostellan pits, of which he is the porprietor. These clays are employed, according to their quality, in the manufacture of porcelain, fine pottery, and terra cotta. Other materials found in the same place are much used in the manufacture of glass.

BRITISH COLONIES AND DEPENDENCIES.

The EAST INDIA COMPANY has exhibited a collection of minerals and rocks, consisting of about 450 specimens, most of them belonging to crystalline formations.

We have, however, noticed amongst these marbles, which have every appearance of being of the palæozoic age, some specimens of tertiary rocks: there also exists coal of good quality.

It is to be regretted that the labels accompanying these specimens contain no information as to their relative position, while the names of the localities are for the most part absent from the common maps of India; so that great difficulties are in the way when we attempt to make out their geographical locality. It would be very desirable that the East India Company should entrust the arrangement of this collection to some one who knows the spots where the specimens were collected, as it would then become of great value for the study of the geology of this part of Asia.

With the exception of the tin ores of Malacca, and some sulphurets of antimony, and several specimens of ochre, also from Malacca, the various mineral products of India are not even indicated in the Official Catalogue; but the Jury have satisfied themselves that the collection contains several objects of much interest. They have noticed especially the iron and steel of Salem, a district in the presidency of Madras, whence a carefully-selected series has been sent, including not only the ores, but the products obtained in the various stages of manufacture. The Jury have awarded a Prize Medal to the INDIAN IRON AND STEEL COMPANY (pp. 860—869), for this collection, and have also awarded to the HONOURABLE EAST INDIA COMPANY (pp. 868, 869) Honourable Mentions for tin working (Singapore Committee), for specimens of coal, and for the treatment of antimony, the latter process being represented by specimens of the sulphuret of antimony, and of the antimony in the metallic state.

The collection that illustrates the methods of iron and steel working shows that two distinct operations are involved—the formation of blooms or lumps weighing at most 22 lbs., and the refining, or rather forging, these into flat bars from ten inches to a foot long. This iron is always steel-like, some bars being true steel. The work resembles that of the Catalonian forges, except that it is on so small a scale, and the process might be partly understood by considering the size of the blooms; but additional proof is obtained as to this mode of working, since we find in the Indian Collection a series of models, executed in the country, of a considerable number of industrial processes, amongst which is one of the forges of Salem. By looking at this model a sufficient idea may be obtained as to the nature of the iron manufacture.

The forges appear to be temporary establishments, capable of being conveyed about from one place to another. The hearth, hollowed out at the bottom, is round, and may be about 18 to 20 inches in diameter; it is surrounded by a rim of earth about six inches high, in which are the 'tuyeres,' supplied by two pair of bellows of the shape of leathern bottles. The dimensions of the blooms lead us to suppose that only one is made at a time; the bars, which are placed on the walls of the hearth, and would be partly covered by the fuel, show that the forging is performed at the same time that the bloom is obtained. Two blacksmiths, with a man to work the bellows, complete the number of those employed in one of these little establishments, and the forging is done entirely by hand. The ore, which is principally a metalloid form of the kind called oligist, is broken into small fragments, none of them larger than a walnut, and few larger than a hazel nut, before it is smelted.

The collection also includes buttons of cast-steel from 2 to 2½ inches in diameter; this material being the *Wootz*, so celebrated in India for the preparation of Damascus blades. There is nothing to show directly in what way they have been prepared, but it is impossible to doubt from their form that they have been obtained in small crucibles.

The specimens of tin ore are all water-worn pebbles, and it is therefore very probable that the mining operations in Malacca are confined to stream works. We may conclude that there are very extensive deposits of such ores in this part of India, since a large quantity of tin is exported.

The coal exhibited is from four localities, which belong to two distinct deposits. One of these is situated south of Mirxapoor, a dependency in the province of Benares, the seam cropping out in the valley of the Sone river, which empties itself into the Ganges a little above Patna: the other is in the valley of Damoodah, emptying itself into the Hoogly very near Calcutta. This latter coal, which is of very good quality, is in cubical lumps about 18 inches a side; the other, exhibited by Mr. HAMILTON (p. 861), belongs to a bed four feet thick, the position of which in the coal measures will be understood by the following section:—

	ft.	in.
Vegetable earth and alluvium . .	3	0
Sandstone	35	0
First bed of coal	0	9
Clay, with vegetable markings . .	1	6
Argillaceous schist and clay . .	4	6
Second bed of coal	1	2
Argillaceous schist, micaceous schistose sandstone, &c.	20	0
Third bed of coal (worked) . .	4	0

Mr. Williams, who long occupied the post of geological surveyor to the East India Company, drew up a very interesting geological report on the valley of Damoodah, in which some details of the carboniferous basin of the valley are given.[*] Of this deposit, which is likely soon to have an important influence on the industrial progress of India, we willingly give a short notice.

The coal basin of the valley of Damoodah is situated in longitude 84° E., and in latitude 22½° N. It commences a little west of the point where the Barakur flows into the Damoodah, and occupies a space of upwards of ten leagues along the valley. Towards the north it reaches as far as the river Adji, on whose banks the coal formation is seen outcropping for a distance of upwards of 25 miles. It is included between the towns of Nagore and Bancoorah, the first to the north of the Adji, and the other to the south of the valley of Damoodah.

The coal measures rest on crystalline and metamorphic rocks, consisting of diorite, gneiss, and mica schist. In the hills to the north on which the actual contact is seen, there are also talcose schists with tourmaline, and schistose chlorites with magnetic iron ore. Towards the east the beds are covered up by a ferruginous sand, which is an extension of the alluvium of the plains of the Ganges.

Extensive researches have been made by the Bengal Coal Company, and by Messrs. Erskine and Co. The latter have explored chiefly in the neighbourhood of Bucktenuggur and Mungulpore, and have made known the existence of five beds of coal having a total thickness of 22 feet, as seen in the following shaft-section of one of their pits:—

	ft.	in.
Whitish and brown fine-grained sandstone, composed of quartz, felspar, and mica . .	11	0
Schistose micaceous sandstone . . .	2	0
First bed.—Slaty coal, called *Top coal* . .	6	0

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[*] The report alluded to was written in 1847, by Mr. Williams, and published by direction of the Bengal Government after his death, which took place in 1848.

	ft.	in.
Black shale, very carbonaceous	0	4
Second bed.—Coal of good quality. *Best coal.*	8	4
Black shale with vegetable impressions	0	1
Third bed of coal	0	6
Black carbonaceous shale	0	1
Fourth bed.—Coal of fair quality. *Good*	4	6
Carbonaceous shale with vegetable impressions	0	8
Fifth bed of coal	2	6

These beds have been reached in several other pits, but they seem to form only a part of the mineral riches of the basin, as the pits, opened half-way between Mummudpore and Dussul by the Dhaba Company, have made known three other seams, one of which is 10 feet thick. But, more than this, a commission sent by the government to estimate the value of the Damoodah basin, with a view to the construction of a railway thence to Calcutta, has reported that there is a total thickness of at least 54 feet of workable coal, viz.:—

	ft.	
Mungulpore	20	54 feet.
Khantagurreah	10	
Mummudpore	24	

The island of Ceylon (p. 937) is represented in the Exhibition by a collection of minerals obtained for the most part from crystalline rocks. We may mention particularly the crystals of quartz, corundum, cymophane, zircon, tourmaline, and garnet. There may also be noticed magnetic iron ore, titaniferous iron ore, spathic ore (crystalline carbonate), and the ores of manganese.

The island of Borneo (p. 988) has sent for exhibition coals from Labuan on the north-western side, besides some specimens of sulphuret of antimony, and some pepites of gold, and rolled diamonds.

The east and west shores of Australia are not represented in this Class, and the ores of copper from South Australia are the only objects worthy of notice from the south side of that vast island. These are worked by several companies, one of which "the Barossa Range Mining Company" (S. Australia 2, p. 991), has sent a series of beautiful specimens of oxide of copper, native copper, and carbonate, from Lynedoch valley, about 30 miles from Adelaide, a town whose origin dates only about 15 years back, but which has already a population of 8,000 inhabitants.

Messrs. Graham and Hallett (S. Australia 3, p. 991) exhibit a similar series of ores from the Burra-Burra mines, which have yielded 56,428 tons of ore, averaging 40 per cent. of copper between the time of their first opening in 1845 to the end of 1850, at which date more than 1,000 workmen were employed. At first these ores were smelted at Swansea, but the Company has lately constructed an establishment for reducing them on the spot, and the proprietors have added to their collection a view of this establishment, and specimens of the products obtained. The Jury have observed with interest the gradual development of this establishment in a spot till lately without any industrial occupation, and have awarded a Prize Medal to Messrs. Graham and Hallett, who have been the originators of it. They also wish to make Honourable Mention of the specimens exhibited by the Barossa Range Mining Company.

The copper ores from Australia are strictly analogous to those from the Oural; they occur in nodules disseminated in a slightly coherent sandstone or ochrey clay, and the surface of the nodules is studded over with crystals, the interstices between which are filled with clay or sand. Some of the nodules are of large size; one of them in the Burra-Burra collection measuring 2½ feet by 2 feet superficial, with a thickness of 6 inches. In the specimen the principal mass consists of oxide of copper, with the green and blue carbonates of the same metal forming an external coating; but the three minerals are not superimposed in zones, the red oxide, although principally in the centre, sending out shoots in every direction. A little native copper also occurs with the oxide.

The reporter has observed with some surprise phosphate and chloride of copper among the specimens exhibited by the Burra-Burra Company (3, p. 991). These cupriferous combinations, which are chiefly found in Cornwall and Chili, usually occur in veins, which suggest the query as to whether there are in Australia both kinds of copper ground, or whether these specimens are accidentally mixed. The labels do not enable us to reply to this query, which is of some geological interest.

Van Diemen's Land appears to have been explored in some detail, Mr. J. Milligan (p. 997) having exhibited a somewhat extensive series of rocks and minerals chiefly obtained from the east side of the island. Amongst these, and numbered 256 to 268, are several varieties of granite and metamorphic limestones, containing galena and coal, the latter mineral occurring in the river Douglas, associated with bands of carbonate of iron. We may also mention the beryls (white emerald), and yellow and orange-yellow topazes, exhibited by the same person (313 to 320, p. 998). The coal has been the object of research by a company called the Douglas River Coal Company (13, p. 993), who exhibit several specimens, showing that the fuel is compact and of good quality. The Jury have therefore awarded a Prize Medal to Mr. Milligan, and they make Honourable Mention of the Douglas River Coal Company.

New Zealand (p. 1000), like Van Diemen's Land, appears to have been the subject of a serious geological study. Eight persons have exhibited ores which are the result of their explorations, and some of the ores are already the object of practical workings. We may particularly refer to the coal of Waikato, and the copper mines of Kawaii.

The Jury have awarded an Ordinary Mention to the different exhibitors whose names we proceed to quote in the order of the Catalogue.

Hargreaves, Mr. J. (8, p. 1001). Lignite worked on the banks of the Tamaki river, New Zealand. Judging from the specimens, this lignite exhibits a passage to cannel coal, and it is stated that the bed is 5 feet thick.

Greenwood, Mr. W. (9, p. 1001). Coal and building stone; the last-named are referred to in the Catalogue as No. 17.

Connel, Mr. (10, p. 1001). This exhibitor represents the Auckland and Waikato Coal Company (of which he is secretary), who have exhibited specimens of coal from the Waikato mines.

Taylor, Mr. J. (11, p. 1001). Geological series from the copper mines of Kawaii.

Reeve, Mr. J. (12, p. 1001). Specimens of cupriferous pyrites and blue carbonate of copper, from the mines called Whitaker and Heale's near Kawaii.

Lewis, Mr. T. (13, p. 1001). Specimens of copper ores from the mines called Great Barrier Island Mines, situated 35 miles N.N.E. of Auckland.

Smith, Mr. J. A. (14, p. 1001). Specimens from Brodie's copper mines, situated 100 miles north of Auckland. The same exhibitor has also shown sulphur from White Island, in Plenty Bay; and samples of an argillaceous limestone, adapted for the manufacture of Roman cement (19, p. 1001).

Meuranq, Mr. E. (15, p. 1001). Pumice-stone from the banks of the river Waikato.

The Cape of Good Hope (p. 949) has sent fine specimens of galena, worked at the Maitland mines at Port St. Elizabeth. It also exhibits graphite from Cape Town, and iron ores from Uitenhage.

Of all the British colonies Canada (p. 957) is that whose exhibition is the most interesting and the most complete; and one may even say that it is superior, so far as the mineral kingdom is concerned, to all countries that have forwarded their products to the Exhibition. This arises from the fact that the collection has been made in a systematic manner, and it results that the study of it furnishes the means of appreciating at once the geological structure and the mineral resources of Canada. It is to Mr. W. E. Logan, one of the members of the Jury, who fills the office of geological surveyor of Canada, that we are indebted for this collection; and its value arises from the fact, that he has selected on the spot most of the specimens that have been sent to the Exhibition, and has arranged them since their arrival in London. The arrangement that he has adopted, which is entirely technical, includes eight divisions, viz.:—

Metalliferous minerals, and metals obtained from them.

Minerals which require complicated operations to render them fit for use.

Lithographic limestones and minerals employed in jewellery, and in the manufacture of glass of various kinds.

Various kinds of clays, and refractory clays.

Rocks furnishing whetstones, hones, and polishing stones.

Rocks and minerals in use for improving soils.

Materials used in construction, and rocks serving for architecteral decoration.

Combustible materials.

All these classes include materials of great interest for industrial purposes, and we think it useful to mention some more specially. The ores of iron require notice first of all for their abundance and excellent quality, as the magnetic oxide is worked in upwards of ten different localities.

The mines of Marmora, the most important of all, are situated in the west of Canada, and are worked in a mass of ore more than 100 feet thick. The magnetic ores obtained from them (4, p. 961) are accompanied by pig and bar iron from the works established on the spot, and belonging to the MARMORA IRON COMPANY. The Jury has recognised the good quality of their products by making Honourable Mention of this Company; and the same is awarded to Dr. J. WILSON (2, p. 961), who has exhibited magnetic iron ores from South Sherbroke, and phosphate of lime from Burgess.

Ordinary Mention has also been made to Mr. LANCASTER of VAUDREUIL (6, p. 961), Captain MORIN of St. Vallier (9, p. 961), Messrs. L. SEER of St. Eustache (16, p. 961), E. CARON of St. Ann, Montmorency (19, p. 962), G. DUBERGER of Murray Bay (21, p. 962), and R. W. KELLY of Gaspé (22, p. 962), who have exhibited ores of iron of different kinds.

Massive hydrous oxide of iron is an important mineral amongst the iron ores of Canada, and is worked in large masses in several localities. We may mention, particularly, that of St. Maurice, which for more than half a century has supplied the iron works and foundries of that name. The Honourable J. FERRIER, the proprietor of the mines whose products are exhibited in No. 5, p. 961, has added to the ores specimens of pig and other iron, besides slags and ashes obtained during the working of the ores.

The iron from St. Maurice is of good quality, and the products exhibited show that this establishment proceeds with regularity, in a metallurgical point of view: these considerations have induced the Jury to award a Prize Medal to the proprietor.

The exhibition of Canada includes the ores of zinc, lead, and copper, from several localities. The ores of copper from Lake Superior and Lake Huron are remarkable for their richness, and that called 'Bruce Mine,' on Lake Huron, has been worked for some years. The MINING COMPANY of MONTREAL (the proprietors of this mine) have erected an establishment for working the ores on the spot, according to the methods adopted at Swansea, and the objects sent by this Company (10, p. 961), exhibit, by the side of the ores, the various products of smelting, besides the specimens of black and refined copper. Specimens of copper and native silver, from the Island of St. Ignatius, on Lake Superior, are added to these, and the Jury has awarded to the Company a Prize Medal for these various objects.

The existence of spangles and pepites of gold has been proved, by actual investigation, in several rivers of the east of Canada, and Honourable Mention is made of the CHAUDIERE MINING COMPANY (12, p. 961), who exhibit pepites of native gold collected in the washing those streams. Messrs. BOUDOIN and LEBARE (15, p. 961) are also rewarded with a Mention for the white quartzose sands which they exhibit, which are used with advantage in the manufacture of flint and crown glass.

The last award that we have to mention in the case of Canada, is the Honourable Mention adjudged to Mr. Logan (1, p. 958), who has exhibited iron ores, lithographic stones, minerals, and various rocks. Our colleague has not thought it right to add to these the geological map he has made of Canada, a matter which the Jury greatly regret, not because they would then have been able to adjudge a higher reward for this beautiful work,—for the position of Mr. Logan, as member of the Jury, would render this impossible,—but because of the great interest it would have added to the Canada exhibition.

The lithographic stones exhibited by Mr. Logan (1, p. 958) belong to a palæozoic rock, occurring at Marmora, where the magnetic iron ore has been mentioned as forming a deposit of enormous thickness. These stones are remarkably homogeneous and fine grained; the degree of finish of the drawings that Mr. Logan has caused to be made upon them giving every promise of the quality being good. The geological position of the stones is interesting, and the reporter is not aware of such material having been previously found in the old rocks, since, up to the present time, those who practise lithography seek for stones from rocks of the oolitic series. The discovery of Mr. Logan, proving that the palæozoic rocks may also furnish good lithographic stones, increases the resources available for this important branch of engraving and drawing.

We must also notice, amongst the articles exhibited by Mr. Logan, a cast of the footsteps of an animal discovered in one of the argillaceous schists of the palæozoic period. When this schist was first laid bare to a certain extent, Mr. Logan observed the impressions of footsteps repeated several times, and he had the upper bed removed to satisfy himself as to whether they were continued. Their existence, under these circumstances, fully proves that the markings were made at the time of deposit of the bed, and thus carries back the existence of quadrupedal animals to the earliest Silurian epoch. The length of the track discovered is eight feet, and as many as twenty impressions of each foot are traceable. Besides these is an impression between the footmarks, which may be regarded as the trail either of the abdomen or the tail of the animal.

It would carry us beyond the proper limits of this Report if we were to give even a sketch of the geology of Canada, and those who wish to become acquainted with the subject must be referred to the Report for the years 1848-49 and 1849-50, addressed by Mr. Logan to the Governor-General of Canada, and published by order of the Legislative Assembly of the colony. We must, however, mention the presence of phosphate of lime and gypsum; the former disseminated in large prismatic crystals in the metamorphic limestones occurring in thick beds at Burgess, while the gypsum is found in many localities forming large irregular masses, intercalated in the upper members of the Silurian series, especially at Oneida Seneca, on the Grand River. This gypsum has an even fracture, is foliaceous, and of a fine white colour, and being very pure, may be used for the manufacture of plaster for casting.

NEW BRUNSWICK and NOVA SCOTIA (pp. 969, 970), which are only separated from Canada by the River St. Lawrence, possess a similar geological structure, and the mineral productions are identical. The first of these colonies is only represented by some specimens of lignite and asphalte, recently discovered on the shores of the Peticodiac. There are, on the other hand, two rather interesting collections from Nova Scotia, one (3) exhibited by the Central Committee of the colony, the other by Mr. S. D. ARCHIBALD, F.R.S. (2, p. 970). The Jury has awarded a Prize Medal to the Committee, its collection including the whole geology of the colony, and offering a more general interest than that of Mr. Archibald. In the latter collection (2), the object has been to illustrate the resources of New Brunswick, with regard to the manufacture of iron and steel by means of charcoal fuel; and for this purpose Mr. Archibald has added to the specimens of magnetic and specular iron, which exist in thick masses, pig iron, wrought iron, and steel made from them, besides many manufactured objects worked at Sheffield, to prove the excellent quality of the iron and steel of the colony. The Jury has granted a Prize Medal to Mr. ARCHIBALD likewise.

In the collection of the Nova Scotia Committee, we may notice very good specimens of sulphate of barytes, ores of manganese, coal in large blocks, having all the characteristics of bituminous coal, and ores of iron and copper. There are also blocks of bluish gypsum, of even fracture, and several basaltic minerals, especially stilbite, chabasie, apophyllite, heulandite, and mesotype.

The gypsum exists in several localities, grouped, for the most part, round the large inland bay called "Mines Basin," which communicates with the Bay of Fundy by a small strait. Numerous quarries are opened where this gypsum is worked in the south of the Bay, near Falmouth, Windsor, and Cenept, and in the north in the county of Cumberland, near Tower Hill, the material being exported to the United States, where it is chiefly employed as a mineral manure. The gypseous masses in Nova Scotia, as in Canada, are intercalated in the palæozoic rocks, and are chiefly found associated with beds of sandstone in this formation.

The coal appears to form two distinct basins, one at the northern extremity of the county of Cumberland, and on the shores of Chignecto Bay, and the other in the Pictou district, near the town of Egerton. The latter is the best known, and most of the specimens in the Nova Scotia collection are from it. They are accompanied by numerous vegetable impressions, especially of '*Lepidodendron elegans*,' but there are also sigillariæ more than two feet in diameter, one specimen of which is very remarkable, on account of the arrangement observable in the roots. This has been the subject of special description by Mr. Richard Brown,[*] according to whose investigations it appears that this trunk of the sigillaria was erect, and penetrated several strata. This remarkable arrangement, quoted in support of that theory of the origin of coal which supposes it to be due to an accumulation of vegetable matter *in situ* is not, however, a solitary example, as Mr. Jackson, in his valuable work on Nova Scotia[†] says, "they are invariably found traversing one or more of the strata at right angles with its layers."

The ores of iron are in the state of magnetic oxide, red hæmatite, and oligist in compact masses. The hæmatite appears to form a considerable mass, in which the ore presents the various peculiarities common to concretions; some are remarkable as containing crystals of arragonite in geodes occupying the centre, while in the same deposit sulphate of barytes occurs in tabular white crystals, connected at the base, and forming sometimes considerable masses. Occasionally, also, ores of manganese occur in radiated lumps, of a grey metallic appearance, without apparent crystals, the streak and other characters connecting the ores with pyrolusite.

Among the ores of iron we noticed particularly the massive oligist, which is studded with a multitude of fossils of spirifers, &c., and which is a palæozoic deposit in this state. It is more than 16 feet thick, and quite continuous, as, according to Mr. Jackson, it is seen at the eastern extremity of the Pictou district, and ranges westwards as far as Annapolis; the specimens in the Exhibition, one of which is almost cubical, measuring 2 feet on each side, being from the latter place. In this deposit, so remarkable for its richness and extent (ranging for upwards of 100 miles), the ferruginous bed is not constantly traceable at the surface, having only been noticed from place to place at intervals, but the red colour of the soil, and the regularity of the stratification, render it highly probable that the bed of ore is continuous. It is intercalated among shales of the palæozoic period, traversing Nova Scotia in a direction bearing N. 60 E., with a remarkable regularity. The dip, which is about 50° to 60° towards the north, is equally constant.

The **Island of Trinidad** is the last of the British Dependencies to be mentioned in this Report. The Governor, **Lord Harris**, has exhibited (1 to 35, p. 972) a series of useful minerals, which either have been the object of research or are now worked. They consist of ancient rocks, yielding good building material, and the following minerals, viz., magnetic iron ore, hæmatitic iron, yellow ochres, pyrites which exist in sufficient abundance to be employed in the manufacture of sulphur, and lastly bitumen. The latter mineral is collected on the surface of a lake, around which are extinct and active volcanoes, and is represented by a collection of specimens of bitumen of various degrees of purity. The Jury has awarded an Honourable Mention to **Lord Harris**, as an acknowledgment of his interesting exhibition of the geology of Trinidad.

United States of America.

The geological works that have been published on the United States, among which must be mentioned as of the first importance the Reports addressed by several distinguished scientific men to different legislative assemblies of the Union, have satisfied us that this part of North America is destined to occupy an important place in the development of mineral industry.[*]

It results from these Reports, that magnetic iron ore and specular iron ore or oligist occur in many states of the Union in an abundance not in any way inferior to that of Sweden. In America, also, as in Northern Europe, forests exist almost untouched, which will provide for centuries the fuel required to supply numerous iron-making establishments. The immense blocks of native copper discovered in the trap formations of Lake Superior exhibit a degree of richness surpassing that of all known ores; and if the working of these remarkable deposits confirms the expectation raised by the investigations and researches carried on for some years under the direction of Mr. Jackson, Michigan will soon become one of the richest metalliferous districts in the world.

The exhibition from the United States does not, however, completely illustrate these sources of wealth, for we find them represented by only four iron-works, one manufactory of zinc, and some isolated specimens from iron mines in the states of Pennsylvania, New Jersey, Massachusetts, New York, and New Hampshire. We may add to these some fine blocks of anthracite from Pennsylvania, and the ores of copper from Lake Superior, one specimen of which weighs 2,544 lbs.

The iron exhibited by these different establishments is of excellent quality, and reminds one of the soft iron of Berry, and the iron so highly valued from Sweden. We regret not to have been able to procure any information, either as to the quantity of iron produced annually in these works, or the mode of manufacture. We know that the operations are carried on for the most part with charcoal fuel.[†]

The series exhibited by three of these establishments are nearly identical, and the Jury have not been able to distinguish any superiority between them. A Prize Medal has therefore been granted to each, viz.:—

Messrs. Morris, Jones, and Co, Philadelphia, Pennsylvania (44, p. 1435).

Trenton Iron Company, at Trenton, New Jersey (167, p. 1443).

Adirondac Manufacturing Company, New York (344, p. 1456).

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[*] Quarterly Geol. Journal, for 1849, vol. v. page 539.

[†] "Mineralogy and Geology of Nova Scotia," by Charles T. Jackson and Francis Alger, page 70.

[*] Those Reports include "Geology of the State of New York, by Mr Emmons, Professor at Williams' College, and by Mr. Vanuxem," 3 vols. "Mineralogy of the same State by Mr. M'Beck, Professor of Chemistry at Rutger's College, New Jersey," 1 vol. "Report of the Geology of Connecticut," by Mr. Shepherd. "Report on New Hampshire," by Mr. Jackson. "Report on the Geology of the State of Maine," by Mr. Jackson. "Geology of Nova Scotia," in 1 vol. 4to, by Mr. Jackson. "Report on the Copper Mines of Lake Superior," by Mr. Jackson. "Report on the Geological Constitution of Massachusetts," by Mr. Hitchcock.

[†] The annual make of iron in the United States is estimated at 400,000 tons. This quantity is the produce of about 298 furnaces, which are in constant operation, the low price of foreign (chiefly English) iron in the market having thrown several out of blast. Of these 298—

57 are anthracite furnaces, and make 50 tons each per week (average);
7 are bituminous coal furnaces, and make 22 tons each per week;
4 are coke furnaces, and make 48 tons each per week;
85 are charcoal furnaces (hot-blast), and make 21 tons each per week;
145 are charcoal furnaces (cold-blast), and make 14 tons each per week.

The objects exhibited consist of iron ore, slags, pig iron, and different specimens of iron. The Adirondac Company has also added manufactured iron and bars of steel, remarkable for the delicacy and evenness of the grain. The Trenton Iron Company has exhibited iron and iron wire of different numbers. One of these, of extreme delicacy, is also not less remarkable for the regularity with which it is drawn than for its great tenacity.

The exhibition from the iron-works (202, p. 1450), belonging to Messrs. MORRELL, STEWART, and Co., of Cincinnati, in the state of Ohio, is less complete, containing neither ores nor pig iron, which makes it probable that this Company has not erected smelting furnaces. The sheet iron produced by them is of good quality, but the difference we have mentioned has induced the Jury to limit their acknowledgment to an Honourable Mention.

The ores which supply these several works consist chiefly of magnetic oxide, oligist, and spathic iron. The dimensions of the blocks of ore, and especially of the spathic iron, which are upwards of 20 inches a side, afford satisfactory proof of the riches of the deposit; and with regard to some particular localities, we have descriptions which seem to show the presence of ores even on a larger scale than in Sweden and Elba, and where the magnetic oxide and oligist appear to have been erupted.

According to the description of Mr. Emmons,* the mass of magnetic ore which supplies the works at Adirondac is the most remarkable of all for its thickness and extent. It would seem to occupy, at the height of Lake Henderson, the whole of the valley of Adirondac for more than 15 miles in length, reappearing on the shores of Lake Sandford, and having a range of more than eight miles. In each of these localities there is a band of magnetic iron ore more than a mile wide, not stratified, but forming three distinct veins, manifested by differences of grain, and even by the quality of the iron made from each, without the chemical composition indicating any distinction. Often these veins are cut by others of a different kind; just as we sometimes see veins of large-grained granite penetrating masses of fine-grained rock of the same kind.

It is an interesting fact, and one we feel it right to mention, because it may to a certain extent throw light on the causes which determine ores of a similar nature to yield iron of various qualities, that in the Adirondac mines, a contact with trap rock is observable. Mr. Emmons states that, "when the mass of ore is intersected by a trap dyke, its appearance is more crystalline, the reduction of the ore is a slower operation, and the iron obtained is hard and difficult to work."

A Prize Medal is also given to the NEW JERSEY EXPLORING AND MINING COMPANY, the seat of whose operations is at Newark in New Jersey, and which has exhibited (166, p. 1447) zinc obtained from "*franklinite*," and some fine crystals of this mineral. The composition of franklinite, which is oxide of zinc combined with oxide of manganese, probably requires a different treatment from that pursued in Belgium, Silesia, and England, to obtain metallic zinc. We should have been glad to learn the nature of the difference, but were not able to obtain any information on the subject, neither were we able to obtain a specimen of it, which we wished to possess in order to repeat the analysis made by M. Berthier on specimens mixed with magnetic iron ore and veinstone.

Honourable Mention has been awarded to seven exhibitors, whom we shall mention in the order of their insertion in the Catalogue.

Mr. C. W. PEALE, of Hicksherville, in Pennsylvania (74, p. 1438), for very fine specimens of anthracite, and the accompanying rocks. These specimens agree with an interesting description given of the mines of Pennsylvania, and place this fuel among the carboniferous series.

Mr. W. DARLING, of Reading, in Pennsylvania (191, p. 1449), for iron ores and metallic iron.

Mr. A. J. ROUSSEAU, of Troy, New York (314, p. 1454), for iron ores.

Mr. W. LEE, New York (322, p. 1456), for spathic iron ore, each specimen measuring upwards of a foot every way. This ore contains a little manganese, and passes into the state of hydrous oxide on decomposition. It forms a vein of great thickness, and has been followed to a considerable distance.

Messrs. W. and J. W. WARD, of Boston, Massachusetts (408, p. 1462), for specimens of copper ore.

Mr. G. H. RUGGLES, also of Boston (416, p. 1462), for sheets of mica of very large size, used for the doors of stoves, as being transparent and allowing the fire to be seen through them. The construction of the stoves is such, that the heat, which is probably carried to the back of the fire, does not attack the mica, and it often lasts several years.

Dr. FEUCHTWANGER (469, p. 1464), of New York, for a collection of minerals, fossils, and fresh-water shells, collected in America. In this large series of specimens, which are in rather a bad state of preservation, perhaps occasioned by their transport to Europe, there are several rare minerals, especially zoolites from trappean rocks. There are also cystalline diamonds, some fine topazes, and specimens of native copper and silver. The mass of native copper from Lake Superior, mentioned at the beginning of this account of the United States products, and weighing 2,544 lbs., belongs to this Exhibitor, and bears marks of the chisel which prove it to have been part of a still larger piece. It will be seen, indeed, from the brief notice here subjoined on the deposit of native copper in Lake Superior and the Isle Royale, that masses have been extracted whose weight exceeds 10 tons.

Deposit of Copper on the Shores of Lake Superior.

The peculiar nature of the deposit of copper in the state of Michigan, and the influence that this discovery may have on the production of that metal, have induced the Reporter to give some details on this important fact in relation to the mineral industry of the United States. They are extracted from the interesting Report published by Mr. Jackson,* on the researches that have been instituted to make known the circumstances of this deposit, and the well-founded expectations to which it gives rise.

We must first remind the reader, that the discovery of copper on the shores of Lake Superior is not so recent as is generally imagined, as it dates from very shortly after the establishment of the French in Canada; and if at that period it led to no results, the reason was that the country being then occupied exclusively by the Indians, was little accessible to the colonists, while, as far as the Indians themselves were concerned, very ancient superstitions prevented them from making any long stay at Keweenaw Point, where the existence of the native copper was first determined.

The antiquity of this discovery is attested in a work published in Paris in 1636, by M. Logarde, who states that M. Truchemont Beusle had given him an ingot of copper, obtained 100 leagues west of Lake Huron. A second notice of the existence of a mass of copper in this part of America is given in the account published in 1666, by Father Claude Allouez, of the Mission of the Holy Ghost at Outaonoes, in Lake Tracy or Superior. He there states (chap. ii., p. 32), that copper exists in abundance on the south shores of this lake, at 50 or 60 leagues beyond the Leap of St. Mary, on the other side of the place called Missipiconatong.

It is clear from later publications, that the trace of this discovery was never lost, and several travellers, amongst whom may be mentioned General Cass, have personally verified its correctness. But the first scientific researches commenced only in 1842, and were made by Dr. Douglass Houghton, attached to the government of the state of Michigan as geological surveyor, but who died on the coast at Keweenaw Point before his observations were published. The details that we have at present concerning the deposit are due to Mr. Jackson, who has made a detailed study of the district.

According to the description given by this distinguished geologist, the native copper exists on the shores of Lake

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* "Geology of New York," Part II., by Mr. Emmons, Professor of Natural History, at Williams' College, p. 246.

* "Geological and Mineralogical Reports," by Mr. Charles Jackson, November 1849.

Superior in two distinct deposits, one towards the northern extremity of the state of Michigan at Keweenaw Point, which forms a projecting headland towards the middle of the south shore of Lake Superior, and the other in Isle Royale, situated in the lake, about 50 miles north of Keweenaw Point. This island, which ranges north-east and south-west, lies exactly parallel to Cape Keweenaw, and to the strike of the beds of which it is composed. It presents also a geological construction identical with that of the shores of the lake. The two deposits occur in the same formation, and under circumstances precisely similar.

Mr. Jackson's geological map shows that the Michigan shore of the lake consists of granite, trappean rock, and red sandstone belonging to the lower Silurian series. The trap, like that of Scotland, is composed, according to Mr. Jackson, of an aggregate of crystals of hornblende and feldspar, mingled with crystals of magnetic iron ore. There are also found, occasionally, prenite, datolite, laumontite, chlorite, and laminated calc-spar.

The sandstone and trap form parallel bands, running due north-east and south-west. At Cape Keweenaw the sandstone is seen to the right, and the trap to the left. At Isle Royale the south shore is the only one on which the sandstone can be traced, so that from this arrangement the trap would seem to form two parallel bands. The separation of the sandstone and trap is marked by a conglomerate, called by Mr. Jackson, trap-tuff, which consists of fragments of sandstone, compact trap, melted trap, amygdaloid, and sometimes pebbles of old rocks. In many localities, especially at Eagle River, this conglomerate is of considerable thickness, and has been falsely regarded as belonging to the palæozoic epoch. Near the junction the trap is amygdaloidal, and seems to have undergone a certain modification of texture at its contact with the sandstone. The cavities are filled with chlorite, agates, laumontite, pectolite, and laminated calc-spar, in small concretionary nodules, the size of which varies from that of a grain of millet to a musket-ball. The surface of the included calc-spar and agate is covered by a film of chlorite, so that when first removed they look like small nodules of chlorite, and their true nature can only be determined by breaking them. It has been noticed in the course of the operations carried on by the Lake Superior Company, that when the cavities were filled with chlorite nodules, "there was always a grain of copper in the centre. Elsewhere, and near the veins of copper, the included minerals in the same amygdaloid were occupied by copper or native silver, or by these two metals at once."

Native copper and silver are found at Cape Keweenaw and Isle Royale only in the trap formation, all the important veins forming together a narrow zone in the amygdaloid. When a vein of copper penetrates the trap it at once thins out, and only affords a thin film not worth working. The sandstone and conglomerate form also another limit of the metalliferous band, and when the veins do not terminate at the contact of the sandstone, the part extending into this rock is filled with calc-spar instead of copper. It hence results that the thickness of the amygdaloidal band intervening between the trap itself and the sandstone becomes the limit of the cupriferous veins, and this thickness rarely exceeds 2,000 feet. The depth of the veins is unknown, but Mr. Jackson imagines that they extend below the sandstone.

At Keweenaw Point the cupriferous zone may be about 120 miles in length; and in Isle Royale it ranges through the whole extent of the island, which is about 45 miles long. The richer portions are unequally distributed; and Mr. Jackson states that his numerous researches, extending over several years, have made known to him almost all the places where workings may be carried on with advantage.

The trap forming a band in the middle of the sandstone, there occur, of course, two amygdaloidal zones at the contact of the rocks. A marked difference is always observed on the two sides, both in the quantity of copper and the state in which it is presented. The difference may, however, have reference to the nature of the trap. Metallic copper is chiefly found in the north zone at Keweenaw Point, while in the south the copper is in a state of sulphuret. The trap here is a porphyry, consisting of a compact felspathic base with crystals of felspar. On the small lake called "La Belle Mine" (near the extremity of Keweenaw Point, and which belongs to the southern zone), the trap rock is very crystalline, and resembles syenite.

We will not follow Mr. Jackson in relating the details of the veins, of which he has explored upwards of a hundred, merely stating that these veins are generally transverse to the amygdaloidal band. In Copper-fall's mine they take a direction from N. 25° W. to N. 30° W. and S. 25° to 30° E., almost at right angles to the line of separation of the trap and sandstone, and the dip is here 70° W. These veins are 18 inches wide, of which metallic copper occupies at least a fourth part. Mr. Jackson states that he has seen a mass 20 feet long, 9 feet wide, and from 4 to 6 inches thick taken from these mines. The mass weighed about 10 tons.

These masses of large dimensions are not rare, and to give an idea of the richness of the mines and the expense of working them, Mr. Jackson states in a Report, dated 26th September, 1848, "that the produce of the mines for one year had been nearly 43 tons (95,994 lbs.) of ore, containing 70 per cent. of metal, or about 30 tons of copper in all. This produce was the result of the labour of 33 men, of whom 20 were miners and the rest labourers. Among the masses of copper obtained from these mines, he mentions four whose respective weights were 7,018, 7,484, 7,678, and 14,000 lbs.

Austria.

The Exhibition affords but a very imperfect view of the mineral resources and mineral industry of Austria; for the working of mines is really very actively carried on in the different states of this vast empire. The difficulties we have referred to at the commencement of this Report, and which have prevented so many persons from taking a part in the Exhibition, have been especially felt in a country whose territory reaches the sea in only a few points, and whose average distance from London is upwards of 500 leagues. It thus happens that the numerous industrial occupations carried on in Austria, and referred to the consideration of this Jury, are represented by only 50 exhibitors, 30 of whom are occupied exclusively in the production of iron and steel. Of this number again, Carinthia, Styria, and Upper and Lower Austria, have furnished two-thirds, and the mines of copper, mercury, cobalt, and nickel in Hungary, those of pyrites in Bohemia, and of arsenic in Salzburg, complete the list. Among the objects missing, and of which the absence is most to be regretted, must be mentioned the various methods of mechanical preparation so well understood in Germany. These would have been especially instructive; for at the present time, when mines formerly abandoned as yielding ores too poor to pay for working are being re-opened in order to draw from their rubbish those valuable portions neglected by the ancients, it is much more by improvement in mechanical preparation that economy can be introduced into these difficult operations, than by any metallurgical processes which have long since been carried to a high degree of perfection.

In order to give some interest to the enumeration of the establishments who have obtained Medals or Honourable Mention, as well as to indicate their relative positions, we here give a rapid notice of the principal sources of mineral wealth in Austria.

Almost all the states of the Empire possess important deposits of iron ore, and the abundance of wood has rendered it possible to introduce everywhere numerous establishments for working these ores. Styria, Carinthia, and Lower Austria are the most important districts, and deserve special mention on account of the abundance and quality of the ores as well as for the peculiar methods of manufacture adopted there.

The most common of the ores of iron is the sparry carbonate (spathic iron), which forms very thick beds, intercalated amongst the grauwacke and Alpine limestones on the north and south flanks of the axis of the Alps. Of those in the northern district we may mention the deposit at Erzberg, near Eisenerz, in Styria, which has been celebrated for many centuries, and which has furnished upwards of two millions of *measures*,* equivalent to 110,000 tons of excellent ore, smelted in the works of Hieflau, Eisenerz, and Vordernberg. Other deposits, not far off, supply the adjacent works of Neuberg, Mariazell, &c. On the southern side of the central chain the deposits of spathic iron are equally abundant, and furnish ores to the works in Carinthia, of which we may mention Lölling, Hüttenberg, and Wolfsberg.

The brown hæmatites, without being so abundant as the spathic ores, perform a very important part in the production of iron in Austria, and chiefly in the southern districts. In Carinthia they occupy veins and form beds in the grauwacke, and in the micaceous schists.

The hydrous oxide of iron, which is a third ore worked abundantly in this country, exists in more modern formations, or at least in rocks which have been less altered, and have not been subjected to metamorphic action. The principal establishments in the south of Austria are supplied from this ore.

The spathic ores and hæmatites are well adapted for the manufacture of steel and strong iron. They occur in calcareous or quartzy veins, and the only injurious substances found with them consist of a small quantity of metallic sulphurets, chiefly copper pyrites disseminated in patches amongst the spathic iron. The presence of these sulphurets requires sometimes a careful picking to separate the fragments in which they are most abundant, and also an exposure to atmospheric action, by which they are decomposed. The spathic ores are, however, always roasted before being smelted, partly in order to get rid of any sulphur that they may contain, although the chief object of this operation is to decompose the carbonates, and thus render the ore more porous and more easily reduced.

The rapidity with which these ores are smelted is ultimately so great, that more than 20 tons of pig per day are obtained from the furnaces at Lölling with an unusually small consumption of charcoal, the proportion being indeed less than one part of charcoal for one of pig; the result in one case ranging as low as 0·83 charcoal for 1·0 of pig.

In Styria are still used occasionally the small Styrian forges; but the principal establishments have adopted reverberatory furnaces for puddling, forging, and other purposes in iron-working. The employment of these reverberatory furnaces is interesting on account of the different kinds of fuel consumed in them: thus at Schlegelmühle, near Gloggnitz, they use gases produced in a special apparatus; at Neuberg and Wolfsberg, wood, either simply air-dried or baked in ovens, is employed; at Mentern, near Loeben in Styria, air-dried turf; and at Prevaly, in Carinthia, lignite.

In the further processes of iron-making, and especially in the manufacture of sheet-iron, the use of turf is common in the Styrian works. We may especially refer to those of the valley of März, where we have had the opportunity of observing the operation.

The refining for steel is performed in small Styrian hearths, and the steel thus obtained is of excellent quality. It is indeed only necessary to refer to the Styrian scythes, whose reputation extends over the whole world, as sufficient proof of the excellence of this material.

Iron and steel are by no means the only sources of mineral wealth possessed by Austria. In Carinthia, and especially at Raibl and Bleiberg, are mines of lead greatly valued for the remarkable purity of the metal. Hungary, Transylvania, the Banat, and Bohemia, also possess important mines of galena, grey argentiferous copper, tellurium ore, gold and silver, antimony and tin.

The mercury mines of Idria in Illyria are almost as rich as those of Almaden in Spain. These two mines furnish nearly the whole of the mercury employed throughout the world in reducing the ores of silver, and other purposes for which this metal is needed.

The copper mines of Agordo, in the Lombardo-Venetian territory, must also be mentioned among the mineral resources of Austria. They are not, at present, in an active state, but everything leads to the conclusion that the deposit is an important one. We must also refer in this enumeration to the salt mines of Transylvania and Wieliczka, celebrated not less for the enormous extent of the excavations than for the thickness of the deposit.

We have just stated, that the Austrian exhibition, as referred to this Jury, is chiefly remarkable with regard to iron, and we have also observed, that the iron-works being grouped into natural districts determined by the position of the ores and the abundance of forest, the working in iron and steel must necessarily present very similar products. The Jury have thus had some difficulty in the distribution of the rewards, and they have been for the most part guided in their decision by the greater or less care shown by the different proprietors to exhibit their methods of working, and by the elaborateness rather than the nature of their products, which are all generally of the finest quality. There is, indeed, only one exception to this, the case of the BARON VON KLEIST (424, p. 1031), to whom a Council Medal has been awarded for a sheet iron, called paper iron, of extreme thinness and great strength. This beautiful material, which is altogether peculiar, has been unanimously considered by the Jury, as well as by those gentlemen whom they associated with them, as worthy of the highest distinction. The details already given at the commencement of the Report on the sheet iron of this Exhibitor have made known the motives for this decision of the Jury, and we only now, therefore, refer to them.

Of the other iron-masters the Jury have more especially distinguished eighteen, to seven of whom Prize Medals have been granted, while the others, whose exhibits were less complete, have been Honourably Mentioned. We proceed to speak of each in the order of their occurrence in the Catalogue. The objects exhibited being, for the most part, similar, we only give details where there exist some essential points of difference.

ZOS, Widow, CARL, of Tauerburg, in Carniola (405, p. 1030). This exhibitor has added to the iron ores used in her foundry the grey pig for wrought iron, white pig for steel, and the different qualities of iron and steel which she manufactures. She has also sent some manufactured iron, especially nails, and has accompanied these objects by the slags and cinder obtained at the different periods of the process.

Most of the products of the Tauerburg works are exported to Italy, where they are much valued. Till within a few years, there was only a small quantity of iron manufactured at this establishment, but latterly it has much increased. The difficulties experienced in developing an industrial occupation so complicated as that of iron, in a poor country where everything has to be provided, speak at once in favour of the excellence of the products of these works, and the wise and enlightened spirit which conducts them.

COUNT FERDINAND VON EGGER, of Carinthia (409, 410, 425, p. 1031). The Jury have associated in one notice the products of the works at Lippitzbach, Freibach, and Feistritz in Carinthia, all belonging to the Count von Egger, and exhibited by him. The pig and bar iron are made at Lippitzbach, and the other two establishments are intended for the manufacture of iron and steel. The products exhibited in No. 425 include blistered steel, rolled steel, and steel wire.

The puddling and reheating furnaces in these works are supplied with wood fuel, and the work proceeds with great regularity and great economy. The establishments of Count Egger were the first in Austria in which the English methods were introduced, and they have served as models, their proprietor having, in the most disinterested manner, permitted them to be copied.

IMPERIAL DEPÔT OF IRON MINES and IRON WORKS at Vienna (408, pp. 1030, 1031).

The Austrian Government possesses several iron and steel works in Styria, the products of which have been collected and exhibited together under this title. They include—

1. Spathic ores, for the most part passed into the state of hydrous oxide, and yielding an ore of very fine quality.

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* The "measure" is equivalent to 56 kilogrammes, or about 123½lbs.—I. W.

2. Grey pig, from the foundries of Zell, in Styria, which enjoy a high reputation in the country.

3. White pig, from Eisenerz, in Styria, of different qualities, from a finely-porous to a large laminated grain.

4. Specimens of steel, raw, forged, and cast.

5. Slags and cinder produced in the various processes of smelting and preparing iron and steel, according to the different ways in which the furnaces are worked.

6. Manufactured iron and steel. We may especially notice here the rails, of whose admirable quality the Jury have satisfied themselves, and which afford a fracture remarkable for the homogeneity of the grain.

Töpper, A., of Scheibbs, Lower Austria (411, p. 1031). Among the numerous objects sent by this exhibitor, we specify particularly the hollow iron made at his foundry. The tubes are of excellent quality, and we learn from Professor Tunner, the Austrian member of the Jury, that M. Töpper's establishment enjoys a high reputation for the manner in which it is directed, as well as for the excellence of its produce. The work is carried on in a very economical manner, and for 15 years the gases of the furnaces have been used economically in some of the operations.

Prince Schwarzenberg, of Murau, in Upper Styria (417, p. 1031). The foundry of Murau is intended for the production of hard iron and natural steel: the exhibition made by the Prince is very complete, presenting an assortment of different qualities of iron and steel, as well as cinder of all the operations. We may again state that the steel is of admirable quality, enjoying a well-founded reputation in Austria and the Lombardo-Venetian Kingdom.

Fischer, A., of St. Ægide, in Lower Austria (420.) Brown spathic iron ores; white, grey, and speckled pig, obtained from charcoal fuel; bar iron of different kinds; steel, raw and forged; iron wire, rolled and drawn. All these are of excellent quality. The mechanical arrangements in M. Fischer's works are remarkable for their finish, and for the facility with which they admit of the different operations being performed.

The Wöllersdorff Tin-plate Works, Lower Austria (423, p. 1031). This establishment, intended for the manufacture of tin-plate, is of modern construction, and the proprietors have availed themselves of the most recent mechanical improvements and contrivances. The products are not inferior in quality in any respect to the best tin-plate manufactures in England and Belgium. This is considered to be the largest establishment of its kind in the country.

The different iron-foundries, whose various products we have here mentioned in a very summary way, have each obtained Prize Medals; and before proceeding to give a few details concerning those other establishments of the same nature which have been adjudged Honourable Mention, we desire to notice one more to which the Jury have awarded a Prize Medal. It belongs to J. B. Egger,* of Villach, in Carinthia, and it has for its object the manufacture of sheet lead and lead tubing. The products exhibited (435, p. 1032) are tubes of various bore and different dimensions, one of them being 1800 feet long. Notwithstanding this great length, the bore is perfectly cylindrical, and the thickness is the same throughout.

The Jury have awarded Honourable Mention to the following Exhibitors:—

The Community of Radmeister, at Vordernberg, Styria (400, p. 1030). A collection of ores, pig iron, slags, iron, and steel. The furnaces, which have been recently enlarged, are worked with hot blast.

The Prince Fürstenberg, Bohemia (412, p. 1031). The products of his foundries in Bohemia, especially the boiler-plate, are all of very excellent quality.

The Count von Bouquoi, Kallich, Bohemia (414, p. 1031). In these works bar iron is obtained from turf fuel. The sheet iron, both black and white, appears very fine.

The Count G. Andrassy, of Dernö, Hungary (415, p. 1031). In these works the puddling and reheating of the iron are carried on by the aid of reverberatory furnaces, supplied with the charcoal of brushwood, otherwise of no value. This important modification, which has introduced a great economy in the manufacture of the iron, is not alluded to in the collection of products from the Dernö foundry.

Fischer, B., of Traisen, Lower Austria (421, p. 1031). These works chiefly manufacture cast steel; their products are carried into all parts of Germany.

Huener, F., of Josefalthal, Styria (428, p. 1031). Iron and steel wire of different kinds. The Jury have noticed steel wire of very excellent quality, one specimen being remarkable for its extreme fineness and great tenacity.

Schedl, Carl, Wasserlug, Lower Austria (429 p. 1031), likewise exhibits iron wire of fine quality.

Ordinary Mention is made of the following:—

Imperial Foundries of Pillersee and Tennbach, in the Tyrol (407, p. 1030).

Foundry of the Chapter of Gurk, at St. Magdalene, Carinthia (416, p. 1031).

Steel Works of Mr. J. Pfeiffer, at Spitzenbach, Styria (418, p. 1031).

Steel Works of the Count von Thurn, at Streileben, Schwarzenbach, and Müss, Carinthia (419, p. 1031).

Forges of Mr. H. D. Lindheim, at Plau, in Bohemia (422, p. 1031).

Other Metals besides Iron.

Of the whole number of collections which relate to the production of other metals than iron, the Jury have remarked six as possessing interest from the methods they indicate and the objects they exhibit, each of which has been deemed worthy of Honourable Mention. They are as follows:—

Imperial Administration of Mines in Vienna (2, p. 1006). For a collection illustrating the processes of obtaining mercury in Idria and lead at Bleyberg, and for extracting sulphur from pyrites at Sworzowicz, in Gallicia, and at Radoboj, in Croatia.

Szumrak, J. F., of Neusohl, Hungary (4, p. 1006). Ores of cobalt and nickel from Boiza, with metallic nickel and cobaltiferous products. This collection illustrates the preparation of nickel, the oxides of cobalt and nickel, and the different smalts obtained from cobalt.

Kochmeister, F., of Pesth, Hungary (5, p. 1007). Similar products obtained in the preparation of nickel and combinations of cobalt.

Volderauer, G., of Salzburg (13, p. 1007). Preparation of arsenic, of the white oxide of arsenic, and of yellow and white glass made with this metal.

Count Ferdinand von Erwein Schönborn (15, p. 1007), and the Prince von Lobkowitz (16, p. 1007), who have exhibited a fine collection of pyrope garnets, rough and cut.

Miesbach, A., of Vienna (1, p. 1006), for a collection of lignites from Upper and Lower Austria, Styria, Moravia, and Hungary. These lignites, all of which are worked by the exhibitor, belong to various formations. They are now much and widely used for many purposes, and are employed in puddling furnaces for iron.

To complete the list of objects in Austria, considered by the Jury worthy of Ordinary Mention, we have still to record those exhibited under the five following numbers, viz.:—

The Proprietor of the Mine of Zemberg, in Hungary (7, p. 1007), for ores of cobalt and nickel.

Batka, W., of Prague (9, p. 1007), for ores of uranium, nickel, cobalt, and vanadium.

Sezgo, M., of Rosena, in Hungary (10, p. 1007), for ores of antimony and metallic antimony.

Hochberger, J. (14, p. 1007), for the manufacture of sulphate of iron and alum, and the production of sulphur from pyrites.

Count G. Egger, of Krappenberg, Carinthia (401, p. 1030), for a series of crystals of sulphate of barytes.

Belgium (p. 1150).

The mineral industry of Belgium is represented in the Crystal Palace by 58 exhibitors; but the most important department of all, and that which has furnished to this country a source of wealth altogether disproportionate to its superficial extent—we mean the working of coal—is brought under notice by only a few isolated specimens, while the iron works, clay works, refractory sandstones, and grindstones, have furnished the greater part of the objects exhibited. To render as brief as possible the general account of the different rewards granted by the Jury, we shall group them according to the nature of the products.*

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* This Exhibitor receives a Prize Medal in Class XXII., in whose Award List his name appears.—I. W.

We must first recall attention to the fact that the Council Medal has been awarded to the Company of Zinc Mines and Foundries of the Vieille Montagne. The high reputation enjoyed by this establishment, whose products are exported to all parts of the world, fully justifies this distinction, and we will not here repeat the reasons which have guided the Jury in its judgment, and which we have already stated at the commencement of this Report.†

The first object that has attracted the attention of the Jury is the safety-lamp, of which two kinds are exhibited; one by Mathieu Louis Mueseler, mining engineer (24, p. 1151), and the other by Félix Eloin, associate engineer (11, p. 1151).

Long experience has established the advantages of M. Mueseler's lamp, more than twelve thousand of these instruments being at present in use; and we may attribute partly to its adoption the sensible diminution that has taken place in the number of accidents from the explosion of carburetted hydrogen gas in those mines, where gas is constantly given off from the coal.

In this lamp, a part of the metallic covering which surrounds the flame and forms the chimney, is replaced by a glass, a modification which insures a much stronger light than that given by the Davy lamp, and which is preferred by the miners; but the essential peculiarity of M. Mueseler's arrangement consists in the mode in which the air to support combustion is introduced. It is brought in from above, through two wire gauzes at right angles to each other, and afterwards escapes, with the products of combustion, by a central chimney.

The chief objection that at first suggests itself to this lamp, is the brittleness of the glass; and on this account the Jury for some time hesitated in admitting any marked superiority in it over the Davy lamp. But the Belgian government having communicated the official reports of experiments made by a special commission, their doubts have vanished, and they have granted a Prize Medal to M. Mueseler.

It results from these experiments "that the resistance of the glass has been found to be infinitely superior to that which could be presented by wire gauze, and that in this respect it offers a greater security; that the instances of fracture have been very rare, and that on no occasion, whatever the cause of the fracture may have been, has it resulted in the introduction of the external air to the interior of the lamp. On the other hand, the fragments of glass have always remained in their place until the lamp was opened."

The lamp of M. Eloin is also provided with a glass in its lower part, and the inventor has given it a concave form on the outside, to disperse the rays of light, and diminish, as much as possible, the numerous shadows produced by the opaque parts of the lamp. The essential difference between this lamp and that of M. Mueseler consists of an apparatus for admitting the air and distributing it round the flame. This apparatus is simply a ring of wire gauze, pressed between two circles, having several openings corresponding to each other, and resting on the edge of the lid of the reservoir of oil. This exhibitor, as well as Messrs. Roberts and Coombes, has added a peculiar trumpet-shaped contrivance, of which the larger end rests on the oil reservoir, a little below the air-holes, the upper part having a circular opening about three-quarters of an inch (18 to 22 millemetres) in diameter, placed about three-eighths of an inch above the bottom of the wick. This arrangement makes it necessary that the air introduced to feed the flame should pass quite close to the wick, which is flat, and the combustion is thus rendered more active, while the inflammable gas is more or less consumed as soon as it enters the lamp.

The Jury have examined with interest the lamp exhibited by M. Eloin; but as it is at the present time submitted by the Belgian government to a special commission, who will report on the advantages or defects that it may possess, they have thought it best not to publish an opinion with regard to it. They think it right, however, to state that the experiments made by Messrs. Blackwell, Rogers, and Smith, in the coal mines of Abercarn, near Newport, and of Shipsey, in Derbyshire, have satisfied them of the value of M. Eloin's lamp.

Manufacture of Iron.

The Jury have awarded six Prize Medals and three Honourable Mentions to the Belgian exhibitors in iron. They have been obtained by the following establishments:—

Moncheur, F. and A., iron-masters of Ardennes, in the province of Namur (366, p. 1162), who have exhibited pig iron made with charcoal, and various specimens of iron bearing the mark [MBR], also made with charcoal. A part of the iron exhibited by this firm is intended for gun-barrels, and they supply exclusively the royal manufactory of the Belgian government. Mr. Timmerhaus, inspector of weapons for the government, has certified in an official document handed to the Jury, that not a single gun manufactured of this iron has burst at the proving-house, even under the most extreme trial.

Amand, J., iron-master, of Ermeton-sur-Bierse, Namur (368, p. 1162). This manufacture resembles that of MM. Moncheur, and part of the iron is also intended for making fire-arms.

Orban, J. M. and Son (372, p. 1162). These exhibitors manufacture iron with coke, and also with charcoal fuel; and besides merchantable iron, they make also sheet iron and iron wire. It is especially for these latter products that the Jury award the Medal, and they wish to mention particularly—

> A piece of rolled coke iron, measuring 106½ feet in length, and half an inch (14 millemetres) in diameter, and weighing 86 lbs.
>
> Another specimen, only one-fifth inch (6 millemetres) in diameter, corresponding to No. 4 of the English gauge, measuring 282 feet in length, without a joint, and weighing 42 lbs.
>
> A specimen weighing 55 lbs., the length of which is 375¾ feet.
>
> A roll of galvanized iron wire, No. 8, weighing 99 lbs., and measuring 1476 feet, used in the construction of the electric telegraph. Similar wire is not received by the Belgian government till a succession of trials prove it to be capable of supporting at least 1,760 lbs. without breaking, a strength corresponding to 140 lbs. per sq. millemetre (= ·00155 sq. inches English). It is also sufficiently malleable to admit of the extremities being bent into a very small eye.
>
> Several pieces of charcoal sheet-iron of various dimensions and thickness, but all of the first quality.

Remacle, J., and Pérard, of Liege (371, p. 1162), have exhibited sheet iron of different numbers, manufactured with wood fuel, and of very excellent quality.

Dellove-Matthieu, C., of Huy (376, p. 1163). A complete assortment of common and polished sheet iron and steel, whose high degree of excellence will perhaps be most easily seen in their small thickness compared with the dimensions, their perfectly-continuous surface, the absence of all oxidation, their ductility, and their tenacity.

The Pommerœul Smelting Company (6, p. 1150), for the specimens of pig and rolled iron, produced at their works, and exhibited by them.

Honourable Mention has been awarded to J. Cockerill, of Seraing, Liege (119, p. 1155). The Company has exhibited specimens of pig and wrought iron, wheel tire for locomotives, manufactured iron, and especially rails. This Jury, not taking into consideration the manufactured articles, which it is not their province to judge of, and regarding it as almost certain that the Cockerill Company would obtain honourable distinction for the admirable construction of its machines, have been guided, in some measure, by these reasons in only making Honourable Mention of their products in this place.

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* This outline is borrowed in great part from a note addressed to the Chairman of the Jury by M. Gernaert, Ingenieur en Chef des Mines Belges, and Member of the Jury.

† See *ante* p. 3.

Messrs. Pérard and Mineur, of Couvin (18, p. 1151), for their iron ores and bar iron.

The Marcinelle and Couillet Smelting Company[*] (20, p. 1155). The iron which this company exhibits is of very excellent quality; but they are placed in the same category as the Cockerill Company, exhibiting machines as well as raw produce.

Zinc and Brass Works.

The Nouvelle Montagne Zinc Mining Company, at Verviers (7, p. 1151).

The exhibition sent by this company includes lead and zinc, in pig and manufactured articles in zinc, the latter consisting of sheet zinc for various uses, such as engraving, smoothing paper, sheathing for ships, zinc tiles of different forms, &c., and zinc powder (oxide of zinc) for painting. To illustrate the uses of the different kinds of tiles, the company has added two models of roofs remarkable for their lightness. The Jury recognize the good quality of these by awarding the Prize Medal to the company.

Chaudoir, Messrs. C. and H., of Liege (377, p. 1163), have also obtained a Prize Medal, for boiler-tubes of locomotives exhibited by them. These tubes, which are drawn and completed without joint, are of very beautiful manufacture.

Terra Cotta, Bricks, Crucibles, Refractory Clays, and Kaolin.

This department of mineral industry is well represented in the Belgian Exhibition, and has obtained several Honourable Mentions. Notwithstanding the interest belonging to such products, on which the success of some establishments, as of cast steel or glass, may depend, we must be contented with simply naming the Exhibitors as worthy of Honourable Mention.

Pastor, B. & Co., of Ardennes, Namur (395, p. 1168), have exhibited:—

1. A gas-retort, weighing 1474 lbs.
2. The hearth of a blast furnace for coke fuel, made of refractory bricks, and weighing 504 lbs.
3. A series of refractory bricks, for lining different parts of blast furnaces, also burning coke fuel.
4. Drainage pipes of various dimensions.
5. Specimens of clay of different qualities, especially refractory clay.

The same distinction is awarded to F. Coste,[†] of Tilleur, Liege (397, p. 1163), who has exhibited two sets of crucibles, the one made of a mixture of plumbago with clay, and the other of refractory clay only. The former are intended for fusing steel, and are divided into three parts, the lowest of which only is the crucible, properly so called, the intermediate portion serving to contain an additional charge, so that when the fusion is complete, the true crucible is entirely filled. The Jury notice this arrangement as presenting some interest.

The Exhibitors having the numbers 12, 14, 15, 396, and 399, have obtained Honourable Mention.

Tombelle-Lomba, E., of Bonneville (12, p. 1151). Specimens of porcelain clay.

De-Gaiffier d'Hestroy, the Baron of Mallien, near Namur (14, p. 1151). Specimens of porcelain clay.

De Ferrare, F., and L., of Wierde, near Namur (15, p. 1151). Specimens of plastic clay, employed in the manufacture of fine pottery.

Temsonnet and Dartet, of Namèche, Namur (394, p. 1163). Samples of fire-clay.

Communal Commission of Marchin (396, p. 1163). A quartzose conglomerate with a silicious cement, forming the base of the coal measures, and yielding a material absolutely refractory for the construction of the hearth or crucible of blast furnaces. Blocks of this conglomerate cut and arranged for the construction of a crucible or hearth.

Boucher, T., of Baudour (399, p. 1163). Specimens of refractory clay; gas retort manufactured of this clay. Saggers, for baking porcelain.

Slates, Grindstones, Hones, &c..

Belgium, a country which consists in great part of palæozoic deposits, possesses a great number of rocks adapted to the manufacture of grindstones and hones; and as the slate formation (one member of the group) is especially developed, the working of slates is also very active in this country. The geological constitution, which always has a great influence on the commerce of a country, here exercises a powerful action, and this department of industry is represented in the Crystal Palace by several exhibitors. Since, however, slates, whetstones, and other products of this kind, require no change in preparing them for the market, the peculiar form in which they are wanted involving the only modification they undergo, so that there are thus no very great difficulties in the way of their preparation, the Jury have only thought it necessary to distinguish them by Honourable Mentions, except in the case of M. E. de St. Hubert (8, p. 1151), to whom a Prize Medal was awarded. The account of them would be almost exclusively technical; so that, notwithstanding the interest which attaches to this branch of industry, it is impossible in this Report to do more than enumerate the products.

Colette-Doucet, F. I., of Bertrix, Luxemburg (5), has exhibited—

1. Writing stones (slate pencils?)
2. Hones from different rocks, and for various purposes.
3. Specimens of slate of various qualities and sizes.

Jean Antoine Guillaume, of Bovigny (1, p. 1150),
Charles Joseph Otte, of Vielsalm (2, p. 1150),
Christophe Lamberty, of ditto (3, p. 1150),
Pierre Joseph Offergeld, of ditto (4, p. 1150),
Lamberty Brothers, of Stavelot (25, p. 1152),
Dupierry, jun., of Vielsalm (494, p. 1166),

have all exhibited very good collections of whetstones, as remarkable for their dimensions as for the care taken in their preparation.

J. B. Fallon-Piron, of Namur (10, p. 1151), has exhibited a fine block of black marble, peculiar to the district, which can be produced in large masses, and at a low cost.

Ed. de St. Hubert, of Bouvignes (8, p. 1151), and J. B. Morimont (9, p. 1151), have exhibited millstones of good quality, the collection of the former being on a more extensive scale, which induced the Jury to select him for the award of the Prize Medal. This source of industry was only introduced into Belgium since 1846, but has already become important. The millstones from the province of Namur possess qualities which render them comparable with those from La Ferté-sous-Jouarre, in France.

China.

China, so richly represented in the Crystal Palace by its silk stuffs and porcelain, has only obtained a solitary Honourable Mention for its mineral productions. This is granted to R. Alcock, Esq., H. B. M.'s Consul at Shanghai (1, p. 1418), for a collection of materials employed in porcelain manufacture at the great porcelain works of Kiaing Tiht'Chin, near the Poyang Lake.

This collection includes specimens of prepared clays, and also a series of pigments employed in porcelain work. In their present state it is impossible to determine the nature of the materials without analysis; but they are exactly analogous to a more complete collection forwarded to the Ecole des Mines in 1846 by Mr. Stanislas

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[*] This Company was awarded a Prize Medal by the Jury of Class V., in whose list its name appears.—I. W.

[†] This Exhibitor has been awarded an Honourable Mention by the Jury of Class XXVII., in whose list his name appears.—I. W.

Julien, member of the French Institute, who had received the specimens from Mr. Joseph Li. To the prepared clays, Mr. Li had added some compact felspathic rocks resembling the Cornish elvans. These rocks are reduced to a paste under a mill, and serve partly for covering the porcelain with a glaze, but are also mixed in various proportions with the paste intended for the porcelain, according to the nature of the material which it is intended to prepare.

Chili.

We have already, at the commencement of this Report, referred to a magnificent specimen of native silver, weighing 154 lbs., obtained from Chili (p. 1429).

The mines of copper, without affording so important a supply of mineral wealth to Chili as those of silver, have still obtained a great development within a few years, and this republic is now placed among the number of those countries which supply Europe with a sensible proportion of the copper used in manufacture. The ores of this metal worked in Chili are of two kinds—vitreous copper ore (the disulphuret) and copper pyrites (sulphuret of copper and iron), which exist in different deposits, the former ore occurring in veins more or less continuous at the separation of the crystalline from the calcareous rocks. This ore, always very rich, often occurs in considerable nodules, and two specimens are in the Exhibition from the district of Tamaya, remarkable for the purity of the ore. Their weight is stated at 250 lbs., and their yield at 62 per cent.

The copper pyrites occur in veins in the gneiss, and are associated with iron pyrites, galena, and ores of gold and silver. Messrs. **Schneider** and Co. have exhibited a very fine specimen (not numbered), stated to contain 12 ounces of gold and 220 of silver (p. 1429). This specimen presents the appearance of a quartz rock passing into gneiss, in which the copper and iron pyrites form a tolerably thick vein. Galena may be observed disseminated in small quantities parallel to the lamination of the gneiss, but neither silver ore nor native gold can be distinctly perceived. The iron pyrites appears in two very distinct conditions, viz., in imperfect crystals of a gold-yellow colour, and in dull portions, having a compact fracture of a greenish-yellow colour. Possibly the two precious metals are associated with the latter variety of pyrites, the peculiar and exceptional characters of which agree with the supposition of there being an admixture of metals.

This fine specimen is from the mine of Madre Lios, near Coquimbo, and was obtained at the depth of 49 yards below the surface, and weighs 300 lbs. An Ordinary Mention is awarded to the exhibitors.

Egypt.

The Egyptian Government has exhibited (1 to 18, p. 1412) some minerals, which would be of interest if they were accompanied by indications of their origin; but, with the exception of the natron obtained from lakes in Lower Egypt, we are ignorant of the localities whence the various specimens come. They belong to clays for the most part ochreous; but one, notwithstanding this condition, is described as refractory. There is also a specimen of sulphur adhering to limestone, somewhat resembling the mineral found in Sicily, besides gypsum and some tolerably fine slabs of oriental alabaster.

The Jury, while regretting not to have been able to procure details concerning the position of these minerals, have still testified the interest which they feel in the discovery of sulphur in the Egyptian territory, as well as in the extraction of natron, and they make Honourable Mention of these two objects.

France (p. 1168).

The mineral industry of France is at present almost entirely concentrated in the working of coal and the production of iron, which have both acquired a considerable development; but notwithstanding this, its territory is not less rich in metalliferous deposits than several other countries in Europe celebrated for the prosperity of their mines. Official documents, recently published by the French Government, show that the number of known and worked mining localities amounts to 500, which, in relation to the crystalline rocks, may be grouped into five metalliferous districts corresponding to the five mountain ranges of Brittany, the Centre of France, the Vosges, the Pyrenees, and the Alps. These communicate to France a peculiar geological character, and in some degree equalize the climate, the higher mountains being situated in the southern part of the country.

It is clear from written documents, and yet more from the existence of old galleries and extensive heaps of rubbish, that most of these mines were worked on an extensive scale during the dominion of the Romans, and still later under the feudal lords. After the time when the powers of these lords were reduced under a central authority, tradition informs us that the workings were gradually diminished, and only presented rare intervals of activity or success. The revolution of 1793 gave the finishing stroke to this source of industry, which requires a prospect of security, and the mines at that time flourishing were abandoned. There are now in France hardly ten metal mines in activity, and of these only four are really important. They all have for their object the extraction of argentiferous lead ore, and their total mean produce within the last ten years is only about 42,000*l.* (1,050,200 francs). We may indeed add to this small sum, 10,000*l.*, as the value of the manganese mines, 1,500*l.* or 2,000*l.* for the production of antimony, and 3,200*l.* for the reopened copper mines of St. Bel and Chessy.

The working of coal and the production of iron form a happy contrast to the workings of metal mines, and we proceed to make known in a general way these products.

Working of Coal.

About the commencement of the eighteenth century this branch of mineral industry, now so flourishing, hardly existed at all; the coal known at that time at St. Etienne, Alais, Vigan, and St. Gervais, in the department of Herault, being used only by the blacksmith; and it was not till this time that any serious researches were made for coal deposits. In 1734 was first discovered the existence of mineral fuel at Anzin, now the centre of one of the finest coal districts in Europe; while in the same year commenced the workings at Creusol, a spot which has become the centre of the important coal district of the Saône and Loire. From the date of these discoveries the use of coal became more widely extended, and it was soon applied to the manufacture of glass and the burning of lime; but it is only since 1802, a period when industry made rapid progress, that the extraction of coal acquired an important development. In 1789 the total production in all France barely reached 215,000 tons; but in 1802 it had already increased to 900,000. Stationary then till 1820, it rose in 1830 to 1,600,000 tons. In 1845* the official returns show that it reached to 4,202,091 tons, and now France occupies the second place in reference to the production of this mineral, immediately succeeding England, whose production is, however, eight times as great.

The vast development of the extraction of coal in France attests the corresponding development of all those industrial occupations of which coal is one of the elements of production. It affords a startling proof of the progress made in all the useful arts during a period of a third of a century passed in perfect peace.

Production of Iron.

The manufacture of iron has always been tolerably active in France. The ores of this metal exist there in almost all the geological formations, but are especially abundant in the middle tertiary deposits which cover the elevated plains of Champagne and Berry, and generally the vast expanse of oolitic limestone which forms the central plateau of France, occupying more than two-thirds of the whole surface of the country. The tertiary deposits, generally sandy, are not very fertile, and have for centuries been devoted to the growth of wood; and this position of the iron ores in the midst of forests has always been taken advantage of for the construction of foundries. Each of the tertiary plateaux has thus long been a small metalliferous district where the manufacture of iron was active in proportion as the wood was abundant; and these districts have for many ages been the only sources of the supply of iron.

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* Comptes rendus des Travaux des Ingénieurs des Mines, tome xiv., 1846, p. 21.

Within the last 25 years, since the manufacture of iron has been carried on with coal fuel, the position of those establishments where wood was employed has been essentially modified; and, in fact, the introduction of iron made with coal, the cost of which is so much lower than when made with wood, and which is only limited in quantity by the extent of the demand, has changed the conditions which nature seemed to have established. Charcoal iron could not have borne up at all against the formidable competition of that made with coal, had there not been an important modification of the methods of treatment, consisting of the introduction of coal in the ultimate processes adopted to produce wrought iron from the pig, the use of charcoal fuel being retained in the first production of the pig itself. These further processes with coal fuel are carried on in works specially constructed for the purpose on a large scale, situated where the coal can be obtained at a moderate price. This mixed method has produced a great reduction in the price of iron, which has fallen from 70 to 27 francs for charcoal iron, and from 52 to 22 for that made with coal; and the difference in price has been obtained without the superior quality of the charcoal iron being at all affected.

This method, while lowering the price, has also given a great development to the manufacture of pig and wrought iron. If, for example, we take the production of pig as the term of comparison, we find that between 1819, when it amounted only to 112,000 tons, and 1845, when it reached 522,385, the increase was in the proportion of 100 to 465. Even this is only the fourth part of what is produced by Great Britain; but on the Continent, France is now placed in the first rank of iron-making countries. It appears, from statements made in the annual report of the *Corps des Mines*, that the three countries on the Continent which come next in order to France in the manufacture of iron, are Russia, Sweden, and Prussia, and that the make of the first from 1835 to 1838 was 189,000 tons of pig; of the second, in 1839, 115,000 tons; and of the third, in 1840, 112,000 tons. The average in France of the three years 1835 to 1838 was 239,000; in 1839, 305,000; and in 1840, 348,000.

The mixture of fuel adopted has allowed of the use of part of the vegetable fuel, formerly employed in the manufacture of wrought iron, for the making of pig; but, at any rate, the statistics of the iron trade in France distinctly show that the use of coal in preparing wrought iron is very far from having diminished the consumption of charcoal. Thus we find the quantity of pig iron made with coke and charcoal respectively thus stated:—

	Quantity of Pig Iron made with Coke.	Quantity of Pig Iron made with Charcoal.	
Years.	Tons.	Tons.	Total Tons.
1819	2,000	110,500	112,500
1830	27,103	239,258	266,361
1840	77,063	270,710	347,773
1846	239,702	282,683	522,385

Whence it appears that while, in 1819, the amount of pig iron made with coke was only one fifty-sixth part of the whole production, it amounted in 1830 to a thirteenth part, and in 1846 reached to 46 per cent., or nearly half of the whole amount.

A similar fact may be observed with reference to the refining of pig; but the proportion of wrought iron manufactured with coal, being much larger than in the former case, the equality of production from the two sources was established between 1835 and 1838; after which latter date, the consumption of charcoal in this branch of the manufacture has been nearly stationary, the produce ranging at less than 110,000 tons of iron. The use of coal has, however, continued to increase, and in 1846, 70 per cent. of the wrought iron was thus made. The following tabular statement establishes this interesting fact:—

	Quantity of Iron made with Coal.	Quantity of Iron made with Charcoal.	
Years.	Tons.	Tons.	Total Tons.
1819	1,000	73,200	74,200
1835	101,380	108,159	209,539
1838	115,110	109,085	224,195
1846	254,325	105,865	360,190

The production of pig iron requires at least 130 per cent. of charcoal,* for making, refining, and rolling; and the different processes of manufacture of charcoal iron consume at least 145 per cent. Combining these figures with those which precede, we find that the total consumption of charcoal, in the production of cast and wrought iron in 1819, was only 250,137 tons, whilst in 1846, it might have risen to 519,991; the latter amount being, however, in all probability, too great, since even in the charcoal foundries they frequently use coal in the re-heating process; but if we grant that this substitution diminishes the consumption of wood by one-half, it still results that the total consumption, in 1846, reached 443,239 tons, being almost double that of 1819. The use of coal in the manufacture of iron has not therefore, as is commonly enough supposed, done away with the use of charcoal. The two methods of operating have increased together, and on the same scale; and, on the whole, the production both of cast and wrought iron has been quadrupled.

After this general summary concerning the manufacture of cast and wrought iron in France, it is right to observe that the weak point with regard to the metallurgical industry of that country consists in the dearness of fuel. It possesses inexhaustible stores of ore distributed in numerous localities, easy of extraction, rich, and in almost all cases of excellent quality. But so long as

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* In many parts of France, only equal quantities of pig and charcoal are used, but the quantity stated in the text is a general average. We find, in fact, from the "Comptes rendus des Travaux des Ingénieurs des Mines," for the year 1846, p. 57, that the production of charcoal pig, and the consumption of fuel, were as follows:—

	Met. Quintals.	
Pig, for refined metal .	1,929,106	Charcoal, 3,316,843
Ditto for casting . .	535,260	
	2,464,366	

Which shows a consumption of 130 parts charcoal for 100 of metal. With regard to the further processes of manufacture by charcoal, we find, p. 59, that the refining at—

	Met. Quintals		Met. Quintals.
Comtois produced .	829,413	of bar iron, with a consumption of charcoal of	1,184,381
Wallon ,, .	40,902		78,624
Nivernais ,, .	4,139		10,977
	874,454		1,273,982

Whence it follows that these methods combined show a consumption of 145 parts of charcoal for each 100 parts of wrought iron.

Applying these figures to the production of pig and wrought iron in 1819 and 1846, we find—

Years.	Tons.		Tons.	
1819 .	110,500	of pig iron, requiring	143,650	of charcoal.
1846 .	282,683	,, ,,	366,487	,,
1819 .	73,200	of wrought iron ,,	106,140	,,
1846 .	105,865	,, ,,	153,504	,,

The consumption of charcoal being therefore—

		Tons.	Total Tons.
1819 . .	For pig iron .	143,650	249,790
,, . .	For wrought iron	106,140	
1846 . .	For pig iron .	366,487	519,991
,, . .	For wrought iron	153,504	

If we suppose that in 1846 the charcoal foundries have used half charcoal and half coal, we shall still find the consumption of charcoal to be—

	Tons.	Total Tons.
For pig iron . . .	366,487	443,239
For wrought iron .	76,752	

charcoal costs 80, 100, and even 120 francs (64*s.* to 96*s.*) per ton, and coal from 30 to 60 francs (24*s.* to 48*s.*) the advantage gained by the condition of the ore is very soon swallowed up, and the whole efforts of the iron-masters must be directed towards economising fuel. Great improvements have already been made in this respect in the working of iron, and, no doubt, the incessant efforts of the manufacturer will produce others; but we are quite safe in asserting, from the knowledge we possess of this kind of operations, that France can never succeed in producing iron by these mixed methods at the same price as it is made at in those places where the manufacture is carried on by coke exclusively, and especially at the very spots where the coal is worked.

An exhibition in London of the various modifications at present introduced into the manufacture of iron would have been very interesting for the study of metallurgy, and it is greatly to be regretted that so few of the French iron-masters have responded to the appeal made from England on this occasion. We are satisfied from the good feeling that has been shown to all French exhibitors, and the friendly relations that have constantly prevailed amongst all the members of the Jury, that their efforts would have been duly appreciated, and that all the improvements which they have introduced within the last twenty years would have received honourable rewards.

The almost entire absence of iron from the French portion of the Great Exhibition, and the small number of objects relative to the working of coal that have been sent, have prevented this branch of industry in France from appearing as important as it really is. The secondary departments of mineral industry have better appreciated the advantages offered by the great idea of a Universal Exhibition, and have sent objects worthy of interest, so that France has still an honourable position amongst the rewards granted by the Jury of this Class. It remains now to make known these rewards; but the task is difficult and unsatisfactory, for the great diversity of the objects only allows a very imperfect arrangement in describing them: we shall, however, endeavour to bring those exhibitors together whose objects have the nearest analogy one with another.

We must first recall attention to the two exhibitors to whom the Council Medal has been decreed. These are

Mr. **Bérard** (51, p. 1173), for his coal-washing apparatus.

Messrs. **Estivant**, Brothers (1214, p. 1235), for the size and quality of the objects exhibited by them in rolled and hammered brass.*

Mr. J. M. F. **Méhu**, mining engineer, of Anzin (627, p. 1208). Apparatus for the extraction of coal, and for the descent and ascent of mines.

It is now some years since a contrivance was introduced into the mining districts of Germany, England, and Belgium, the object of which was to prevent the great fatigue and frequent accidents experienced by miners on account of their having to descend and ascend the shafts of deep mines by means of vertical ladders or by the tubs and tackle used in lifting the produce. This apparatus consists of two wooden beams placed in the same shaft opposite to and balancing each other, and moving up and down by an alternate vertical motion communicated by machinery. On each of these beams small sets of horizontal planks or steps are placed, the distance between each being twice the length of one lift. The miner then standing at the bottom on the ascending beam, in order to come to the pit-mouth, steps to the opposite plank as soon as by the motion of the frame he is brought to its level, taking advantage of the short interval that elapses while the levels of the two steps are the same. He is then lifted again by the rise of this part of the frame, that on which he first stood descending, and again steps off when the lift is concluded. He thus rises step by step till he reaches the top. One of the best of these machines has been erected by M. Abel Waroqué in a shaft of a coal mine at Marimont, between Mons and Charleroy.

This apparatus was a great improvement in working mines; but it is exposed to a serious inconvenience, as it is impossible to lift ore or coal from the shaft in which it is fixed.

Mr. Méhu has constructed a similar machine, which serves at the same time to lift the ore or coal, and convey the miners to the bottom or top of the pit. It has been in operation for three years in the 'Davy' pit at the Anzin mines, and this long experience has proved its advantage. This engineer has in his apparatus substituted for each of the wooden rods a pair of connected rods, provided with spring catches on which the waggons rest while being raised or lowered. One of these pairs of rods serves to raise the loaded waggons, and the other pair to lower the empty ones; on both lines the waggons are raised or lowered by successive lifts, separated by short intervals of rest, during which they remain resting on other catches, fixed in the sides of the shaft, and arranged in stages at distances a little less than the length of one stroke of the vertical rods.

For lowering or raising the miners, the men step on moveable planks, in the place of the waggons, and the descent or ascent is conducted in the same manner. The depth of the Davy pit, where this machine by M. Méhu is in operation, is 200 feet, the beams traversing 50 feet at each lift.

The Jury, considering that Mr. Méhu's apparatus is likely to be of important service in the working of mines, have awarded to him a Prize Medal.

Messrs. **Gallicher** and **Company**, proprietors of the foundries of Bigny, department of the Cher (229, p. 1187). The exhibition from these foundries consists of various kinds of merchantable iron. Both iron and wire have been found to be of excellent quality, and a Prize Medal has been awarded to the exhibitors for the excellence of their products.

Mr. A. T. **Baudry**, proprietor of the steel works of Athis Mons, department of the Seine and Oise (1071, p. 1229). The steel-works of Athis Mons, whose origin dates as far back as 1823, consist of two cementing furnaces, and all the furnaces and apparatus required for the reheating, rolling, and forging steel. Its annual production is above 200 tons, and the principal manufacture consists of steel for springs, although M. Baudry has begun to make steel for cutlery. The different kinds of steel are made exclusively from Swedish iron, and the kinds employed are the best of the third quality for springs and iron, and of first and second quality for cutlery. The steel made by this exhibitor is of uniform and homogeneous grain, and the quality has been considered to merit for this establishment the Prize Medal.

Honourable Mention has been granted to the following:—

M. C. **Lapeyrière**, proprietor of the works at Bruniquel, department of Tarn and Garonne (1710), who has exhibited iron of various kinds, admitted to be of good quality.

Morel Brothers,* of Charleville (1666, p. 1256), who have exhibited a collection of cast-iron vessels, many of them coated inside with enamel.

Dietrich and **Son**,* of Niederbronn (188, p. 1183). The objects sent by these exhibitors consist principally of moulded cast-iron, not coming within the cognizance of this Jury; therefore, while recognizing the excellence of their products, the Jury do not feel justified in awarding more than an Honourable Mention to Messrs. Dietrich. They desire to direct attention to several objects remarking, in the first place, an iron figure of Our Saviour on the cross, five feet high, and on a round plinth which fully attests the care taken in casting in this establishment.

In the second place, they notice a collection of clichés for lithography, which introduce a new application of iron-casting to the art of engraving on stone with machinery. Very fine impressions are thus obtained; and in this particular matter the justly-celebrated Berlin iron ware is equalled by Messrs. Dietrich.

By means of the engraving-machine there may be obtained, with these clichés, delicate vignettes, which would seem difficult to imitate, and some of which have already been used for bank cheques and letters of exchange.

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* See the detailed account, *ante* p. 5.

* These Exhibitors have been awarded a Prize Medal by the Jury of Class XXII., in whose list their names appear. —I. W.

They have succeeded at Neiderbronn in giving great softness, tenacity, and flexibility to their cast-iron, and Messrs. Dietrich have exhibited a sheet of this material, measuring 7 feet by 2½ inches thick, which is very flexible. The exhibitors consider that, for some purposes at least, these plates of cast-iron might be substituted for sheet-iron.

GANDILLOT and COMPANY, Rue Bellefond, No. 49, Paris (230, p. 118.) Hollow iron and tubes.

The objects exhibited by Messrs. Gandillot consist of two distinct sets; the one of tubes called *light tubes*, intended for such purposes of construction, furniture, &c., as do not require that the joints should be close; and the other of tubes properly so called, of which the joints, being carefully soldered, are capable of resisting a pressure of at least *fifteen* atmospheres, and are intended for heating purposes, for conveying gas, or for worms for chemical works.

These tubes are manufactured in two different ways, according to the purposes for which they are intended, and the pressure they are to bear. The common kinds, which have to resist a pressure of only fifteen to twenty-five atmospheres, are united at a white heat, being welded by juxtaposition in a series of three to five decreasing draw-plates. The degree of resistance of the weld in these tubes depends on their greater or less thickness.

For purposes requiring a much higher pressure, M. Gandillot makes double tubes, and these he designates "without joint." To make these, he provides two common tubes, such that one will just enter the other with friction. The smaller is then inserted into the larger, the welds being opposite, and in this state he has them drawn out at welding heat, and through a series of decreasing gauges, until the diameter of the external tube has become smaller than that of the one originally included, so that the latter is welded, and, in some measure, incorporated with the other, the two together making a single tube, which is then without joint.

When a punch is forcibly introduced into a tube thus made, it tears it in some part of the circumference, but not in the direction of the welding of the external tube; and if the trial is repeated in different portions of the same tube, which has been previously sawn into several parts for the purpose, at each trial the tear will commence in a different part, so that the measure of resistance possessed by such a tube is that of a piece of iron of equal thickness.

MM. Gandillot have added to their collection of objects exhibited, fragments of tubes that have been tested, and these show that in fact the tearing does take place in various directions. For some purposes, especially for the roasting of animal black, where the vapour requires to be very intensely heated, these tubes, described as "without joint," have perfectly succeeded. MM. Gandillot have, therefore, rendered service to industry by thus providing tubes capable of bearing considerable pressure, and the Jury have, accordingly, granted them a Prize Medal.

Messrs. GROULT and COMPANY, Paris (531, p. 1204). These exhibitors manufacture brass tubing of all sizes, from 1-24th of an inch to 6 inches ($0^{m}\cdot001$ to $0^{m}\cdot150$) in diameter, the thickness being so graduated that all the sizes can be placed one within the next above it. They also exhibit tubes for cotton printing, for telegraphic uses, and for locomotives.

The Jury have remarked with interest, amongst the products exhibited by Messrs. Groult, bent tubes obtained by these ingenious manufacturers, by a combination of the ordinary work of tube-drawing, with a regular rotation given to the principal tool used in the operation. These tubes tear less readily than jointed tubes, and are beginning to be used for conveying gas, under the name of "*rope tubes*." A Prize Medal is awarded to Messrs. Groult and Co.

M. DEYEUX, of Linncourt (Oise) (476, p. 1200). Crucibles for fusing metals. The crucibles manufactured by M. Deyeux are of two distinct kinds, according to the uses for which they are destined; those intended for fusing bronze, copper, gold, and silver, are marked with the letters [A.D.]; the others, manufactured expressly for the fusion of cast-iron or steel, are marked No. 28.

These crucibles have been in use for the last ten years, and certificates forwarded with the objects exhibited, and signed by the Baron Thenard, and Messrs. Barruel, Darcet, and Desprets, testify to their good quality. The Jury, who have not been able to satisfy themselves by experiment, have been happy to take for the guidance of their judgment in the matter, the opinion of men so learned and so competent to decide, and have accordingly granted a Prize Medal to M. Deyeux.

POULET, J. F., Paris (1680, p. 1257), manufacturer of spun lead. The happy idea of employing spun lead, or lead wire, for horticultural purposes, suggested itself to Mr. Poulet, the resistance offered by this metal to atmospheric influences rendering it in most cases very valuable for binding and tying up vegetable substances. Among the objects exhibited we notice especially some wire of considerable tenacity, whose diameter is only about $\frac{1}{30}$th of an inch. The Jury have granted a Prize Medal to M. Poulet.

DERVILLÉ and Co., Paris (162, p. 1181). Marbles. The quarrying of marbles, which formerly prospered in France, especially under the reigns of Louis XIV. and XV., has been much neglected from the commencement of the present century, Italy within that period having almost exclusively supplied the statuary marble, while Belgium furnished the greater quantity of the marbles used in France for the decoration of private houses. For some years past, however, there have been resumed, under the influence of Government, a considerable number of neglected marble quarries, especially in the Pyrenees and the Vosges.

The exhibition of Messrs. Dervillé is more particularly directed to illustrate the marbles from the Pyrenees, their collection including upwards of 100 slabs, 16 inches high, and offering at least 20 varieties, among which may be noticed those called Campan marbles, the marble called "griotte" (spotted with red and brown), and the white marble of St. Béat; all remarkable for the variety of their colours, and the beauty of their polish. The Campan marbles also possess a peculiar geological interest in the number of goniatites which they enclose, and which are often mixed confusedly with the paste; an arrangement which evidences the great amount of change which these limestones have undergone at some period, and which supports the theory of metamorphism. The Jury, taking into consideration the different circumstances above alluded to, have awarded a Prize Medal to Messrs. Dervillé.

J. R. COLIN, Marble-dealer at Epinal (1564, p. 1251). The marbles of the Vosges, to the treatment of which this exhibitor has especially devoted himself, take a fine polish, but their colours are less agreeable than those of the Pyrenees. M. Colin has also worked the granites, syenites, porphyries, and diorites, of which there is a great variety in the Vosges; and it is principally these fine rocks that have attracted the attention of the Jury, and have induced them to give M. Colin a Prize Medal. Among the rocks of this kind, so difficult from their hardness to cut and polish, the Jury have remarked a fine slab of granite with large pink crystals of felspar, the slab measuring 8 feet 2 inches long and 18 inches wide, having an extremely fine polish, but unfortunately cracked in the journey.

Messrs. GUEUVIN BOUCHON and Co. Millstones of La Ferté-sous-Jouarre (532, p. 1204). The millstone rock of La Ferté is a silicious rock, full of interstices, presenting a multitude of empty spaces and hard portions, giving it a superiority over all other materials for the manufacture of millstones, and especially over granites and sandstones, as the grain, being caught in the little cavities of the fixed stone, is immediately reduced to powder by that which revolves. The hardness of this quartzy grinding material is such that no part of the stone becomes mixed with the grain, and this quality has obtained for the stones in question a preference over all others used for grinding, so that they have become a somewhat important branch of export trade to foreign countries; and a few years ago they fetched a very high price, because under the old system of managing mills, stones of very large size were required, and blocks capable of yielding such stones are rare and difficult of extraction. Within about 30 years, however, there have been substituted for stones made of one piece, those which are constructed of several segments cemented together and bound by iron hoops. These segments, to which in France the name of *moulage* has been given, have almost entirely superseded the single millstones, as will be seen by referring to the following table; and it has resulted that this source of industry, while being more fully developed, has yet, for some years past, produced smaller returns than at a former period.

The following table will give an idea of the extent and importance of this manufacture:—

Condition of the Millstone Trade at La Ferté in 1833.

Millstones.	Fr.	Fr.
15 pairs, diameter 6 ft., 1st quality at	1,200	18,000
260 ,, ,, ,, 2nd ,,	800	208,000
300 ,, ,, ,, 3rd ,,	600	180,000
300 ,, ,, 5 ft. . .	300	90,000
300 ,, ,, 4 ft. . .	350	105,000
190,000 segments at 3 fr. 50c. each		685,000
Total value in 1833 .		1,286,000

Condition of the Trade in 1849.

2,600 stones at an average price of 250 fr. per pair.	325,000
200,000 segments at 3 fr. 50 c. each . .	700,000
Total value in 1849 .	1,025,000

The quarries of Tartarel are the most important, the number of workmen constantly employed there exceeding 200. The arrangement of the interstices and solid portions of the stone from these quarries is considered especially favourable for the best mill work, and the stones are almost all regarded as of the finest quality. The working and trade in these millstones is in very few hands, and of these the house of Messrs. Gueuvin Bouchon and Co. is one of the most important. They have sent a very complete collection to the Exhibition, calculated to give a proper appreciation of this branch of industry, and the Jury have awarded to them a Prize Medal.

Honourable Mention is also made of Messrs. **GAILLARD** (226, p. 1187), and **ROGER** (1248, p. 1245), who have exhibited similar objects, but not of such fine quality. The collection they exhibit is also less complete.

C. **TOUALLION** (1508, p. 1248). This exhibitor has also forwarded millstones, but he is not himself a producer, being occupied more particularly in the operation of re-dressing them. When the stones have been so long used that the sharp edges which serve to catch the corn are worn smooth, they are put right again at a moderate cost by this exhibitor, who employs in restoring them a machine of great simplicity invented by himself. The Jury have granted Honourable Mention for the double object of his exhibition.

C. **LARIVIÈRE**, slate merchant, of Angers (290, p. 1190). The slate quarries of Angers enjoy a high reputation, the produce being conveyed throughout France, wherever the means of transport permit this to be done, at a price not too considerable. Most of the towns in the valleys of the Loire, the Seine, and the Marne are partly roofed by these slates, and the same is the case with several of the coast towns, such as La Rochelle, Rochefort, and Bordeaux. These slates are highly fissile, which allows of their being reduced to a very small thickness, and therefore permits of great lightness in the roofs which have to support them. They contain no pyrites, and, notwithstanding their thinness, are very strong, so that roofs covered with Angers slate are very durable.

The exhibition of Angers slates in London does not do justice to their high character; and without intending to institute a comparison between products of similar kind, the Jury have found it very inferior to that of the Welsh slates. They have, however, made Honourable Mention of the Angers Slate Company, as represented by M. Larivière.

CHAPOT and **SELON** (448, p. 1200), Viganilliers (Gard).

MARX and Co. (1344, p. 1240), Vigan (Gard). Honourable Mention is made of these two exhibitors from Vigan for their lithographic stones. These, which are obtained from the beds of the upper lias, called Belemnite marls, are of very good quality, and since they have been worked, upwards of 12,000 stones per annum have been obtained from them. This experiment, made on a large scale, has proved that the Vigan stone will bear comparison with that from Pappenheim.

M. **ALLUAUD**, sen. (1051, p. 1229), manufacturer of porcelain at Limoges. This manufacturer has added to his exhibition of white porcelain ware the kaolins and pegmatites, which he employs in preparing his porcelain clay and glaze. The manufactured objects exhibited not coming within the range of Class I., it is only for the beauty of the natural productions, and the care taken in working them, that the Jury have awarded Honourable Mention to M. Alluaud.

We ought to add, that the kaolin of Limoges has long been regarded as of excellent quality, and that the superiority of the white porcelain of this place, which is largely exported, especially to the United States, is due to the purity of the clay. M. Alluaud, sen., is to a great extent the promoter of this important branch of industry by the discovery he has made of considerable deposits of kaolin, which he works, and with which he supplies other porcelain manufacturers.

M. **ELOFFE**, naturalist, of Paris (1597, p. 1253). M. Eloffe has exhibited—1st. A collection illustrative of agricultural geology. 2nd. A general collection for technological geology. 3rd. Two tables, entitled "Geological Epochs," where all the formations are characterised by the minerals, rocks, and fossils peculiar to them. 4th. A mineralogical collection adapted for travellers, including 1600 specimens arranged in compartments in two boxes, according to the method adopted by M. Dufrenoy in his "Treatise on Mineralogy;" and 5th. Two small collections of mineralogy and geology, of 150 specimens each, intended for students.

The collection for agricultural geology is intended to illustrate the materials capable of being used for the improvement of soils, and sufficiently abundant to be supplied at prices justifying their employment on a large scale. It contains about fifty such rocks, and M. Boubée, the author of the collection, states that the most of them are absolutely inexhaustible. Their use is shown by an ingenious contrivance which consists in placing together those rocks which yield soils by degradation, and those which furnish the mineral manures proper for them.

The general collection of technological geology is accompanied by a large synoptical table, which serves at the same time as a catalogue. This table, entitled "Ensemble des Matériaux dont le Globe Terreste est formé," is prepared by M. Boubée, whence it results that this geologist is the real author of the collection. It contains in succession the minerals employed for obtaining metals, those used in architecture, hydraulic works, paving, lithography, and other arts in which the raw material is obtained from the mineral kingdom.

The interest presented by this table has induced the Jury thus to make mention of M. **BOUBÉE**, although the table is not specially referred to in the Catalogue. They have also made Honourable Mention of M. **ELOFFE** for the whole of his collections; but they have not thought themselves justified in awarding a Medal to him, because the ideas and views illustrated by the collections and by the tabular lists of mineral manures have not yet received the sanction of experience; and they feel that in matters which affect such extensive interests, and may have such serious consequences, it is necessary that the result of any proposed improvement should be fully proved before being recommended to the agriculturist.

Ordinary Mentions have been granted to the following exhibitors:—

M. **CHENOT** (119, p. 1177). Iron and steel produced by means of metallic sponges.

M. Louis Fiolet, of St. Omer (211, p. 1184). Various clays for the manufacture of fine and coarse pottery.

M. A. Babin (758, p. 1216). A kind of tripoli called "*tellurine*," being a very fine silicious deposit from the mines of Mayanne, department of the Drôme.

M. Favrel (835, p. 1236). For the beating of gold leaf.

M. Maehly (915, p. 1223). For a model of apparatus for the distillation of oils from schist.

M. Seguin, marble manufacturer, Rue d'Assas, Paris (1693, p. 1257). Most of the objects exhibited by M. Seguin are sculptured, and the Jury have only taken into consideration the rough marble and sawn or polished slab.

We think it desirable to offer a few remarks on the objects exhibited by M. Chenot, and on the apparatus of M. Maehly for distilling oil from schist.

M. Chenot has endeavoured to solve a very important problem, which has for its object the obtaining of iron directly from the ore without passing through the intermediate condition of pig, as in the Catalonian method, or without being obliged to perform two operations, and smelt the cinder.

To do this, the ore is deoxidised in a closed vessel at a dull red heat by the contact of a reducing gas, and there is thus obtained a porous iron described under the name of *metallic sponge*. M. Chenot hopes to be able to bring this into a massive form by simple compression at the usual heat employed in forging, but hitherto his expectations have not been crowned with success, or he would have obtained a much higher reward. The Mention has been made in consideration of the remarkable properties presented by his metallic sponge, which burns with flame at the simple contact of a lighted match, the iron being transformed into oxide. Owing to the facility with which oxidation takes place, the sponges, mixed with certain substances and moistened, form a very solid cement.

The apparatus of M. Maehly, for the distillation of oil from schist, consists of a kind of sheet-iron box placed in a muffle, and made to slide along a little railway, which extends to the sole of the muffle. In this box are sheet-iron plates, placed horizontally at distances of about four inches apart, and forming a kind of stage, which are intended to receive the schists about to be distilled, and equalize the temperature throughout the retort. The schists are then all exposed to the same current of hot air, and the oil is distilled under similar conditions. It thus results that no part of the schist is calcined before the rest has been exposed to a similar and sufficient heat.

When the distillation is completed, the box full of calcined schist is removed and replaced by another; the inventor considering that this arrangement causes a great saving of fuel, since there is no need to cool the furnace after each operation, as is the case with the ordinary method.

Algiers (p. 1259).

The investigations carried on in Algiers within the last twelve years by the mining engineers charged with this duty, and by several industrial companies, have proved the existence of a large number of metalliferous localities. The operations conducted at these places are not yet sufficiently complete to ensure profitable returns, although many observations render this result probable.

In 1850 the Government had already granted concessions for eight metal mines, four of which, in the province of Constantine, have for their object rich and good iron ores. The difficulty of obtaining fuel in abundance at a moderate price has hitherto been an obstacle in the way of opening these mines with advantage, and only one establishment has been started. This is situated near the concession of Meboudja, in the neighbourhood of Bôna.

The four other concessions, those of Mouzaia, Cape Tenès, Oued-Alleah, and Oued-Taffiler, are situated in the province of Algiers, and have for their object the working of mines of copper and lead.

The mines of Mouzaia include three groups of veins, composed of sulphate of barytes, carbonate of iron, and grey copper ore. They are situated on the southern side of the first mountains of the Atlas range to the north of Medeah, and have been worked since 1844, employing 600 persons.

The veins of Cape Tenès are altogether different, the veinstone being a ferriferous dolomite, mixed with beds of clay and ore, consisting of copper pyrites. These veins have been worked for two years, and are remarkable for their great number and for the space over which they spread, a circumstance which renders the preparatory operations very costly. They, as well as those of Mouzaia, occur in sandstones and cretaceous clays, which appear to correspond to the *macigno* of Italy.

The mines of La Calle are worked in a fine vein of argentiferous galena mixed with ferruginous clay, the veinstone being quartzy. They have been worked with activity for about two years, and have already yielded results of some importance.

The province of Algiers, where these mines are situated, is as barren with regard to supplies of fuel as that of Constantine; but the ores are more valuable, and can readily bear the cost of transport to Europe. There are already two works erected in the neighbourhood of Marseilles for reducing the ores of copper and lead, the rich coal basin of Alais offering favourable conditions for these establishments, and there is every reason to hope that they will become flourishing in a very short space of time.

In order to show the interest they have felt in the development of the mineral industry of Algeria, the Jury have granted Honourable Mention to—

The Company of Mines and Forges of Bona (20, p. 1261), for their forged and cast steel.

And they also award Ordinary Mention to the interesting specimens exhibited by—

M. Beauregard de Philippeville (4, p. 1259). Ores from Mount Tilfilah.

Mining Commission of Mouzaia (18, p. 1260). Grey copper ore.

Mining Commission of the Province of Algiers, (45, pp. 1261, 1262). Sundry ores of copper, lead, and iron.

Mining Commission of the Province of Constantine (46, p. 1262). Geological collection from the province, and sundry ores.

States of the Zollverein.

The Zollverein (customs' league) includes all those mining districts of Germany which are regarded as classical either by the antiquity of their works, or by the careful attention with which the mining has been carried on. Of these the Hartz in Hanover, Freiberg in Saxony, Silesia, and the Rhenish provinces, are the principal centres. Within this range all the metals are worked, even those being included which are generally most rare, such as mercury and tin; and thus the study of the mineral industry of this part of Germany offers an interest not inferior to that of England, since if, on the one hand, some of the deposits are less rich, the ores, on the other hand, are more varied, so that the metallurgical processes are more complete. Most of these mines are known by numerous and detailed accounts; but perhaps it may not be amiss to recall some facts relative to their products.

The Hartz mines chiefly produce argentiferous galena, and their yield is estimated at upwards of 2,100 tons (42,000 quintals*) of lead, and 10,000 lbs. (20,000 marcs†) of silver, employing more or less directly a population of 30,000 persons. The skill with which they are conducted, the mineralogical and geological studies to which they have given rise, and the advance which they have occasioned in the art of mining, have deserved a high reputation. It was here that machines were first constructed, by Chief Mining-Captain Albert, for lowering and lifting miners; and one of these machines (that at Andreasberg) is employed in a shaft upwards of 1,500 feet deep.

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* The quintal may be calculated as nearly equal to our hundredweight. The *metrical* quintal, however, is equal to 100 kilogrammes, or about 2 cwt., and the ton is, therefore, taken as equal to 20 common quintals, or 10 *metrical* quintals.—I. W.

† The marc of silver is equal to about 8 oz. avoirdupois. —I. W.

The next group of mines, and the most important in respect of the number of veins worked, is that of Saxony Proper, of which Freiberg is the centre, and, if we may so say, the personification. More than 400 metalliferous veins furrow in every direction the northern flanks of the Erzgebirge chain, which forms the eastern boundary of Saxony; and the numerous mines worked on these veins produce on an average 800 tons (8,000 metrical quintals) of lead, 32,500 lbs. (65,000 marcs) of silver, and 120 tons (2,400 quintals) of tin per annum. The mining operations are conducted on as large a scale as those of the Hartz; and the mining school rendered illustrious by Werner enjoys a never-dying celebrity.

The Rhenish provinces also present a considerable number of metalliferous localities widely spread over their surface, but capable of being grouped into several well-marked districts. Thus from the neighbourhood of Hersberthal, on the left bank of the Rhine, to beyond Brilon on the right bank, the lines of contact of the carboniferous limestone and the carboniferous schists of the coal measures, offer a series of deposits of galena, blende, and calamine, some of which give rise to very active mining operations. The mines near Stolberg placed in these conditions have produced for the last three years from 12 to 14 tons of lead per day, and similar deposits occur near Elberfeld and Brilon.

The galena is here associated with a large quantity of blende, the abundance of which has long been an obstacle to the prosperity of these mines; but since a method has been discovered of rendering the blende available as an ore of zinc, it has become an important source of wealth, and the manufacture of zinc from blende is now very successfully carried on. The first works erected on a large scale for this new mode of treatment were placed near Mülheim.

The neighbourhood of Siegen is also one of the most remarkable of the mining districts, spathic iron being as abundant in the Stolberg as it is in Styria and Carinthia. This ore is reduced in numerous establishments, whose manufactured iron and steel are equally celebrated. This district also includes veins of grey copper ore, gentiferous galena, nickel and cobalt ores; and the copper veins of Dillenburg have given birth to a group of small establishments, extremely interesting in a metallurgical point of view.

We must also mention as of great importance the mines of copper in the bituminous schist of Mansfeld, where the metal is distributed throughout the schist in a manner almost homogeneous over the whole district. This deposit, the only one known of its kind, both in regard to its wide range and the condition of the ore, furnishes more than half the copper produced by all the states of the Zollverein, amounting to 1,200 tons out of 2,000. This production is not equal to the consumption of these countries, as they import in addition from 1,500 to 1,800 tons annually; but it must be added, that they export from 400 to 500 tons in various objects manufactured in copper and brass.

Silesia, concerning which it now remains to say a few words, offers, by the concentration of great operations and large establishments, a character entirely different from that of the other mining districts of the Zollverein. It is the only country in Germany where the manufacture of iron in the English fashion is carried on on a large scale, and it owes this concentration of the iron-works to the existence of a large coal-field in which the ores of iron are abundant. The conditions so favourable to the production of the metal possessed by England are repeated in Silesia; but the coal in this latter country is not bituminous, and yields a coke less fit for the manufacture of iron than the coal of Staffordshire or Wales. From this inferiority of the quality of the coal, the same result obtains in Silesia as in France, namely, that the manufacture of charcoal-iron proceeds parallel with that of iron made as in England, so that it is calculated that, of the 25,000 tons of bar iron produced in Silesia, as much as three-fifths are made in charcoal fires.

The production of pig iron is about 40,000 tons (400,000 metrical quintals), upwards of a fourth part of that obtained throughout the states of the Zollverein, which is estimated by M. Von Goldenberg at about 150,000 tons. We have not had the opportunity of verifying these figures personally; but it is certain that industrial operations connected with iron have made rapid progress in Silesia within the last ten years.

The palæozoic rocks of Silesia include valuable deposits of calamine very easily worked, and the quantity furnished by this Prussian province is nearly equal to that produced in Belgium, M. Callon, mining engineer, having estimated it as upwards of 20,000 tons (200,000 metrical quintals). These two countries together possess almost a monopoly of zinc for Europe, the total effect of the whole quantity produced in England, Germany, and France, having but very little influence in the commerce of this metal.

The manufacture of zinc in Silesia, as in Belgium, is favoured by the abundance of the coal; the quality of the fuel not being so important in reducing this metal as in manufacturing cast and wrought iron.

Besides the coal basin of Silesia, the Zollverein also possesses other considerable deposits of mineral fuel, one of which, that of the basin of the Ruhr, is little more than the prolongation of a vast carboniferous zone traversing Belgium, and yielding the same qualities of coal. The following statement, taken from the excellent Report by M. Von Goldenberg, on the exhibition which took place at Berlin in 1844, represents with sufficient accuracy the production of coal at that date in the different states of the league:—

	Metrical Tons.
Basin of the Ruhr in Westphalia . .	1,000,000
„ of Saxony	150,000
„ of Bavaria	50,000
„ of the Duchy of Hesse . .	50,000
„ of Silesia	800,000
„ of Saarebruck and the provinces on the banks of the Rhine . .	700,000
Total yield . .	2,750,000

To complete these notices, we have still to mention the beds of excellent lignite found principally on the Rhine, near Merseberg in Saxon Prussia, at Gruneberg in Silesia, and at Laasan near Breslau. The quantity of this material worked is estimated at 2,400,000 tons per annum, and the deposit at Laasau is considered to be the most important of all, producing at this time 1,200,000 tons of a fuel, which serves both for domestic purposes and for manufactories, and is supposed to be capable of yielding annually several hundred thousand tons.

The exhibition of mineral wealth from the states of the Zollverein, now in the Crystal Palace, does not however correspond with the richness and variety of the mines, the principal districts of which we have just now imperfectly indicated. We have already stated, at the commencement of this Report, that the Hartz and Saxony have sent none of their products, and Silesia is indeed the only province represented in a manner at all corresponding to the importance of the subject. From that country there are good specimens, both of its iron and zinc works.

In order to follow more conveniently the enumeration of those objects that have been noticed by the Jury, we will group together those of the same nature, although they are not all rewarded in the same manner. We are indebted for most of the observations that will appear in this part of the Report to notes with which we have been furnished by Mr. Schreiber, member of our Jury from the Zollverein, and we shall begin by recapitulating the two exhibitors who have obtained the Council Medal.

The first of these Council Medals was granted to Mr. W. Guettler (6, p. 1048), of Reichenstein, in Silesia, and Professor Plattner, of Freiburg, for the process of separating gold from arsenical pyrites. This process, amply illustrated by the series numbered 6 in the Catalogue, has admitted of the profitable re-opening of the auriferous mines of Reichenstein.

The second is to Mr. Krupp, of Essen, for fine specimens of steel (649 and 677, pp. 1086, 1087), manufactured by a process peculiar to him.

Iron Ores and Bar Iron.

The Jury have awarded two Prize Medals and three Honourable Mentions for this part of the Exhibition. The following have Prize Medals:—

Royal Iron Foundry at Malapane, near Opeln (2, p. 1047).

Messrs. Gienanth Brothers, forge-masters of Hocheleim, in Rhenish Bavaria (95, p. 1102).

The Royal Iron Foundry at Malapane employ charcoal fuel, and exhibit iron ores, cast and wrought iron, and the slags and cinder collected during various parts of the process. There are also a pair of cylinders of cast steel of great hardness; samples of sheet iron of different thicknesses and length; specimens of red and white calamine from the mines of Scharley; various products obtained in the preparation of zinc in the works in Beuthen in Upper Silesia, especially zinc in ingots and sheets, and oxide of zinc; and a very interesting product obtained at this establishment, viz., metallic cadmium.

These foundries have also a high character in Prussia for the quality of the cast and wrought iron and steel which they manufacture, and the articles exhibited in London fully justify this reputation.

The exhibition sent by Messrs. Gienanth Brothers, consists of merchantable iron, gun-barrel iron, various kinds of sheet iron, iron-ware of different numbers, and steel of various qualities. The products of Messrs. Gienanth are much valued in Germany, the steels being especially in demand (p. 1102).

Honourable Mention has been awarded to—

Royal Forges at Lohe and Stahlberg, near Siegen (324 and 326, p. 1069).

Spathic iron, lamellar white pig, natural steel, and forged steel.

J. Hamblock, of Crombach, near Siegen (454, p. 1076). Ores of iron from the mines of Müsen, with specimens of forged and refined steel.

J. H. Dresler, sen., of Siegen (449, p. 1075). Ores of iron from Hohegrethe, Peterback, St. Andre, and Huth Mines, situated in the neighbourhood of Hamm. White laminated pig, refined iron, and bar iron.

Natural Steel, Blistered Steel, and Cast Steel.

The manufacture of steel is very actively carried on in the states of the Zollverein, as it is calculated that out of 21,000 tons (210,000 met. quintals) furnished by the whole of Germany, their proportion amounts to 8,000 tons, that of Austria being 13,000. The abundance of the ores of spathic iron, resembling those of Styria and Carinthia, has had the same effect as in those two states of Austria, in inducing a great development in the manufacture of natural steel, while the converted or blistered steel is the exceptional form, the latter being more difficult to work than the natural steel, and both being obtained in Germany at about the same price. The cast-steel works are of some importance; and we have noticed the important results obtained in this manufacture by Mr. Krupp, of Essen.

Among the establishments who have exhibited materials of this kind the Jury notice four, and to two of these Prize Medals have been awarded:—

Lehrkind, Falkenroth, and Co., of Haspe, near Hagen (447, p. 1075), who have exhibited ingots of cast steel, and forged steel of various kinds.

Huth and Co., of Hagen (632, p. 1085), who have also exhibited steel in its various forms of blistered, forged, and cast.

And Honourable Mention has been awarded to—

Mr. Vorster, of Eilpe, near Hagen (446, p. 1075).

Messrs. Boking, Roehr, and Lefsky, of Limburg (453, p. 1076).

The steels exhibited by Messrs. Lehrkind and Co., of Haspe, have been obtained by a peculiar method in the puddling furnace. According to Mr. Schreiber, their price is lower than that of other German steels, being sold at 22*l.* per ton. It would seem that similar attempts have been made in other works, but without success.

Mr. Vorster, of Eilpe, has obtained malleable iron and steel directly from the pig.

The difference made between these four exhibitors is the result of an examination of the objects exhibited, and not a comparison of the relative importance of the establishments, and the quality of their products.

Ores of Lead and Metallic Lead.

Eschweiler Mining Company, in Stolberg (318, p. 1068).

A Prize Medal has been awarded to this Company for the detailed exhibition it has made of the products of its mines and foundries. These consist of ores of lead and zinc from the mines of Dieppen Kirchen and Breiniger Berg, near Aix-la-Chapelle, of Bleiberg, between Cologne and Siegen, and of Kickfeld and Heidchen, near Aix-la-Chapelle. They also include pigs of lead and zinc, and a cake of silver obtained at the foundries of Birkenyang and Binsfeldhammer, near Stolberg.

Honourable Mention is awarded to the following:—

E. F. Ohle (Heirs of), of Breslau (62, p. 1052), who exhibit lead pipe of various calibre, sheet lead, and lead wire.

Meinerzhagen and Kreuser Brothers, of Mechenech and Commern (316, p. 1068), who exhibit lead ores from the mines of the Count Julius, of Lippe, and Messrs. Kreuzer, Brothers, besides pig and sheet lead.

Zinc and Cadmium.

The production of zinc is well represented in the Exhibition, and the Jury have awarded to this branch of industry three Prize Medals and two Ordinary Mentions.

Royal Iron Foundry at Königshutte (3, p. 1048). A Prize Medal for ores of zinc, metallic zinc, and metallic cadmium.

Ruffer and Co., of Breslau (11, p. 1048). An assortment of sheet zinc, two samples being as thin as paper, and remarkable for their style of execution. Sheet zinc for roofing. Also a Prize Medal.

C. Rochatz and Co., Mülheim on Ruhr (452, p. 1076). A Prize Medal for specimens of zinc ores from different mines, and for manufactured zinc of fine quality.

Ordinary Mention to Messrs. Bredt and Co., of Stolberg (315, p. 1068), for zinc and lead ores, including some rare ores, such as Wilhemite, chloro-phosphate of lead, and crystalline carbonate of lead; and also to Mr. Hagen, of Cologne (322, p. 1069), for calamine from the mines of St. Margaret and St Joseph, near Mülheim, on the banks of the Rhine.

Copper.

The working of copper is exclusively represented by the combined Mining Works of Mansfeld (850, p. 1096). Besides treating the cupriferous schists for copper, they also separate the silver that is mixed with the metal, and this separation, formerly effected by liquidation, is now performed by a new process, concerning which no information has been given to the Jury. The Jury have recognized the value of the result, and have awarded a Prize Medal to the establishment at Mansfeld.

Cobalt.

P. Graff, of Siegen (592, p. 1083). The exhibition of cobalt is only made by this exhibitor. The ore which he works is from Hoffnung, near Siegen, and consists of minute microscopic crystals disseminated in an argillaceous and quartzy schist. The ore does not yield more than 2½ to 3 per cent of metal; and the method adopted in working, as described to the Jury by M. Schreiber, is extremely perfect, not more than two parts in a million of cobalt being lost. Honourable Mention is awarded to Mr. Graff.

Manganese.

The ores of manganese are chiefly employed in the manufacture of chlorine and the chlorides, and do not therefore undergo any metallurgical preparation; so that the care with which the working is conducted and the picking of the ore are the only matters that the Jury can reward. They have been able, therefore, to grant nothing more than Ordinary Mentions for this branch of industry, and these have been awarded to two Prussian and two Nassau exhibitors as follows:—

Mr. J. Biegel, of Blessen, near St. Wendel (311, p. 1068). Manganese in crystalline masses and in powder, prepared for the manufacture of chlorine.

Mr. J. H. Herthum, of Ilmenau. Manganese, crystallized, in fine specimens, and massive.

Messrs. **Rosenberg** and Co., of Giessen (Hesse) (2, p. 1125). Oxide of manganese, in very fine crystals; a very pure ore.

Messrs. W. **Briel** and Co., Giessen (4, p. 1125). Similar ores in crystals, less perfect.

Coal, Coke, Lignite, and Bitumen.

The details given at the commencement of this part of the Report have established the importance of the coal basins and beds of lignite, and we have only here to add that the deposits of the latter fuel belong exclusively to the tertiary period.

Among the small number of persons who have exhibited products of this kind, the Jury have made Ordinary Mention of the following three:—

Mr. H. A. **Stinnes**, of Mühlheim on the Ruhr (448, p. 1075). Coal and coke of great purity, from the mine of St. Victoire Mathias.

Mr. F. **Haniel**, of Ruhrort on the Ruhr (455, p. 1076). Coal of different qualities from the mines of Heinrich, Steingalt, Hagenback, Sälzer, and Neuack. Coke manufactured from the coals of the three last mines.

Messrs. A. **Wiesman** and Co., of Augustenhütte, near Bonn (334, p. 1070). Bitumen, mineral oil, dussodyle, and various products obtained from the distillation of bitumen.

Amber.

Amber is found associated with certain lignites, and is tolerably abundant, but transparent specimens of fine colour are rare, Prussia being almost the only country by which they are furnished for commercial purposes. They are collected chiefly in the environs of Konigsberg and Memel, on the shores of the Baltic, and according to the rules established by the Jury, they ought not, perhaps, to grant rewards for this material. Considering, however, that a certain degree of intelligence is required in collecting it, and selecting the pieces proper for cutting, Honourable Mention has been granted to Nos. 40, 438, and 441.

D. F. **Tessler**, of Stolp (40, p. 1050). Two very fine specimens of rough amber; and a third specimen containing insects.

W. **Mannheimer**, of Konigsberg (438, p. 1075). Two specimens of amber, weighing respectively 6 lbs. and 4½ lbs., remarkable for their large size and purity.

W. **Von Roy**,* of Dantzig (441, p. 1075). A fine collection of ambers, differing in colour, brilliancy, and transparency. The exhibitor has been 25 years making his collection, and the rough specimens are accompanied by manufactured articles, several of which are of great value.

Working of Salt Mines and Purification of Salt.

In most of the states dependent on the Zollverein, salt is obtained from the evaporation of saline springs. The trade is not open, the salt-works being conducted by the Government. The Jury have granted the following Ordinary Mentions:—

Royal Prussian Salt-works of Dunzberg (445, p. 1075). The collection sent by this establishment consist of impure and prepared salt, of various degrees of fineness.

Salt-works of Salshausen, in the Grand Duchy of Hesse (3, p. 1125). Common salt, purified salt, lignite and bituminous wood employed in the evaporation of the brine; various products of the salt-works.

Salt-works of Theodorshalle and Kreuznach (Hesse 5, pp. 1125, 1126). Salt in grains; crystallized salt, remarkable for the size of the crystals. Concentrated mother-liquor, containing iodine, bromine, and chloride of calcium.

Millstones, Marbles, and Refractory Clays.

S. **Landau**, of Andernach (321, p. 1069). Lavas possess the property of millstones up to a certain point, being vesicular and hard, and their application in this way may be productive of very good results.

The Jury, guided by this consideration, have granted a Prize Medal to Mr. Landau, who has exhibited excellent lava millstones from Niedermendig, near Andernach. These stones, of which the dimensions vary from 18 inches to 6 feet in diameter, may be employed for grinding corn, preparing oil, and for all agricultural purposes.

F. **Zeller**, of Neckar-Tenzlingen, near Stuttgard, Wurtemberg (1, p. 1114). Specimens of stone from Mr. Zeller's quarries, arranged for the manufacture of millstones. According to their different conditions of hardness, grain, and colour, these millstones are employed for grinding wheat or other grain. Honourable Mention is made of Mr. Zeller for this interesting manufacture.

The **Counsellor Von Minutoli**, of Liegnitz (191, p. 1058). Amongst numerous objects of antiquity and architectural decoration, this gentleman has exhibited some very fine marbles of Silesia, for which the Jury have awarded an Ordinary Mention.

M. **de Mulmann**, of Zeche Plato, near Siegburg (319, p. 1018). Refractory clay, refractory bricks for lining the interior of blast furnaces, and crucibles for steel casting. The crucibles are considered by Mr. Schreiber to be of good quality, and they are made of the same clay as the bricks, to which, however, is added graphite from Bavaria.

Messrs. **Kapeller** and **Son**,* of Hafnerzall, near Passau (28, p. 1099). The reputation of the plumbago crucibles of Bavaria has been long established, and they were considered, till lately, as the only ones that could compete with those employed in the steel-works of Sheffield, and manufactured of Stourbridge clay. These crucibles owe their superiority to a mixture of plumbago, which modifies the dilatation and contraction of the material of the crucibles when they are exposed to the high temperature of the steel furnaces, or withdrawn to pour out the steel.

The crucibles of Messrs. Kapeller are of very different size, and we have noticed some 2 feet high and about 20 inches in diameter. According to their dimensions, and perhaps also the preparation of the clay, these crucibles are employed for fusing silver, gold, or steel.

A Prize Medal is granted to Messrs. **Kapeller** for the excellent manufacture of their crucibles.

Geological Maps and Collections.

Geological maps and collections are properly regarded as a means of spreading geological knowledge, and favouring the development of mineral industry. These considerations have induced the Jury to grant a Prize Medal and two Honourable Mentions for different geological maps, published by several editors in different German states, although these editors have in no degree participated in the investigations made in preparing these maps.

The Prize Medal has been awarded to Messrs. **Jonghaus** and **Venator**, booksellers of Darmstadt, for their beautiful relief maps:—1. Of the Grand Duchy of Hesse, and the Grand Duchy of Nassau, executed by M. Ewald, Secretary of the Geographical Society of Darmstadt. 2. Of Wurtemberg, Baden, and the countries surrounding the Palatinate and Alsace. These maps are part of the exhibition of Hesse (6, p. 1126).

Honourable Mention is made of T. **Dickert**, of Bonn (432, p. 1074), who has prepared relief geological maps of the Siebengebirge, the Valley of the Rhine, and Vesuvius; and also of Messrs. **Schropp** and **Simon**, of Berlin (303), who have published a coloured lithographic series of geological maps.

Mineralogical and **Metallurgic Collection** of the Duchy of **Nassau**, collected and exhibited by the **Government Engineers** of Mines (Nassau, 1 to 5, p. 1031).

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* This Exhibitor has been awarded an Honourable Mention by the Jury of Class XXIX., in whose List his name appears.— I. W.

* These Exhibitors have been awarded a Prize Medal by the Jury of Class XXVII., in whose List their names appear.— I. W.

The interest possessed by this collection, which includes the useful minerals and the different rocks of Nassau, and the productions of the most important mining establishments, has induced the Jury to award a Prize Medal to the Exhibitors.

We do not repeat the names of the minerals and rocks contained in this fine collection, and merely refer to the establishments which have assisted to form it. These are as follows:—

M. Lossen, Iron Foundry of Michelbach (2, p. 1132), to whom the Jury awarded an Honourable Mention.

Isabellenhutte Smelting Works near Dillenburg (3, p. 1132).

In this establishment, partly devoted to the preparation of nickel, arsenic is also obtained, and various alloys are manufactured, especially German silver, composed of 8 parts copper, 3 nickel, and 3½ zinc.

Marble Manufactory of Diez (5, p. 1132). The marbles of Nassau, worked in this establishment, all belong to the palæozoic rocks. They include fine black varieties, and others which are red, yellow, and grey.

Greece (p. 1400).

The Greek Government has sent for exhibition a series of specimens of minerals and rocks, marked in the Catalogue with the numbers 15 to 50 (p. 1400). This collection, grouped according to the provinces, chiefly includes a fine series of marbles and materials for construction, obtained for the most part from the cretaceous limestones, either compact or crystalline.

We notice also puzzuolanas from Santorin, emery from Naxos, meerschaums from the environs of Thebes, and lithographic stones from Messina. The latter are of even grain, and appear to be of good quality.

The Jury wish to make Honourable Mention of the Greek Government (pp. 1405, 1406), on account of the interest presented by the series of marbles, as well as for the discovery of lithographic stone in that country, and also of Milo (15, p. 1402) for samples of steatite (the soapstone, or French chalk of commerce).

New Granada (p. 1430).

E. Paris, of Bogota (p. 1430), has exhibited very fine emeralds from the Muzo mines, which supply almost all the precious stones of this kind imported into Europe. These emeralds, which are all crystallized, are attached to the parent rock, and thus possess a geological interest. An Honourable Mention has been awarded to Mr. Paris.

Portugal (p. 1306).

Among the objects sent to London by Portugal a large number of specimens of marbles may be noticed. There are two excellent series of these, the one exhibited by Mr. J. de Figueiredo (120 to 231, pp. 1309, 1310), and the other by Mr. Déjeant (232 to 257, p. 1310). All the specimens are in squared or rounded slabs, and polished. The colours are very varied, white and dark grey predominating; but there are also fine yellow and deep and beautiful violet tints. Almost all the marbles are crystalline; but one amongst them is a very fine round slab, with specimens of "*Chama ammonia*," in which the shell is preserved. These fossils, which are of a deep-grey colour, stand out from the marble, which is of a yellowish grey; and it is interesting to see them thus completely preserved in a limestone of which the crystalline condition is so decided. The Jury have desired, as a matter of geological interest, to learn whence these marbles have been obtained; but the localities are not indicated on the specimens, and the person in charge of the Portuguese exhibition has not been able to give any assistance in this respect.

Mr. Déjeant has also exhibited (110, 111, 115, p. 1309) lithographic stones of even grain and very compact. Similar stones are sent by the Duke of Palmella, and also by the Royal Tobacco Contractors.

Honourable Mentions have been granted to the Duke of Palmella, Mr. Déjeant, Mr. De Figueiredo, and to the Royal Tobacco Contractors (p. 1309), for the objects just described. Also to Mr. M. A. da Silva, (p. 1316), for the manufacture of lead for shot, of which he exhibits a fine series (991 and 1014), and to the Proprietors of the Mines of Bracal (1295, p. 1318), for specimens of lead ore and manufactured lead.

Rome (p. 1235).

The Roman States have sent to the Exhibition a tolerably large number of manufactured articles, but only five or six persons have exhibited the productions of the mineral kingdom. Of this small number the Jury have given Ordinary Mention to two, viz., the Count Bianconcini (1, p. 1285), who has forwarded perfectly pure quartz, sand, and other materials used in the manufacture of glass; and Messrs. Pasquali and Domenico Rinaldi (2, p. 1285), who send a collection of native asphaltes, and the products of purification of this bituminous mineral.

Russia (p. 1361).

The gold mines of Russia have yielded for some years past a revenue of nearly four millions sterling; but as their working consists of mere stamping and washing, the latter offering few difficulties on account of the high specific gravity of the metal, this important source of riches to the country has little interest for science. On the other hand, the working of iron affords great variety in the methods of proceeding, requires powerful machinery, and its manufacture, joined to the working of copper, forms the principal part of the mineral industry of Russia. This fact has produced its effect in that part of the Exhibition from Russia coming under the cognizance of this Jury, which is, indeed, to a great extent, confined to the objects sent from the iron-works, and chiefly those of the Government, namely—

The Imperial Forges of Alexander, at St. Petersburgh.

The Imperial Foundries, for Cannon, at Olonetz.

The Imperial Steel-works of Zlataoust.

The Imperial Forges of Koushvinsk, of Goroblagodatsk, and of Kamensk, situated in the Government of Perm.

The Imperial Establishments of Nijne-Tourinsk, Verkhne-Barantchinsk, and Verkhne-Tourinsk.

The Manufactory of Arms, of Zlataoust, Tatkinsk, and Tonisk.

These works are supplied by metalliferous deposits, which are remarkable at once for the abundance and the excellent quality of the ores. In this respect we may mention, as of the first importance, the celebrated deposits of magnetic iron ores of Goroblagodatsk, which yield the ores used by the works numbered 1, 7, 10, 11, and 12 (p. 1362, 1364, 1365), in the Catalogue.

Among the principal articles obtained by the fusion of these ores in the imperial establishments, we may mention, as having principally attracted the attention of the Jury, the castings for cannon, and the projectiles from the works at Olonetz, the fine hammered and rolled irons of Verkhne, Nijne-Tourinsk, Verkhne-Barantchinsk, and different forges dependent on the group of Zlataoust.

Several remarkable productions prove that Russia now prepares, with success, for its own consumption, the metals which it formerly exported in the unmanufactured state to foreign countries. Among these we may mention drawn, shear, and rolled steel, from the works at Zlataoust.

A scientific supervision has been exercised in the formation of these collections, which represent the operations of the different establishments we have mentioned. The Jury have remarked with interest the series of minerals and rocks accompanying the principal ores of the Ural and the Altai, and have wished to reward the care with which the collections have been prepared by granting a Prize Medal to each of the persons charged with their preparation. Since, however, all the establishments have been described as "Imperial," it has only been possible to award one Prize Medal to the Russian Government for the whole of this interesting exhibition.

Among the establishments not belonging to the Government which have sent samples of their productions to London, the Jury have remarked particularly the forges of Khamounitsky Viatka, belonging to Madame Ponomareff (19, p. 1366). A Prize Medal has been granted to this lady for the manufacture of the sheet iron described as oxidised, a product remarkable for the evenness with which it is rolled, its tenacity, and the brilliancy of the surface.

A Prize Medal has also been granted to Messrs. Demidoff, of Nijne-Tagilsk, in Siberia, (pp. 1377, 1378), for their collection of gold and platinum washings. To the auriferous sands in the state in which they are found, and in different stages of preparation, as well as scales of gold obtained by washing, these exhibitors have added specimens of the containing rock, and of the rocks found as boulders or pebbles in the auriferous alluvium. This interesting series furnishes, therefore, a complete history of the kind of deposit it illustrates.

Lastly, there are Honourable Mentions made of Messrs. A. and M. Pashkoff, of Orenburgh (23 and 24, p. 1367), who have respectively exhibited copper in ingots and also of the Imperial mines of Poland (15, p. 1366), for the fine specimens of the metallic cadmium exhibited. This metal is obtained in large quantities from the common zinc ore of the district, and is sent into the market at a price sufficiently low to induce, probably, a more extended economic application of it.

Sardinia (p. 1302).

From this country the exhibition of mineral produce is but small and unimportant; the awards of the Jury have consequently been limited to Honourable Mention to the following exhibitors:—

F. Grange, of Randens, near Aiguebelle, Savoy (1, p. 1302), for spathic iron ores from the mines of St. Georges des Hurtières.

S. Zolesi, Chiavari (2, p. 1302), for specimens of slates, rough for roofing purposes, and also sawn and planed for internal fittings.

D. Pianello, Chiavari (3, p. 1302), for a fine slab of slate, 5 feet 6 inches square.

Spain (p. 1320).

We feel some difficulty in speaking of the objects in our class from this country, which is, however, one of the most favoured by nature, in regard to the sources of mineral wealth. Thus Spain possesses vast deposits of coal in the Asturias, and in the province of Leon; its mines of salt at Cordova are as rich and as extensive as those of Wieliczka; ores of iron exist in abundance in all its provinces, and the lead mines of the Sierras, of Gader, and Almagrera, are richer than any that are known. It shares also, with the mines of Idria, the monopoly of the trade in quicksilver throughout the world; and yet, notwithstanding all this, almost the whole of the mineral collections sent to the Exhibition might be kept in a single drawer. The specimens which compose this series are also small, many of them badly selected, and almost all of them badly preserved.

The only rewards that the Jury have been able to give have no reference to the important mines of which we have just given a very summary enumeration. They belong to the objects of secondary importance in the mining industry of Spain.

One Prize Medal has been awarded to the Leonese-Asturian Company (21, p. 1330), which has exhibited steel of excellent quality.

Four Honourable Mentions have been granted, viz.—

D. Juan Giró, of Malaga (23, p. 1330), for the manufacture of cast and wrought iron, in his fine establishment, called "El Angel."

The Province of Cordova (29, p. 1330);

The Province of Saragossa (32, p. 1330); and

The Royal Library of Madrid (31, p. 1331), for the fine series of marbles exhibited by them.

Sweden and Norway (p. 1348).

The working of mines, and the production of metals, form a very active branch of industry in Sweden and Norway; the soil of these countries, derived for the most part from old rocks, and the severe climate of the north, being natural causes giving a great preponderance to mineral industry.

The working of copper, silver, and lead, is there very active, but the ores of copper are generally poor, seldom averaging more than about four per cent. when prepared for smelting, while some are worked which hardly yield so much as two per cent. These coppers are, however, much valued in commerce, on account of the ores containing neither arsenic nor antimony; and the annual supply amounts to 1,500 tons, of which the celebrated mine at Fahlun yields more than half.

The mines of lead would be of no value if it were not for the silver the ores contain.

The mines of Sala are the most important in respect to these metals, and it is estimated that they yield seven-eighths of all the silver produced in Sweden; for, although it is the custom to regard the celebrated Kongsberg mine as of the first importance in the production of silver, its yield varies so greatly as to diminish considerably its value in an industrial sense. In fact, after being frequently abandoned, on successive attempts, and after having shown a deficit of more than 80,000*l.* between 1815 and 1830, there were found parties sufficiently rich to undertake the working once more; and between the years 1830 to 1840 they have, after paying the deficit, shown a clear profit of upwards of 440,000*l.*, with a staff of 110 miners.

The cobalt mines of Skuterad, in the parish of Modum, in Norway, and those of Tunaberg in Sweden, have yielded considerable profits, but we are not aware of the exact amount.

But, however important the mines of copper, silver, lead, and cobalt may be when taken together, they are but trifles compared with the products of the iron mines, which form, both in Sweden and Norway, a very prosperous branch of industry, especially by their intimate bearing on the cultivation of the forests.

The iron ores of Scandinavia consist of magnetic iron ore, mingled accidentally with specular ore, and their average yield is as much as 46 per cent. The most celebrated are those of Dannemora, Utö, near Taberg, Nora, and Phillipstad; but the mines of Gellivara are also very rich, although the difficulty of communication is such, that the produce from them does not exceed 1,500 tons; the total production of the country being 133,500 tons.

The reputation of Swedish iron is sufficiently established to make it unnecessary to do more than mention its extraordinary fitness for the manufacture of steel; but the quality in this respect being unquestionable, it might be supposed that all deposits of magnetic oxide would be equally adapted to the manufacture of iron for the same purpose. This opinion has not been verified by facts, for numerous experiments, repeated both in England and France, have recently shown that the Swedish is preferable to all others, when it is desired to manufacture cast steel of the finest quality. Even in Sweden there are essential differences between the different mines, which exist also in the different parts of the deposit at Dannemora, which mine alone yields the iron that is of the highest excellence.

Up to the present time, the causes of this superiority have escaped all investigation. The magnetic iron ore everywhere presents similar characters, except that the grain is more or less fine; but the chemical composition is frequently the same. There are, therefore, shades of difference of extreme delicacy which mark the finer kinds, but these may, probably, long remain a mystery to science. The best iron is produced at the forges supplied from that part of the deposit called the 'Middle Field,' or the 'Great Mine,' and the peculiarities of the ore are so persistent, that all the iron of the same mark usually presents with very great uniformity, and to the same extent, the steel property.

This superiority of certain establishments over others, established by long experience, would have been sufficient to class the iron sent by Sweden for exhibition, if the Jury had had to award prizes only according to the quality of the iron; but they had also to examine the modifications of the methods adopted, and the care and attention shown in preparing the different objects for exhibition. As far as Sweden is concerned, the difference of awards is almost entirely the result of the Exhibition, for even the inferior kinds of Swedish iron are of a quality very superior, when compared with the iron from other countries.

There have been awarded, for this branch of industry, one Prize Medal, two Honourable Mentions, and three Ordinary Mentions: and we proceed to enumerate the establishments which have obtained them, in the order of the award.

Forges of Motala (6, p. 1349). Iron ores, cast iron, puddled iron, bar iron, steel, and the slags and cinder of the different operations.—A Prize Medal.

C. A. **Rettig**, of Getle and Kihlaforss (2, p. 1349). Ores from the Hammerin mines, in the district of Roslagen, near Stockholm, cast iron, wrought iron, and steel.

Mr. **Treschow**, of Laurvig and Fritzöe, Norway (36, p. 1352). Bar iron; several pieces twisted cold into knots.

To both of whom Honourable Mention is awarded; and Ordinary Mention to the following exhibitors:—

T. **Lagerhjelm**, of Christinehamn and Buforss, Sweden (1, p 1348).

Forges of Hellefors, Sweden (4, p. 1349).

J. **Flood**, of Porsgrund, Sweden (7, p. 1349).

Silver and Lead.—We have already stated, at the commencement of this Report, that the celebrated mine of **Kongsberg** had sent for exhibition specimens of ore remarkable for their large dimensions, and the beauty of the crystals of native silver ore. This establishment, which belongs to the Swedish Government, has completed the collection from this mine by specimens of silver in different states, and of the rocks which constitute the formation in which the veins occur. A Prize Medal has been awarded, for this interesting and instructive series, to the **Kongsberg Silver Works** (34, p. 1352).

The **Mines of Guldsmedshyttan** (16, p. 1350), sending argentiferous lead, have received Honourable Mention.

Ores of Cobalt and Chrome.—The **Tunaberg Cobalt Works** (9, p. 1350) furnish the richest and purest cobalt ores of Scandinavia, and Honourable Mention has been awarded for the objects exhibited from this establishment, including the products obtained in working, and the various operations which the ore is made to undergo, in order to obtain from it the oxide of cobalt.

C. H. **Garmann**, of Drontheim, in Norway (38, p. 1352). —Chrome iron, raw and purified. This ore of chrome is much mixed with the veinstone. In order to purify it, the ore is pounded in a stamping machine, and separated mechanically in the usual way.

The Jury have awarded an Ordinary Mention to Mr. **Garmann** for this application of the method practised in separating lead ores, to the preparation of the ores of chromate of iron.

Switzerland (p. 1264).

For some years past, the manufacture of steel has had a certain development in the Swiss Cantons; several establishments having been started successively at Bienne, Neufchâtel, and Schaffhausen. The products exhibited in London have been recognised as of very good quality; the steel for springs being especially remarkable for its elasticity, and the resistance it offers to fracture.

Two Prize Medals have been granted for the products exhibited by Switzerland, numbered 1 (p. 1265), and 41 (p. 1269), respectively.

Messrs. **Neuhaus and Blösch**, of Bienne (1, p. 1269).—Bar steel and steel wire, for the manufacture of rope.

Messrs. **Mathey and Sons**,[*] of Locle, in the Canton of Neufchâtel (41, p. 1269).—Bar steel, rolled steel for making springs and steel cylinders, used in the manufacture.

And Honourable Mention to J. C. **Fischer**, of Schaffhausen (47, p. 1269).—Ingots of steel, called 'meteoric steel,' bars of steel of different numbers, and various instruments manufactured with this steel.

Mr. Fischer has added to his exhibition a drawing representing the interior of his establishment, from which it appears, that the smelting furnaces are very small, and may be conveyed from one place to another without any other expense than that incurred by the removal of the bellows. Mr. Fischer states, that he manufactures cast steel by a peculiar method; but the drawing, the only document the Jury are enabled to refer to, does not indicate any difference between his method of melting and those already known, except in the small scale on which the operation is carried on.

Tuscany (p. 1289).

The exhibition from Tuscany is very interesting in a mineralogical point of view, the Royal Technological Institution having sent a very fine collection of minerals, including a magnificent series of marbles and alabaster, and superb specimens of the numerous minerals found in the Isle of Elba. Amongst these we may mention once more a block of gneiss, covered with noble crystals of felspar, already noticed at the commencement of this Report;[*] crystals of tourmaline, remarkable for the purity of their forms and the variety of their colours; aquamarines; and crystals of jenite. The useful ores, also, have been included; and we find specimens of specular iron ore, galena, and the ores of copper.

We have observed two blocks of mineral fuel (16-inch cubes) apparently of good quality. It is probable that this mineral belongs to the lignite deposits of Monte Massi and Monte Bamboli, which the Reporter has had the opportunity of visiting, and which agree with the lignites of Aix, the superposition of the bed which contains the lignite (itself about a yard thick) upon the Macigno being very certain, notwithstanding that the quality and general condition of the fuel present all the appearances of true coal, and that it yields a coke. Although there is no positive mention of the locality attached to the specimens, we take it for granted that they proceed from this deposit; but we wish, at the same, time to direct attention to the impressions of ferns and calamites placed near them, no doubt by mistake; for these latter are certainly of the carboniferous period, although no vestiges of the coal formation exist, either in Tuscany, or in any other part of the chain of the Apennines.

Of this fact the Reporter was aware from his own investigations, and these have been completely confirmed by the interesting work just published by Professor Paolo Savi, in conjunction with Mr. E. Menechini.[†]

The Jury, considering the high mineralogical interest of this collection, have awarded a Prize Medal to the **Royal Technological Institute of Tuscany** (p. 1290).

A Prize Medal has also been granted to the **Royal Salt Mines** of Volterra (2, p. 1290), which has sent for exhibition specimens of salt obtained from the evaporation of brine, besides specimens of alum and sulphur from the same establishment.

Ordinary Mention has been granted to the exhibition of the ores of mercury of Levigliani Ripa, in the province of Pietra Santa; and of Yane, Castellazzara, and Capita, in the province of Volterra; numbered respectively, 6, 7, 8, 9, 10, and 11 in the Catalogue (pp. 1290 1291).

Turkey (1385).

The mineral exhibition of Turkey is represented by a collection of upwards of 200 specimens, sent by the Ottoman Government. It was but just unpacked when the Jury separated, and the specimens were labelled only in the Turkish language, with which none of the members of the Jury were acquainted, so that it is impossible for them to state the precise value of the collection. It appeared, however, to be of some importance by the variety of the metalliferous ores included, the principal of them being red hæmatite, in fine kidney-shaped nodules, lead ores, accompanied by metallic lead obtained from them, and rather rich copper pyrites. But that which has chiefly interested us, and requires especial notice in this place, is the presence of 20 or 30 specimens of very good coal; and the person in charge of the collection having had the kindness to translate for us the labels, we are enabled to state the localities whence they were obtained.

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[*] These Exhibitors have been awarded a Prize Medal by the Jury of Class XXII., in whose List their names appear. —I. W.

[*] See *ante*, p. 3.

[†] Considerazioni sulle Geologia della Toscana, dei Professori Cav. Paolo Savi e G. Menechini; Firenze 1851.

All of these localities are distributed over a range of upwards of 40 leagues along the shores of the Black Sea, the Sea of Marmora, and the Archipelago, whence it appears that the coal formation must have a wide distribution in this part of the Turkish empire. The names of the places, beginning from the East, are as follows:—Amastra and Erekli, on the Black Sea; Vivan on the Sea of Marmora; and Scala Nova, in the Archipelago, about 40 miles from Smyrna. There are also in the collection three specimens from Rodosto, in the Roumelia, 28 or 30 leagues west of Constantinople: so that if the indication of these localities may be depended on, the coal formation must exist on both sides of the Straits; but according to a geological collection from the shores of Amasserah and Erekli, collected in 1844, and deposited in the Ecole des Mines, in Paris, by M. de Chancourtoi, Mining Engineer, there is reason to doubt whether the mineral fuel from the shores of the Black Sea (Anatolia) belongs to a true coal formation; and it is possible that the deposit is as modern as the cretaceous period. However this may be, and although it is possible that mistakes may have arisen by confusing the place of production with the port of embarkation, it appears, at any rate, quite certain that Turkey possesses, at a small distance from the capital, and even on the channel of Constantinople, a considerable coal-field, which may become an important source of wealth in the development of its industry, and for the purposes of steam navigation.

Paris, October 1, 1851. DUFRENOY, REPORTER.

CLASS II.

REPORT ON CHEMICAL AND PHARMACEUTICAL PROCESSES AND PRODUCTS GENERALLY.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

J. DUMAS, *Chairman*, France; former Minister of Agriculture and Commerce, Member of the Institute, &c.
T. GRAHAM, F.R.S., *Deputy Chairman and Reporter*, 4 Gordon Square; Prof. of Chemistry, Univ. Col.
JACOB BELL, M.P., 55 Langham Place; Pharmaceutist.
MICHELE GALEANI, M.D., Sicily; Doctor of Medicine.
GEORGE GOSSLETH, Austria; Chemical Manufacturer.
JOHN MERCER, F.C.S., Oakenshaw, near Accrington, Lancashire; Calico Printer.
H. L. PATTINSON, F.C.S., 10 Grey Street, Newcastle-on-Tyne; Chemical Manufacturer.
Dr. VARRENTRAPP, Zollverein; Professor of Chemistry.

Associates.

T. ANDERSON, M.D., F.R.S., Edinburgh; Chemist to the Highland and Agricultural Society of Scotland.
— BALARD, France; Member of the Institute, &c., &c. (Juror in Class XXVIII.)
L. L. BONAPARTE, France; Member of the National Assembly.
WILLIAM LINTON, 7 Lodge Place, St. John's Wood; Artist.
A. PAYEN, France; Member of the Institute, Professor at the Conservatory of Arts and Sciences, Member of the Central Jury, &c. (Juror in Class IV.)
EUGENE PELIGOT, France; Professor at the Conservatory of Arts and Sciences, Member of the Central Jury.
JOHN PERCY, M.D., F.R.S., Museum of Practical Geology, London; Professor of Metallurgy.
J. PERSOZ, France; Professor of Chemistry, Member of Central Jury, &c., &c. (Juror in Class XVIII.)

THE whole number of Exhibitors whose contributions were brought under the consideration of the Jury of Class II. appears to have been 270, of whom 132 were Foreign Exhibitors, and 138 English, or of the United Kingdom. Of these there appeared—as Exhibitors, chiefly or exclusively, of the following classes of substances:—

Of collections of the larger chemical products, such as the mineral acids, carbonate and bicarbonate of soda, chromates and prussiates of potash, borax, chloride of lime, salts of ammonia, and metallic salts for the use of dyers and calico-printers, 31 Exhibitors; 22 Foreign, and 9 English.

Of alum and other aluminous salts and sulphate of iron, 16 Exhibitors; 6 Foreign and 10 English.

Of yellow prussiate of potash and red prussiate of potash exclusively, 8 Exhibitors; 5 Foreign, and 3 English.

Of salts of ammonia, 4 Exhibitors; 2 Foreign, and 2 English.

Of artificial ultramarine, 16 Exhibitors; 14 Foreign, and 2 English.

Of ceruse or white lead, and oxichloride of lead, 16 Exhibitors; 13 Foreign, and 3 English.

Of oxide of zinc or zinc white, and other zinc colours, 7 Exhibitors; 5 Foreign, and 2 English.

Of iodine and the salts of kelp, 5 Exhibitors; 1 Foreign, and 4 English.

Of acetic acid and acetic mordants, 3 Foreign Exhibitors. Of acetate of lead, 1 Foreign, and 2 English Exhibitors.

Of particular mineral paints and preparations to preserve wood, 6 Exhibitors; 4 Foreign, and 2 English. Of cinnabar 2, of litharge and minium 1, and of smalts, 3 Exhibitors; all Foreign.

Of house-painters' colours and artists' colours, 11 Exhibitors; 4 Foreign, and 7 English.

Of liquids for staining and painting wood, and varnishes for wood, 5 English Exhibitors.

Of calico-printers' colours and lakes, 19 Exhibitors; 15 Foreign, and 4 English.

Of the products of the distillation of peat, 4 English Exhibitors; oils of bitumen and bituminous shale, 3 Foreign Exhibitors; oils of coal-gas tar, 2 Foreign, and 1 English Exhibitor; oils of resin, 1 English Exhibitor; purified animal oil, 1 English Exhibitor.

Of the rarer chemical products and substances recommended by their superior purity, chiefly intended for the use of scientific chemists, 4 Exhibitors; 2 Foreign, and 2 English.

Of collections of pharmaceutical products, generally numerous, including the alkaline, earthy, and metallic salts used in medicine, alkaloids and other organic preparations, 18 Exhibitors; 9 Foreign, and 9 English.

Of unmanufactured drugs, such as French opium, dried plants, &c., including one general collection contributed by the London druggists, 6 Exhibitors; 1 Foreign, and 5 English.

Of medicinal infusions, extracts, and confections, 9 Exhibitors; 2 Foreign, and 7 English.

Of cod-liver oil and skate-liver oil, 5 English Exhibitors.

Of quinine salts, 3 Foreign; and of magnesian preparations, 4 English Exhibitors.

The following pharmaceutical products were each shown by but one Exhibitor: by Foreign Exhibitors, salicin, quinidine, phloridzin, santonin, cream of tartar, and tartaric acid. By English Exhibitors, superphosphate of iron, benzoic acid, chloroform, sugar of milk, decolorized gum-arabic, aloine and cantharidine, kousso, sumbul and matico, Indian bael, myrrhine, a natural mineral water, artificial mineral waters (2 Exhibitors), and surgeons' lint.

The following miscellaneous chemical products and preparations were also the contributions of their respective Exhibitors solely: of Foreign Exhibitors, boracic acid, phosphorus, porcelain colours, dyed wool flocks, garancine, chemical preparation for restoring gold and silver embroideries. Of English Exhibitors, red phosphorus, bicarbonate of soda, chloride of sodium, large single crystals of salts, crystallized sulphur, stannate of soda, refined nitre, cyaniodide of iron, hippuric acid, valerianic acid with a series of the valerianites, a disinfecting powder; preserved size, starch, gum, and other products of the potato; a material imported for dyeing black; a new brown colour; woods furnishing dyes, oils, and medicinal substances; illustration of ale and porter brewing; tinted paper for bank cheques; parchments restored after injury by fire; wood preserved by a peculiar chemical process; a marking ink; a cement, Pooloo's Chinese cement; restored cotton waste; washing blue; a varnish for labels and artists' designs, blacking and French waterproof varnishes.

The specimens of the larger chemical products exhibited from the British manufactories, were frequently on a magnificent scale, and of singular beauty; such as the crystallized citric and tartaric acids, the chromates and prussiates of potash, sal ammoniac, alum, carbonate and bicarbonate of soda, and the sulphates of copper and iron. The pharmaceutical collections were also remarkably fine and extensive, including very beautiful preparations of iodine, of mercury, lead, zinc, antimony, silver, potash, and soda; double salts of iron; the salts of morphia, strychnia, and even the rare creatine and creatinine; while medicinal plants were so well preserved as to appear with all the beauty of the living plant. Several of the processes, also, were illustrated by instructive series of specimens, exhibiting the successive steps of the manufacture; as the alum process by shales in different stages of decomposition; the different steps in the white lead manufacture; and others. Many fine specimens were also contained in the foreign collections, although generally smaller and less prominent. It was evident that chemical manufacturing had attained more subdivision in England than abroad, with larger individual production. On the other hand, the great variety of products from a single manufactory was often very striking in the foreign, particularly the German, collections; a variety without inferiority of quality, which bore testimony to the excellent chemical education and varied resources of the exhibitors.

A great reduction in the cost of production is quite as remarkable in chemical substances as in the products of mechanical ingenuity, and equally indicates improvement in the chemical as in the mechanical arts. The great staple articles, such as the mineral acids and the alkaline salts, have become available, from their cheapness, to a variety of new applications, which are gradually altering the aspect of chemical manufactures. Thus we now find sulphuric acid applied directly to clay to form a sulphate of alumina, which competes with alum; and the sulphate of copper, the sulphate of magnesia, and even the sulphate of iron, produced by the direct combination of their constituents. The ore of lead we see treated with the hydrochloric acid of the soda process to form a rival pigment to white lead; and the ores of copper and tin fused with alkaline salts, as the means of purification and reduction, or to form a new salt.

Of a large proportion of the chemical products exhibited, the features which claimed most of the consideration of the Jury were the superior quality and beauty of crystallization of the salts, indicating a high degree of purity in their composition, and superior excellence of manufacture. Such may be said to be the general ground of the award of the honorary distinctions which have to be reported. But in a considerable number of instances the product was further recommended by its novelty, or by some important improvement in its preparation, which demands more special notice.

Red or Allotropic Phosphorus.

Of the elementary and non-metallic substances, an instance of singular interest was presented in the allotropic phosphorus of Schrötter, manufactured and exhibited by Messrs. J. and E. **Sturge**, of Birmingham (119, p. 199). The extraordinary conversion of phosphorus into a red infusible powder is effected by exposing melted phosphorus in a close vessel, to a degree of heat which is near the boiling point of that substance, and which is kept up for a considerable time. It is probable, from the entirely inodorous character of the specimens recently manufactured, that the amorphous phosphorus is now made without the use of sulphuret of carbon to remove any excess of unaltered phosphorus. This new preparation presents great facilities in the manufacture of matches, from being no longer spontaneously inflammable, and yielding no smoke of phosphorous acid; which was found highly injurious to health, producing caries of the bones, particularly of the lower jaw, in workmen exposed to it. The combination of red lead with the amorphous phosphorus in the matches causes them to ignite as usual by friction.

Iodine.

Perhaps the earliest, as they are still among the most esteemed, manufacturers of iodine on the Continent, after its first discoverer, M. Courtois, are the Messrs. **Cournerie** and Co., of Cherbourg (462, p. 1200), who have created in their own sphere a branch of industry in the preparation of iodine, of chloride of potassium, and the other salts of kelp; of which specimens were exhibited, remarkable for purity and beauty. With the exception of the iodine used in photography, the whole iodine produced appears to be still consumed in medicine, and chiefly in the form of iodide of potassium, and other iodides, only a comparatively small quantity being retained as iodine. Of iodine from kelp there are also two Scotch and two Irish Exhibitors, who are each considerable manufacturers. The great increase in the production of iodine took place about 1840. The make of a single house in Scotland, from 1845 to 1850, averaged 276,000 ounces per annum, and is believed to form fully one-third of the entire produce of the United Kingdom during that period. The price of a pure dry article for the three years, 1848, 1849, 1850, remained between 7½*d.* and 8½*d.* The price for 1851 is from 6*d.* to 6½*d.*, with an excess of production.

Sulphuret of Carbon.

Among the newest of chemical manufactures is that of sulphuret of carbon, represented by Dr. L. C. **Marquart**, of Prussia (I.—327, p. 1069). This liquid has found a singular application in electro-plating, the addition of a few drops of it to the silver solution causing the metal to deposit bright, a fact which appears to have been independently discovered by the Messrs. Elkington, and by Mr. Lyons, of Birmingham, who both exhibit illustrations of this application of the substance.

Boracic Acid.

The preparation of boracic acid by Count F. de **Larderel**, of Tuscany (35, p. 1294), was rewarded by a Council Medal. Although this well-known manufacture is not recent, having attained its full development at least ten years ago, still the bold originality of its first conception, the perseverance and extraordinary resources displayed in its successful establishment, and the value of the product which it supplies, will always place the operations of Count de Larderel among the highest achievements of the useful arts, and demanded the most honourable recognition at this epoch. The vapour issuing from a volcanic soil is condensed, and the minute proportion of boracic acid which it contains (not exceeding 0·3 per cent.) is recovered by evaporation, in a district without fuel, by the application of volcanic vapour itself as a source of heat. The boracic acid thus obtained greatly exceeds in quantity the old and limited supply of borax from the upper districts of British India, and has greatly extended the use of that salt in the glazes of porcelain, and recently in the making of the most brilliant crystal, when combined with the oxide of zinc instead of oxide of lead.

Sulphuric Acid.

The most novel feature in the manufacture of sulphuric acid, illustrated in the Exhibition, was the process of making this acid in vessels of earthenware instead of the leaden chamber, as designed by M. **Fouché-Lepelletier** (1229, p. 1236), and followed to a large extent at the celebrated works of Javel, near Paris. The material of these vessels is the salt-glaze ware, which resists acids; and they are in the form of large Wolfe's bottles, connected together in series. The acid fumes are carried through a large number of these vessels, by which the power of condensation is found to be one-third greater than could be obtained from a single chamber of equal capacity; while their original cost of construction is, to that of a leaden chamber, in the proportion of 12 to 100, and the cost of maintaining them is nothing. Such vessels have been in use at Javel since 1846; and of the large annual production of 3,600,000 kilogrammes of concentrated sulphuric acid in that establishment, one-third is at present manufactured in this way. The acid thus prepared, is of course free from lead. The manufacture of vessels of the material described, for chemical purposes, being greatly on the increase in England, the process of Javel could be easily introduced, and appears well deserving of the consideration of manufacturers.

SALTS OF SEA-WATER.

A Council Medal was accorded to MM. **PRAT** and **AGARD**, of Marseilles (1682, p. 1257), for various salts, including the chloride of potassium, sulphate of soda, and sulphate of magnesia, prepared from sea-water, by the process of M. Balard. The long-continued investigations of sea-water, by the last-named eminent chemist, have furnished valuable means for the separation of its useful salts. It appears that the sea-water of the Mediterranean may be concentrated by spontaneous evaporation to density 1·27, without depositing anything but common salt. The mother-liquor, or bittern, when further concentrated, first deposits, as its density rises from 1·27 to 1·32, a mixed salt, consisting of about 40 parts of sulphate of magnesia and 60 parts of chloride of sodium. Or, if the temperature falls to 6° or 7° Centigrade (43° or 45° Fahr.), bittern of density 1·32 deposits sulphate of magnesia nearly pure, in the proportion of about 90 kilogrammes of that salt from one cubic metre of fluid. The most economical application of this sulphate of magnesia is said to be in the conversion of chloride of sodium into sulphate of soda. The next important product obtained is, the double chloride of potassium and magnesium, which serves afterwards for preparing the chloride of potassium. This double salt is deposited from the bittern concentrated to density 1·345, by spontaneous evaporation, after the deposition of the magnesian salts; or by concentrating by artificial heat in an evaporating pan to the same extent. Dissolved in a small quantity of hot water, the double chloride undergoes decomposition, and allows the chloride of potassium to crystallize nearly pure on cooling. The last mother-liquor above density 1·345, after the separation of the potash, contains much chloride of magnesium; a salt which may be had recourse to as a source of hydrochloric acid, being decomposed by distillation.

M. Balard has also proved that the greater portion of the sulphate in sea-water, separates, as sulphate of soda, from sea-water concentrated to from density 1·152 to 1·2, if cooled down to from −4° to −5° Centig. (25° to 23° Fahr.). Waters concentrated as far as density 1·2 to 1·264, produce an abundant deposit of sulphate of soda, even at −2° or −3° Centig. (28° to 26° Fahr.). Sulphate of soda, however, is procured more conveniently by dissolving together sulphate of magnesia and chloride of sodium, in the proportion of 55 of the former to 45 of the latter, at the temperature of 30° Centig. (86° Fahr.), and running off the solution of density 1·264 into open reservoirs. Such a solution exposed during a cold night in winter, deposits a considerable quantity of sulphate of soda at 5° or 6° Centig. (42° Fahr.); about 85 per cent. of the whole quantity of that salt which it contains, at + 2° Centig. (35·6° Fahr.); and if the temperature fall to −2° (28·4° Fahr.), the solution deposits nearly the whole of the sulphate of soda present.

The most important of these products is, no doubt, the chloride of potassium, and M. Balard has, with good reason, looked to sea-water as the great natural source of potash. The water of the Mediterranean contains, according to the analysis of M. Usiglio, 0·0505 pound of chloride of potassium in 100 pounds of water, or about one two-thousandth part of its weight of that salt.

BICHROMATE OF POTASH.

The bichromate of potash was exhibited to great advantage by Messrs. **DENTITH** (8, p. 187), and other makers. Prior to 1820, the process universally followed for the preparation of this salt was, to calcine chrome iron with nitrate of potash. Bichromate of potash appears to have been consumed, at that time, in the preparation of chromate of lead only, and was sold at about 21*s.* per lb. The first alteration in the process was the addition of carbonate of potash to the chrome ore and nitre, by which a saving of the latter salt was effected. The next great improvement made in the manufacture was the dispensing with nitre, and oxidising entirely by means of air admitted into the reverberatory furnace in which the ore mixed with carbonate of potash is calcined. This change took place about 1835 or 1836. An addition of lime to the preceding materials was made by Stromeyer, in Norway, a few years afterwards, and soon became general. The oxidation goes on quicker with the presence of lime, owing to the porosity of the mass, which allows the more ready access of air. The earliest great manufacturers of this salt in the United Kingdom were Kurtz and Niven, of Manchester, and Turnbull and Ramsay, of Glasgow, who were soon followed by the Whites in Glasgow, Swindells in Newcastle, and Dentith in Manchester.

The introduction of the yellow discharge (chromate of lead) upon Turkey-red cloth, by Daniel Koechlin, of Mulhouse, about 1820, appears to be the circumstance which first greatly increased the demand for this salt, and stimulated the improvement of its manufacture. Besides its familiar application, to produce the yellow and orange chromates of lead, bichromate of potash is now used in dyeing wool; a fast and solid black being produced by boiling the wool with bichromate and a little sulphuric acid, washing the wool in water, and afterwards dyeing with logwood in the usual way. By substituting other dye-stuffs for the logwood, various other colours are produced in a similar manner. The wool contains oxide of chromium, which acts like alumina or peroxide of iron in attaching colouring matters. Chromic acid has also been used in bleaching palm oil, and in oxidising oils for other purposes.

The following statement (kindly supplied to me by Mr. J. White, of Shawfield, Glasgow) of the entire production, during several quinquennial periods, of one of the oldest and most considerable manufactories of bichromate of potash in Scotland, gives a fair idea, I believe, of the general advance of this manufacture during the period alluded to:—

In five years—				Per Pound. *s.*	*d.*
1825—1830, 315 tons	bichromate	of potash,	at	2	0
1830—1835, 1256 tons	„	„	at	1	0
1835—1840, 1870 tons	„	„	at	0	9
1840—1845, 2840 tons	„	„	at	0	8
1845—1850, 2670 tons	„	„	at	0	7½

THE PRUSSIATES OF POTASH.

These important salts were exhibited of great purity and beauty, by several manufacturers, particularly Messrs. T. **BRAMWELL** and Co., of Newcastle (27, p. 190); the **HURLET AND CAMPSIE ALUM COMPANY**, of Glasgow (13, pp. 188, 189); the **BOUXWILLER MINING COMPANY**, of France (376, p. 1195); C. **SCHLIPPE**, of Russia (27, p. 1367), and **ALEXANDER BRUSCHIN** (24, p. 1367), also of Russia.

The manufactory of Messrs. Bramwell was established about 80 years ago, at which time *Prussian blue* only was made in it; a considerable quantity of which, I am informed by Mr. Bramwell, was sent annually to China, and used by the Chinese, it was believed, for colouring green teas: a spring shipment was always made of about 2,000*l.* in value, which was often followed by another in autumn. It was first sold at two guineas per pound, made up in neatly-finished one-pound packages, but had fallen, in 1815, to 10*s.* 6*d.*, and about 1820 to 2*s.* 6*d.* For the last ten years the price of Prussian blue has been 1*s.* 9*d.*

Prussiate of potash was not known in commerce in a crystallized state till about 1825, when the price was 5*s.* per pound. But for some years previously a weak solution of the salt, or of the fluxed mass of animal matter and potash, had been sold at 1*s.* per gallon. The process of manufacture, so far as regards the materials used and the furnaces employed, is still essentially the same as it was fifty years ago; but in consequence of agitating the fluxed mass by machinery in closed pots, introduced at Glasgow by the late Charles Macintosh, in 1824, and other minor improvements in the manipulation, the production of prussiate from the same quantity of animal matter has been increased threefold. The rapid progress of this manufacture will appear from the following estimated annual production in the United Kingdom:—

Annual Production:—	Per Pound. s.	d.
From 1825—1830 about 10 tons, at . .	5	0
1830—1835 about 40 tons, at . .	2	6
1835—1840 about 200 tons, at . .	1	4
1840—1845 about 700 tons, at . .	1	4
1845—1850 about 1,040 tons, at . .	1	3

The number of prussiate works in the United Kingdom is, at present, eleven, the whole making, when the salt is in demand, about 20 tons per week, of which the two largest works, those of Messrs. Bramwell, and the Hurlet and Campsie Alum Company, are believed to produce four or five tons each. The value of the annual product for the last five years is calculated from the preceding data at 145,600*l*.

The most extraordinary event in the history of this manufacture is, the attempt made a few years ago to introduce the air-process, which is of much interest both in a scientific and practical point of view. As cyanogen is rapidly converted into ammonia, the artificial formation of the former from the nitrogen of air would likewise furnish an unlimited supply of ammonia, of which the importance to agriculture could not be over-estimated. The experiment was pursued with singular perseverance and ability, as will appear from the following valuable details, for which I am indebted to my friend Mr. F. R. Hughes, of Borrowstowness:—

"In 1844 we commenced a series of experiments upon the large scale, at Newcastle, in company with Messrs. Bramwell, to manufacture prussiate of potash without animal matter, substituting the nitrogen of the atmosphere for it, and continued the experiments till the latter end of 1847.

"In these operations a tube or retort of fire-clay was placed in a vertical position in a furnace so constructed that, when the formation of carbonic oxide was prevented, sufficient heat could be obtained to soften a Stourbridge fire-brick throughout its substance, when exposed in the flue, or off-go, to the full force of the fire.

"The lower part of the retort was made of cast-iron, kept out of the vicinity of the fire, and of sufficient length to afford time for the mass heated by the fire to become cool before it was discharged into a cistern placed below, containing water and a protosalt of iron, into which the lower end of the tube dipped. Provision was made at this end of the tube to regulate the periodical discharge of its contents, in whatever proportion was desired.

"The tube was filled with wood-charcoal, saturated with a solution of the carbonate of potash of commerce, and dried. The mixture in this state generally contained about 20 per cent. of potassa (KO).

"By means of an air-pump, the atmospheric air was drawn through the tube of alkalized charcoal, in a continuous stream from the top, and discharged below in the state of nitrogen and carbonic oxide.

"The alkalized charcoal was thus found to become pretty rich in cyanide of potassium; one-half of the alkali of the cyanized charcoal frequently being found, upon testing, to be in combination with cyanogen; so that when all was working well, 36 to 40 cwt. of prussiate of potash were produced in a week by means of seven to eight retorts, of 10 to 12 feet long in the fire, and 2 feet internal diameter.

"In our first experiments much narrower tubes were employed, to which the heat was applied only externally; but as both the tubes and charcoal are bad conductors of heat, we could not operate upon sufficient quantities, and we found it necessary to build larger tubes, with fire-bricks, of the above dimensions; leaving a circle of small apertures or chinks in the tube, every third or fourth tier of bricks, through which the intensely-heated gases, nitrogen and carbonic acid, were drawn from the flue surrounding the tubes, by the action of an aspirator. We thus had the mass in the interior of the large tubes so hot, that an iron rod one inch in diameter became white hot when thrust down in the centre and allowed to remain there five or ten minutes.

"Our next improvement was to use the alkalized charcoal undried, and to aspirate the air from below upwards, instead of downwards; the surplus heat drying the alkalized charcoal before it reached that part of the retort in which the cyanide was produced, a length of 6 to 8 feet. The top of the retort was in this case rendered air-tight, and the cyanized mass discharged below as before.

"Through seven or eight retorts of the above size about 2,400 cubic feet of alkalized charcoal were passed in a week; and about 1,200 to 1,400 cubic feet of cyanized charcoal were obtained, nearly one-half of the charcoal being consumed.

"There were two great drawbacks to this process; one, the immense quantity of material to be lixiviated for a small return of prussiate; the other, and by far the more important, an extraordinary waste of potash in the process, upwards of three parts by weight being consumed in producing one of prussiate. The whole of this waste could never be properly accounted for. About one part was, of course, recovered in a state of prussiate. It was found that another was lost in the small refuse charcoal, which could not be lixiviated to pay, and the remainder appeared to be partly combined with the bricks of the retort, and partly dissipated up the chimney.

"In 1847 we abandoned the experiment, after a loss of many thousand pounds. But we proved the possibility of producing large quantities of cyanide of potassium, by drawing intensely-heated nitrogen and carbonic acid gases through a mixture of potash and charcoal, with the difficulty of carrying this out as a manufacturing process from the great waste of potash.

"Our experiments were more directed to making the air process practicable, for the purpose of manufacture, than to ascertain upon what principle the formation of cyanogen depended; for it was immaterial, in a manufacturing point of view, whether the cyanogen were produced from the nitrogen of the atmosphere, or from the ammonia which the charcoal was always found to contain. The means of nicely observing the changes were lost from the necessity which existed in operating upon large masses, to draw the intensely-heated gases from the fire into the body of the tubes, in order to bring the alkalized charcoal to a proper heat for the production of cyanide of potassium. It is probable that some part at least of the cyanogen was furnished from the ammonia in the charcoal, which in separate experiments in the laboratory, was found not to be entirely given off at a red heat. Some alkalized charcoal, also brought to a proper heat in a porcelain tube, produced a considerable quantity of cyanide of potassium without the presence of air, the ends being stopped up. On the other hand, when the retorts were filled with charcoal *not alkalized*, and the heated gases drawn through, no formation of either cyanogen or hydrocyanite of ammonia could be detected.

"A paper, by Professor Marchand, contained in the eighth volume of the Chemical Gazette, page 301, on the presence of nitrogen in cast iron and steel, appears to throw some light upon the subject. He has shown that when carbon is combined chemically with iron, and treated with potassium, in the presence of nitrogen, cyanogen is produced. It seems to me, therefore, probable that the first step in our process was the formation of a carburet of potassium, which by combining with the aspirated nitrogen, produced the cyanide of potassium. This might be ascertained by examining the remainder left in the retort, after the production of potassium in the ordinary way from bitartrate of potash, testing the quantity of cyanide it contained, if any, and then testing the increased quantity after heating it in nitrogen gas.

"I have only further to mention that we substituted soda for potash, in the process, with the like loss."

Mr. Bramwell also considers that the process succeeded perfectly, in a chemical point of view, although it did not answer as a commercial speculation; and ascribes its failure in economy chiefly to the circumstance that the fire-clay tube could not be made to resist, long, the combined action of the alkali and of the excessive heat applied.

In 1842–43 the use of the red prussiate of potash in calico-printing was introduced, and since that time a considerable and increasing quantity of the yellow prussiate has been converted by means of chlorine into that salt.

Shortly afterwards both salts were successfully employed in "de laine" printing, as well as in dyeing wool; the blue from the red prussiate being found more durable when fixed by peroxide of tin. The red salt is also mixed with wood colours, to oxidise them, or produce the greater depth and beauty of colour which long exposure to air, without light, otherwise induces in the dye-woods.

Carbonate of Soda.

Few chemical processes have maintained their ground for so long a period as the grand process for the preparation of carbonate of soda from chloride of sodium, by means of sulphuric acid employed to convert that salt into a sulphate, followed by the decomposition of the latter salt by coal and carbonate of lime, upon the floor of the reverberatory furnace. The instructions given by Leblanc, who invented this soda-process at the end of the last century, might still be taken as directions at the present day.

All the carbonate of soda produced in the United Kingdom by this process, up to 1825, was sent into commerce in the form of the crystallized carbonate only. The manufacture was advanced into importance chiefly by the skill and exertions of the late Charles Tennant, at the great chemical works of St. Rollox, near Glasgow. The salt is, in consequence, known in London, to the present day, as "Scotch soda." The crystals were sold in 1820 at 35*s*. per cwt., but the price descended gradually in three or four years to 20*s*., partly in consequence of the increasing demand, at this time, for bleaching powder, giving rise to the formation of much sulphate of soda; and partly from the great reduction in the price of common salt, arising from the increased production which followed the abolition of the Excise duty upon it, although a drawback of the duty had always been allowed upon the salt consumed in this manufacture. The price of crystallized carbonate of soda, at the present time, is about 6*s*. per cwt. About 1823, the soda-ash trade was originated in Liverpool, by the enterprise of James Muspratt, and soon extended to Newcastle, which is now the principal seat of the manufacture, and to other places. When, formerly, the production of carbonate of soda was combined with that of chlorine, the binoxide of manganese was mixed with the common salt and sulphuric acid, which involved an after-operation for the separation of the manganese; but now, the hydrochloric acid is first separated by the action of sulphuric acid upon chloride of sodium alone, in a peculiar form of the reverberatory furnace, and condensed in a stone tower, filled with moistened pebbles, through which the vapours are conveyed; while the chlorine is evolved by the direct action of hydrochloric acid upon manganese, in excavated vessels of sandstone, which are heated by steam applied externally. Depending also, as this soda process does, upon the economy of the sulphuric acid manufacture, it was greatly benefited by the improvement introduced into this country, about 1828, (by Kestner, of Thann,) of throwing steam into the leaden chamber, by which the full equivalent of sulphuric acid came to be obtained for the sulphur consumed. The consumption of nitre, or of nitrate of soda, was also reduced, by the proper management of the chamber, from one-sixth to one-twentieth of the weight of the sulphur, independently of the application more lately made by Gay-Lussac, of strong sulphuric acid to absorb and recover the nitrous fumes which are usually allowed to escape with the exhausted air of the chambers.

The attempts of chemists to modify or entirely supersede the soda-process of Leblanc have been incessant, and of the most diversified character. One of the latest of these is the process of Mr. Longmaid, (Cl. I., 441, p. 162), for decomposing common salt by means of iron pyrites, which appeared to the Jury to have that amount of success which, considering the difficulties to be surmounted and the fundamental character of the soda manufacture, entitled it to the high distinction of the Council Medal. It was ascertained that, with a pyrites containing two or three per cent. of copper, sulphate of soda was economically produced by the ignition of the former with choride of sodium,—the recovery of the copper converted at the same time into sulphate of copper, contributing to the profit. A process, also, like Mr. Longmaid's, which entirely dispenses with the preparation of sulphuric acid in the leaden chamber, is further recommended by the circumstance that it may be found applicable from its simplicity in certain localities where the ordinary process would not be practicable.

Stannate of Soda.

Of the salts of tin exhibited, the most novel preparation is the stannate of soda, in a dry state, which is contributed by G. E. Braun, of Austria (21, p. 1008), and also by J. Young, of Manchester,—by the latter in a beautifully crystallized form. The neutral dry salt was introduced a few years ago by Mr. Mercer, for the use of calico-printers, and prepared by an original process. Metallic tin was oxidated by a mixture of nitrate and hydrate of soda, which give rise to the stannate of soda, with evolution of ammonia:—

$$NaO.NO_5 + 3\,(NaO.HO) + 4\,Sn = 4\,(NaO.SnO_2) + NH_3.$$

The process of Mr. Young (7B., p. 187), which is more recent, is also new, and presents a strikingly beautiful application of science. Instead of reducing metallic tin from the ore, and oxidating the metal again to form the stannic acic, at the expense of nitric acid, Mr. Young takes the native peroxide of tin (stannic acid) itself, and fuses it with soda. The iron, and other foreign metals present in the ore, are insoluble in the alkali; so that by solution of the fused mass in water, a pure stannate of soda is obtained at once. It is crystallized by evaporation, and obtained in efflorescent octahedral crystals, containing nine equivalents of water.

Artificial Ultramarine.

In the person of M. J. B. Guimet, the Jury were able to offer their highest mark of distinction to the first discoverer of the artificial ultramarine. The process of Guimet was communicated confidentially to Gay-Lussac, on the occasion of its being rewarded for the first time by the Société d'Encouragement in 1828. M. Guimet (1620, p. 1255) still maintains an incontestable pre-eminence also as a manufacturer among the now numerous producers of this substance,—his product being remarkable for the intensity of its hue, and standing well the dilution with a white powder, which is a most trying test of that property. It appeared to the Jury, assisted in the department of colours by Mr. Linton, who, as an artist, has made the chemical properties of colours a peculiar study, that, for use in oil and water-colour painting, a pure blue ultramarine, unmixed with red, is desired; while, on the other hand, the ultramarine is recommended, by its purple bloom, as a colour upon cloth. The specimens exhibited generally possessed the latter character, and were no doubt chiefly intended for calico-printing. The discovery of a method of attaching this insoluble pigment to cloth by means of albumen, which is ultimately coagulated by heat, combined with the low cost of production, has led to a great demand for ultramarine, and rapid extension of the manufacture within the last few years. Certainly, many of the finest effects in the beautiful prints at present exhibited are produced by its means.

As the process of M. Guimet was never published, ultramarine has had other independent discoverers: of whom Professor Gmelin, of Tubingen, Professor Persoz, of Strasburg, and M. Koettig, director of the Saxon Ultramarine Works, are best known.

Prior to 1847, only two manufactories of ultramarine existed in France, those of Guimet and Courtial, and in Germany that of Leverkus was in operation; but at that date, the works of Zuber and Co., of Rixheim, in France, were established, and subsequently a large number of manufactories have arisen, twenty, at least, in Germany, where the price of the article has attained its lowest limit. The production of ultramarine by Messrs. Dauptain, Gorton, and Co., in London, and by Mr. Schmersahl, in Manchester, is also comparatively recent.

The total production of ultramarine in France, in 1848, in three manufactories, is estimated at from 90,000 to 100,000 kilogrammes; and for 1851, in four manufactories, from 150,000 to 170,000 kilogrammes; the price of the finer sorts having fallen during the same period from 9 to 5·50 francs per kilogramme. One of the latest improvements in the manufacture is the preparation, by Messrs. Zuber and others, of a *green ultramarine*, of excellent quality, for printing upon cotton and paper, and which has the advantage over arsenical greens of being neither poisonous nor alterable by alkalies.

ALUM AND COPPERAS.

The manufacture of alum and copperas from the pyritous schists of the coal formation is as ancient in England as the reign of Elizabeth, and still maintains its ground in competition with several new and successful processes for both of these salts. It was represented by Messrs. **MOBERLY** and Co. (Cl. I., 17, p. 189), of the Whitby alum district, and by the **HURLET** and **CAMPSIE ALUM COMPANY** (13, pp. 188, 189), with Messrs. **JOHN WILSON** and **SON** (6, p. 185), from the neighbourhood of Glasgow. It is understood that the processes of these eminent manufacturers have not been stationary, but have received improvements of late years, by which the produce from the schist is considerably increased. The residuary mother-liquor is made a source of sulphate of magnesia, which was exhibited by Messrs. Moberly. This liquor is purified from salts of iron and other metals by means of caustic magnesia, obtained by calcining magnesian limestone and washing the lime out of it, according to the patent process of Dr. T. Richardson, of Newcastle.

Excellent alum was exhibited by Mr. **SPENCE**, of Pendleton (7, p. 185), prepared by the direct application of sulphuric acid to the aluminous shale of the coal formation, with the addition afterwards of sulphate of ammonia; and also sulphate of iron, prepared by combining sulphuric acid directly with the residuary oxide of iron of burnt pyrites. Sulphate of alumina itself also has become a considerable manufacture, under the name of "concentrated alum," and was exhibited by Messrs. **PATTINSON**, of Newcastle (18, p. 189), who originated the manufacture.

WHITE LEAD.

Several producers of white lead, manufactured by the old processes, are distinguished among the awards of this Jury, particularly T. **LEFEBRE** and Co., of France (580, p. 1205), Baron F. P. **VON HERBERT**, of Austria (32, p. 1008), and **BISCHOF** and **RHODIUS**, of Prussia (Cl. I., 312, p. 1068). The product of **STRATINGH** and Co., Netherlands (3, p. 1142), is also honourably mentioned. Other salts of lead which have been proposed to replace the carbonate, such as the sulphate of lead with excess of oxide, although equal in whiteness and opacity, have generally been found comparatively deficient in some other property when brought into use. Such substitutes have proved over-sensitive to sulphuretted hydrogen, and tarnish more rapidly than white lead in similar circumstances; or, their excess of oxide appears to combine with the oleic acid and produce a paint which is streaky under the brush, or does not "flat" well, and the remarkably small proportion of oil necessary to liquify the carbonate of lead (a gallon of oil to the hundredweight of white lead) is apt to be exceeded. A new substitute, however, exhibited by Mr. H. **LEE PATTINSON**, a member of the Chemical Jury, appeared highly deserving of commendation, from the originality of the process, namely, the *oxichloride of lead*, consisting of single equivalents of chloride and oxide of lead. This salt is prepared by decomposing native galena by the hydrochloric acid, which is produced in great excess in the manufacture of soda; dissolving the chloride of lead thus formed in boiling water, and mixing the solution with the proper quantity of lime-water to convert one-half of the chloride into oxide.

The following statements represent the present condition of the white lead manufacture in France:—The manufactories are principally concentrated in the neighbourhood of Lille, where seven exist, having an average total annual production of 4,550,000 kilogrammes. In the rest of France there are only three other considerable works, two at Paris and one at Tours, making together about 1,600,000 kilogrammes. The works at Marseilles and Strasburg are small, their united production being about 300,000 kilogrammes. Hence the whole annual French production of white lead is 6,450,000 kilogrammes. White lead was worth 100 francs the hundred kilogrammes in 1825, the price of lead being then 65 francs. At present white lead in France is only worth 65 francs, with lead at 50 francs. There is a duty in that country upon the metal of 5·50 francs.

ZINC-WHITE.

The introduction of oxide of zinc, as a white paint, in the place of a salt of lead, is one of the most remarkable events in the recent history of the chemical arts. This application, first successfully made in France, is rapidly extending on the Continent, and also in England. An oxide of zinc of great whiteness and opacity is obtained by the combustion of the metal in air. This oxide, mixed with 15 or 16 per cent. of its weight of linseed oil, previously heated with a small quantity of peroxide of magnesia, gives a paste which covers well, and has the advantage of not being blackened by sulphureous exhalations. The oxide of zinc of some of the exhibitors has been prepared by burning the metal, as it is first evolved from its ore in the reduction process, an arrangement which must diminish considerably the cost of production.

GARANCINE.

A considerable portion of the madder roots, instead of being ground and exported in that form, as heretofore, is now exposed, after being moistened with dilute sulphuric acid, to a boiling heat by means of steam, by which the colouring matter is considerably altered and improved in quality for some dyeing processes, while the quantity rendered soluble in water is greatly increased. The madder so prepared is known as garancine, and forms an important branch of manufacture in the south of France, which was well illustrated by a collection of specimens supplied by the Chamber of Commerce of Avignon (1049, p. 1229). The spent madder, after being used in dyeing, is now also converted by Mr. H. Steiner, of Accrington, into a garancine (termed *garanceuse* by the French) by steaming it with sulphuric acid in the same manner as the fresh madder, and thus a considerable quantity of colouring matter is recovered and made available which was formerly thrown away in the spent madder. Both varieties of garancine give a more scarletty red than the unprepared madder, and also good chocolate and black, without soiling the white ground, but are not so well fitted, particularly the garancine of spent madders, for dyeing purples, lilacs, and pinks.

LIQUID PRODUCTS FROM THE DISTILLATION OF COAL AND PEAT.

The condensable products from the distillation of coal and other bituminous substances are becoming every day more important, from their various applications. The solid portions of the gas-tar are mixed with gravel, sand, and lime, and made use of for laying the floors of cellars, footpaths, &c. In causewaying the streets of Manchester, the small granite blocks are placed upon a good bed of concrete, about three-quarters of an inch apart, and a space filled up by pitch to within half an inch of the top. The crude oil, distilled from the pitch, is employed to a great extent for impregnating wooden piles to be driven under water, which are thus protected from decay, and from the ravages of marine insects. A great portion of the tar is distilled to obtain naphtha, which is used with oil of turpentine as a solvent of caoutchouc. The volatile naphtha from cannel coal is the most suitable for this purpose, and also for naphthalizing coal gas. Coal naphtha is also used for external lighting, the working sheds and yards of some manufactories being thus brilliantly illuminated. The naphtha is then burnt in the lamp invented by Mr. Beale, in which the ignition is promoted by a jet of air transmitted from the fan-blower or other blowing-machine.

The volatile alkali of the ammoniacal liquor is now generally saturated with sulphuric acid and crystallized, the process being best effected by distilling over the volatile salts of ammonia, and condensing in sulphuric acid. All the carbonate comes over in the first fourth of the liquid distilled; lime is then introduced into the still, to disengage the small remaining portion of ammonia combined with fixed acids, and the distillation completed. The sulphate of ammonia, which is thus produced for from 12*l.* to 14*l.* per ton, is used in alum-making and in agriculture, or converted into sal-ammoniac and the carbonate of ammonia. The manufacture of ammoniacal salts was well illustrated by Mr. F. C. Hills, of Deptford (23, p. 190), and other exhibitors, both of the United Kingdom and Foreign States.

The Chemical Jury likewise extended its commendation to all the exhibitors of the products of the distillation of peat, although properly belonging to Class I. Prize Medals were also awarded to A. Wiseman and Co., of Prussia (334, p. 1010), for the products of distilled schist; to A. Moreau, of France (1361, p. 1241), for a series of products of distilled bitumen; and to J. Young, of Manchester (7a, p. 187), for paraffin and oils obtained from coal.

The process last referred to is one of great importance, which has only been fully developed since the Jury made its awards. By distilling the cannel coal of Boghead, near Bathgate, in Scotland, at the lowest red heat, Mr. Young is said to obtain a quantity of oil, amounting to about 20 per cent. of the weight of the coal. This oil, after rectifying off a small portion of its more volatile part, is exceedingly well adapted for lubricating machinery. It does not oxidate in air, and is equal to the best sperm oil for the purpose stated, being a rich solution of paraffin in more volatile oils. It is difficult to estimate the advantage, in a variety of points of view, of so valuable a discovery.

Such were the principal novelties in the chemical department of the Exhibition. But there is reason to believe that many substances besides those already described were the results of improved processes, peculiar to their respective manufacturers, although no claim was made upon that ground. The full merit of many of the Exhibitors, particularly in the pharmaceutical division, can thus be only very imperfectly estimated. The remaining references to points of interest will be given under the names of the Exhibitors.

The following enumeration of the principal Exhibitors in Class II. contains, with a notice of their contributions, a statement of all the awards both of the Prize Medal and of the distinction of Honourable Mention which were made by the Jury.

Albani Brothers, of Turin (7, p. 1302), obtained Honourable Mention for a collection of chemical products of good quality, including the mineral acids, nitrate of baryta, gelatine, and soda-soap.

— Anthelme, of Andelin (Aisne) (1541, p. 1250), obtained Honourable Mention for alum manufactured by him.

P. H. Aubergier, of Clermont Ferrand (754, p. 1216), exhibited French opium, prepared by a method of incision invented by himself; and also the syrup of lettuce.

H. F. L. Augustin, of Halberstadt (826, p. 1095), obtained Honourable Mention for the good quality of his acetate of lead.

James B. Austin, of Banbury (114, p. 199), exhibited decoctions and infusions of medicinal substances, prepared by him.

The Chamber of Commerce of Avignon (1049, p. 1229) had the Prize Medal accorded to it for garancine; a valuable form in which madder is prepared, and which is manufactured largely in the south of France, where madder is cultivated.

F. Bankart and Sons, of Swansea (49, p. 193), exhibited copperas, manufactured by them in that locality.

James Benjamin Barnes (45, p. 192) had the Prize Medal accorded to him for valerianic acid, produced by the oxidation of fusel oil by means of chromic acid; exhibited, together with a series of the valeriannates of the alkaline, earthy, metallic, and organic bases, of singular extent and completeness.

James Bass, of Hatton Garden (95, p. 197), exhibited specimens of the concentrated medicinal infusions and decoctions which he prepares, and which are much esteemed in the trade.

Wenzel Batka, of Prague (9, p. 1007), exhibited, in addition to his chemical glass apparatus, specimens of tungstic acid, oxide of uranium, and of the rarer metallic oxides, together with selenium in great quantity; for which collection of chemicals the Prize Medal was awarded.

George Bell and Co. (66, p. 194) exhibited mineral paints, compounded so as to dry quickly under water, and to remain attached to metals exposed to extreme heat.

Isaac Lowthian Bell, of Washington Chemical Works, Newcastle-upon-Tyne (12, p. 488), exhibited specimens of Pattinson's patent oxichloride of lead, with illustrations of its use in oil-painting.

John Bell and Co. (116, p. 199), of which firm Mr. J. Bell, Juror of Class II., is a partner, exhibited several pharmaceutical products carefully prepared by them, including cod-liver oil, the stearine from that oil, simple and compound extracts of sarsaparilla, oil of lavender, benzoate of ammonia, iodide of iron, extract and tincture of Indian hemp, juice of taraxicum, &c.

Pietro Bigaglia, of Venice (34, p. 1068), obtained Honourable Mention for his white lead, litharge, and verdigris.

Bischof and Rhodius, of Bonn (312, p. 1068), had the Prize Medal awarded to them for their white lead, which was remarkable for its density and great opacity.

Professor S. Bleekrode, of Delft, and K. Enthoven, of the Hague (1, p. 142), had the Prize Medal awarded to them for their excellent white paints manufactured from oxide of zinc. They exhibited also a yellow chromate of zinc, chloride of zinc, and a pigment which was named green oxide of zinc.

L. Bleibtreu, of Bonn (313, p. 1068), obtained Honourable Mention for good potass-alum. The Rhenish alum is obtained by burning together a highly pyritous lignite and clay, which yield the potash as well as the other constituents of the salt.

Blundell, Spence, and Co. (48, p. 192) had the Prize Medal awarded to them for their painters' colours, of which they exhibited a most extensive and beautiful collection.

A. Bo, of Turin (19, p. 1303), exhibited a very select collection of lakes and mineral colours.

Bobée (Widow) and Lemire, of Choisy-le-Roi, Seine (1092, p. 1230), had the Prize Medal awarded to them for the acid obtained from the distillation of wood, and its salts, which they exhibited. Their glacial acetic acid remains solid at 60° Fahr. This collection included the oils from both wood and coal-tar, in a colourless state; finely-crystallized tartrate of antimony, and several other metallic salts.

J. Bonjean, of Chambery, Sardinia (12, p. 1303), had the Prize Medal accorded to him for ergotine. This extract of the *Sacale cornutum* appears to be judiciously prepared according to the prescription of the exhibitor.

Bonz and Son, of Böblingen, Wurtemburg (2, p. 1114), exhibited good iodide of potassium, and creosote from tar.

Boss, of Warsaw, Poland, exhibited alum which merits commendation.

The Chemical Manufactory of the Fouxwiller Mining Company (376, p. 1195), under the direction of M. Schattenmann, had the Prize Medal awarded to it for fine specimens of alum, prussiate of potash, and glue. Sulphate of iron was also exhibited.

J. Bower, of Hunslet, Leeds (42, p. 191), exhibited carbonate of soda, pure and neutral in composition, and thereby particularly adapted for scouring wool or woollen goods, as it removes grease without injuring the animal fibre.

T. **Bramwell** and Co., of Heworth Chemical Works, Newcastle-upon-Tyne (27, p. 190), had the Prize Medal accorded to them for prussiate of potash; of which salt they are amongst the oldest producers in England.

E. **Brasseur**, of Belgium (42, p. 1153), received Honourable Mention for his white lead.

Brasseur and Co., of Nippes near Cologne (314, p. 1068), contributed specimens of white lead remarkably white and dense.

G. J. **Braun**, of Prague (21, p. 1080), obtained Honourable Mention for his prussiate of potash and stannate of soda.

William Arthur Brearey, of Douglas, Isle of Man (80, p. 196), exhibited a refined oil, which is recommended for watches and fine machinery, from having no chemical action on metals, and not being thickened by cold.

— **Bremiger**, of Kirchheim, contributed a great display of ultramarine from Germany.

A. **Brière**, of Paris (438, p. 1199), obtained Honourable Mention for his arsenical preparations, including arsenic acid, and very fine Brunswick green.

F. X. **Brosche**, of Prague (20, p. 1108), exhibited a fine collection of chemicals, including succinic acid and the oxides of chromium and uranium, for which the Prize Medal was awarded.

Bronell, of Frankfort, exhibited a colourless oil from gas-tar, chiefly benzole.

— **Brown** and Co., of London (7c, p. 187), had the Prize Medal awarded to them for their salts of ammonia, obtained in the purification of coal-gas by Mr. Croll's processes.

Frederick Brown (57, p. 193) had the Prize Medal accorded to him for oxide of zinc colours, which he has contributed much to introduce into use in this country. The oxide of zinc is substituted for carbonate of lead, to give body to various paints (browns, yellows, reds, blues, and greens).

Alexander Brusghin, of Koselsk, Russia (29, p. 1967), received Honourable Mention for the excellent prussiate of potash which he exhibited.

W. **Büchner**, of Pfunestadt near Darmstadt (1, p. 1125), had the Prize Medal awarded to him for ultramarine, of which he exhibited the greatest variety.

The Trustees of the late J. Buckley, of Manchester (4, p. 185), exhibited sulphate of iron, which obtained Honourable Mention for its purity and superior quality.

Edward Bullock and Co., of Galway (37, p. 191), exhibited various preparations from sea-weed, including salts of potash and soda, rough and finely-crystallized iodine, iodides of potassium, lead, and mercury.

John Lloyd Bullock (34, p. 191) had the Prize Medal accorded to him for a beautiful collection of the rarer chemical substances, displayed in considerable quantities and of good quality; especially creatine, to the extent of several ounces, creatinine, caffeine, allentoin, uric acid, hippuric acid, and urea.

Stephen John Burt (85, p. 196) had the Prize Medal accorded to him for his beautifully-crystallized cantharidin, the blistering principle of cantharides, as obtained by solution or sublimation, and in combination with the bases potash, soda, and oxide of lead.

Charles Button (3, p. 185) exhibited a remarkably varied collection of salts and acids, chiefly for the use of scientific chemists. The collection included potass-, soda-, ammonia-, and chrome-alum, finely crystallized; pure iodine, bromine, &c., which received Honourable Mention.

F. **Calloud**, of Annecy, Sardinia (11, pp. 1302–03), obtained Honourable Mention for excellent phloridzin. He exhibited also santonin and morphine.

Cappellemans, Deby, and Co., of Brussels (37, p. 1152), had the Prize Medal awarded to them for a large collection of salts, including *pink salt*, generally of superior quality.

Louis Francois Cerceuil, of Paris (793, p. 1218), exhibited specimens of dyed and milled wool, flocks, and paste-colours for paper-hangings, for which the Prize Medal was awarded.

John Cheshire, jun., of Northwich, in Cheshire (30, p. 190), represented the salt manufacture, by a pyramid of best table salt, with several other specimens. The salt-mines and springs in Cheshire are worked to a greater extent than any others in Europe, their annual production being upwards of 800,000 tons.

G. **Clifford** (26, p. 190) obtained Honourable Mention for his successful efforts in restoring deeds, writings, books, maps, engravings, &c., which have been injured by fire. The process was not communicated to the Jury, but specimens of engraved documents and leaves of books were exhibited, with one-half of them restored without separation from the injured portion. The unrestored portion was hard, horny, and brittle; the restored portion clean and flexible.

Edward Cobbold (Cl. I. 228, p. 143) obtained Honourable Mention from various products derived from peat.

E. E. **Cochius**, of Oranienburg, Prussia (12, p. 1048), had the Prize Medal accorded to him for his prussiate of potash. This is one of the largest manufactories of that salt in the north of Europe. The annual production is about 150 tons.

Coignet and **Son**, of Lyons (1153, p. 1233), obtained Honourable Mention for phosphorus of superior quality, with prussiate of potash and glue, which they exhibited.

M. A. C. **Collas**, of Paris (801, p. 1219), obtained Honourable Mention for the products of coal tar.

Robert Nelson Collins (109, p. 198) exhibited the disinfecting powder prepared by him. This powder consists of a mixture of chloride of lime and sulphate of alumina, and is highly efficacious in many circumstances, but must not be brought, either dissolved in water or dry, into contact with metals.

Mlle. **Anna Colville**, of Paris (802, p. 1219), exhibited a complete set of highly-valued colours for painting on porcelain, for which the Prize Medal was awarded.

W. **Conrad**, of Paris (1156, p. 1233), had the Prize Medal awarded to him for the general excellence of his chemical products, which included purified iodine, iodide of potassium, and refined camphor.

Thomas Ainsley Cook, of Newcastle-upon-Tyne (15, p. 189), received Honourable Mention for one of the finest specimens of crystallized carbonate of soda exhibited (manufactured by the Walker Alkali Company).

William Copney (118, p. 199) obtained Honourable Mention for a collection of remarkable fine single crystals of chrome alum, sulphate of magnesia, sulphate of copper, and several other salts.

John Coppock, of Bridport (65, p. 194), exhibited a chemical liquid for imparting the colour of mahogany and rose-wood to common woods.

G. **Corridi**, of Tuscany (33, p. 1293), had the Prize Medal accorded to him for sulphate of quinine and well-crystallized santonin, in large quantity, exhibited by him.

Coulson, Jukes, and Co. (72, p. 195) exhibited mineral substances used in the manufacture of paints.

Cournerie and Co., of Cherbourg, France (462, p. 1200), had the Prize Medal awarded to them for their chemical products derived from kelp, particularly iodine, which, it is said, they obtained finely crystallized by a single sublimation; iodide of potassium, chloride of potassium, sulphate of potash, &c.

— **Courtial**, of Grenelle, near Paris (807, p. 1219), had the Prize Medal awarded to him for his assortment of ultramarines, which fully maintain, by their superior quality, the high reputation of the French manufacture.

J. **Curtius**, of Duysburg, Prussia (458, p. 1276), was one of the exhibitors of ultramarine distinguished by a Prize Medal.

Dauptain, Gorton, and Co. (63, p. 194), exhibitors of ultramarine, had the Prize Medal accorded to them for the beautiful samples of their manufacture.

John Thistlewood Davenport (111, p. 198) had the Prize Medal accorded to him for a pharmaceutical collection, which was chiefly distinguished by the brilliant lamellæ in which several of the metallic salts were exhibited. The sulphate of quinine and hydrochlorate of morphia were in beautiful crystals.

John Davies, of Manchester (70, p. 195), exhibited preserved size, clear and strong, suitable for any climate.

Davy, MackMurdo, and Co. (62, p. 194), received the Prize Medal for the pharmaceutical products manufactured by them, including carbonate of ammonia, calomel, corrosive sublimate; benzoic, citric, gallic, and oxalic acids; acetate of zinc, nitrate of silver, chloride of barium, nitrate of baryta, tartar-emetic, of which the crystals were particularly fine; sulphate of soda, nitrate of ammonia, acetate of lead, sulphate of mercury, red oxide of mercury, glycerine, and pyroxanthin. The specimens were all remarkably good.

Debbaudt Brothers, of Courtrai, Belgium (39, p. 1153), exhibited white lead of excellent quality.

De Cavaillon, of Paris (109, p. 1176), obtained a Prize Medal for salt of ammonia, prepared in the purification of coal-gas.

V. **Delignou**, of France (1180, p. 1234), exhibited rectified products of the distillation of bituminous shale, a chemical manufacture which has attained more success in France than in England, probably owing to the shales of the former country being less contaminated with sulphur than those of the latter. An Honourable Mention was awarded to the exhibitor.

W. **Dentith** and Co., of Manchester (8, p. 187), had the Prize Medal awarded to them for the products of their manufacture, by which the Exhibition was embellished; beautiful and colossal specimens of chromate and bichromate of potash, ferrocyanide of potassium, alum from the Whitby shale, nitrate of lead, fine green oxide of chromium, and oxide of zinc.

David Dick and Co., of Burgh Chemical Works, Carlisle (7 d, p. 187), exhibited copperas manufactured by Spence's patent process.

Diesel and Co., of Saalfeld (824, p. 1095), contributed superior oil and water colours for painters.

Dinneford and Co. (51, p. 193) exhibited magnesium salts and their fluid magnesia (a solution of carbonate of magnesia in carbonic acid water).

Dixon, Son, and Co., of Newton Heath, Manchester (126, p. 199), exhibited specimens of matches made with Schrötter's amorphous phosphorus, which are said to be as easily and cheaply made as the common matches.

George Dickson and Co., of Edinburgh (79, p. 106), exhibited specimens of cod-liver, skate-liver, and ling-liver oil manufactured by them.

— **Droop**, of Osnabruck, exhibited mineral colours.

Drouin and **Brossier**, of Labriche, near St. Denis (169, p. 1081), had the Prize Medal awarded to them for the peculiar excellence of their colours for the use of calico-printers.

William L. Duncan, of Sydenham, Kent (76, p. 195), exhibited cotton waste before and after being used in cleansing machinery, to illustrate his process of restoring that substance.

Duncan, Flockhart, and Co., of Edinburgh (104, p. 198), exhibited a specimen of chloroform, manufactured by them, which appeared to possess a high degree of purity.

C. A. **Dubois**, of Hirschberg (Cl. I. 7 Zol., 1048), obtained Honourable Mention for a fine specimen of cinnabar, intended for sealing-wax.

L. **Dufour**, of Genoa (13, p. 1303), had the Prize Medal awarded to him for his salts of quinine, of which he exhibited the sulphate on a large scale, and the citrate.

The Electoral Blue Colour Works, of Hesse, Schwartzenfels (465, p. 1077), received Honourable Mention for beautiful samples of smalts, accompanied by other preparations of cobalt, and for ultramarine.

Ellam, Jones, and Co., of Derby (58, p. 193), obtained Honourable Mention for a considerable collection of mineral and vegetable pigments manufactured by them.

Samuel Estcourt (64, p. 194) exhibited specimens of washing-blue.

F. J. **Evans** (5, p. 185) exhibited finely-crystallized naphthaline from coal-tar.

George Evans (Cl. I. 227, p. 143) obtained Honourable Mention for his numerous peat products.

Benjamin Fawcett (29, p. 190) exhibited plain and ornamental specimens in graining or flatting, said to be produced by a kind of paint free from noxious effluvia.

The Firm of **Fouché-Lepelletier**, of Javel, near Paris (1229, p. 1236), had the Prize Medal awarded to it for a rich and elegant display of alkaline and earthy salts, accompanied by pure mineral acids; the sulphuric acid being manufactured in a peculiar manner. Ammoniacal salts are also prepared from urine for manuring purposes.

Société de Floreffe, of Floreffe, near Namur, Belgium (38, p. 1152), obtained Honourable Mention for a good collection of the ordinary chemical products manufactured by them.

John P. Fowler (55, p. 193) obtained Honourable Mention for the pure benzoic acid manufactured by him.

Fox and **Barrington**, of Manchester (44, p. 192), obtained Honourable Mention for a series of the larger chemicals, of which they are manufacturers; including common salt, sulphur, salt-cake (sulphate of soda), barilla or black-ash, soda-ash in illustration of the soda process; bleaching powder, nitrate of lead, fine crystals of chlorate of potash, bisulphate of soda, protochloride of tin, sulphate and nitrate of copper, the two prussiates of potass, with white, mottled, and yellow soda-soaps.

H. **Gademann**, of Schweinfurt, Bavaria (12, p. 1099), is one of the German exhibitors of ultramarine to whom the Prize Medal was awarded.

Gautier-Bouchard, of Paris (1245, 1237), obtained Honourable Mention for various colours manufactured by him.

Godfrey and **Cook** (92, p. 197) had the Prize Medal accorded to them for their pharmaceutical products; among which their carmine and lake from cochineal, and carbonate of ammonia, were most remarkable.

Septimus H. Godson, of Tenbury (50, p. 193), exhibited the mineral waters of that locality, with the bromine and salts extracted from them.

T. **Greenish** (124, p. 199) exhibited a soluble superphosphate of iron recently introduced into medical practice.

W. **Grune**, jun., of Berlin (43, p. 1050), exhibited prepared colours containing the mordant by which wool can be dyed in one operation, without boiling. The process was illustrated by samples of well-dyed wool.

J. B. **Guimet**, of Lyons (1620, p. 1256), had the Council Medal awarded to him as the original discoverer of artificial ultramarine in 1828, and as being still one of the most successful manufacturers of that substance.

Gunsberg, of Stettin, exhibited white lead of good colour.

Gutheil and Co., of Dusseldorf (459, p. 1077), exhibited pure ferrocyanide of potassium.

Hähnell and **Ellis**, of Manchester (10, p. 187), had the Prize Medal accorded to them for a good collection of metallic salts, chiefly for the use of calico-printers; particularly the oxide, nitrate, and sulphate of copper, the oxides and most common salts of lead and tin, sulphate and hydrochlorate of ammonia from gas liquor, and the preparations of archil. The metals, named with their ores, and the commercial varieties of sulphur, were also well illustrated.

Josiah Hall, of Queenborough, in the Isle of Sheppey (40, p. 191), exhibited copperas crystallized in a granulated form, convenient for dry mixing. It is prepared from the river pyrites, of which about eight tons are consumed weekly.

W. **Hattersley** (110, p. 198) exhibited an elixir of sarsaparilla, said to be prepared without heat.

James Hawthorne (39, p. 191) exhibited a new ink for staining oak and mahogany, with illustrative specimens.

P. **Hayes** and Co., of Salford (75, p. 195), obtained Honourable Mention for various products manufactured from resin, including spirits for making varnish, cheap oils for machinery and tramways, &c.

Heinzen, Brothers, of Tetchin, Austria (26, p. 1008), had the Prize Medal awarded to them for their cudbear and archil. A fine assortment of red and violet extracts was exhibited.

A. and W. **Hemingway** (24, p. 190) had the Prize Medal accorded to them for their double salts of iron, ferric tartrates and citrates, and other pharmaceutical preparations, which are extremely well prepared.

Hener, of Lichtenstein, near Osterrode, exhibited white lead commendable for its colour.

Baron **Francis Paul von Herbert**, of Klagenfurt and Wolfsberg, Carinthia (30, p. 1008), the distinguished manufacturer, had the Prize Medal awarded to him for a collection of samples of white lead of excellent quality.

Baron I. von Herbert, of Klagenfurt, Carinthia (32, p. 1008), received Honourable Mention for his varieties of orange and bright red lead, and red and gold litharge. These colours possessed a brilliancy which was not exceeded in any other collection.

O. Herrmann, of the Chemical Manufactory (formerly Royal) at Shönebeck (Cl. I. 683, p. 1088), had the Prize Medal accorded to him for an extensive collection of chemical preparations, which appeared in general to be remarkably good. In the number may be mentioned glacial phosphoric acid of singular beauty, bromine, bisulphide of carbon, pure carbonates of potash and soda, free from silica and chlorine, for scientific chemists, pure gallic acid for use in photography, &c.

J. F. Heyl and Co., of Charlottenburg, near Berlin (44, p. 1050), exhibited colours for paper-hangings and painting; besides acetic acid, acetate of soda and acetate of lead manufactured from pyroligneous acid, at a very low price.

F. C. Hills, of Deptford (23, p. 190), had the Prize Medal accorded to him for sal-ammoniac and carbonate of ammonia, of which he is a well-known manufacturer. The former salt is prepared by the addition of muriatic acid to the ammoniacal liquor of gas-works, and the latter salt by the decomposition of sulphate of ammonia by means of carbonate of lime. Nitrate of potash was also exhibited, prepared by the decomposition of the chloride of potassium of kelp by means of nitrate of soda.

Hirsch and Brother, of Portugal (30, p. 1307–08), exhibited a fair collection of acids, salts, and other chemical products.

Hirschmann, of Warsaw, Poland (26, p. 1367), represented the chemical industry of that city by a collection of salts.

J. Hochberger, of St. Procopi Mineral Works, Kahn, Bohemia (14, p. 1007), exhibited alum and sulphate of iron of good quality.

Hopkin and Williams (41, p. 191) were accorded the Prize Medal for an interesting collection of the rarer chemicals used in medicine, particularly pure aconitine, a series of valerianates, "cardole," an oily substance obtained from the pericarp of the cashew nut, said to be a powerful vesicating agent; bromoform, iodoform, metagallic acid, pure tannin, and crystallized chromic acid.

Henry Hopwood, of Richmond, Surrey (100, p. 197), exhibited beautifully-pure sugar of milk crystallized under different circumstances. The crystals formed at 160° Fahr., in the dark, were particularly fine.

Horstmann, of Horst, near Steele (Zol. i. 462, p. 1107), exhibited exceedingly beautiful samples of smalts.

Howards and Kent, of Stratford (11, p. 187), had the Prize Medal accorded to them. Besides a highly-instructive and complete collection of the cinchona barks, which excited great interest among scientific visitors, salts of the vegetable alkaloids were exhibited by this house, with camphor in every stage of preparation; Borneo camphor, borax, and boracic acid, tartaric acid, citric acid, and their salts; various preparations of mercury of great purity, with salts of antimony, silver, zinc, and iron. A series of beautifully-crystallized salts of potass, soda, and magnesia, completed this magnificent collection.

C. Humfrey (78, p. 196) exhibited colours produced by the combination of fatty acids with metallic oxides.

T. J. Husband, of Philadelphia (U. S. 49, p. 1435), exhibited his calcined magnesia.

J. W. and H. Huskisson (86, p. 196) were awarded the Prize Medal for a beautiful collection of the principal salts used in pharmacy, manufactured by them. It included Rochelle salt, carbonate, bicarbonate, and phosphate of soda; nitrate and bicarbonate of potash; iodide of potassium, of which some very fine crystals were exhibited,—with the iodides of lead and mercury, and tartaric and citric acids.

C. Jäger, of Barmen (469, p. 1078) exhibited an excellent specimen of safflower-carmine.

H. C. Jenkins (99, p. 197) exhibited starch, gums, and vegetable wax from the potato.

William Harry Jenkins (43, p. 192) exhibited arsenical powders intended to protect wood, &c.

F. Jobst, of Würtemburg (4, p. 1114), one of the first great manufacturers of quinine, obtained the Prize Medal for a case of that substance, which he exhibited. It was Mr. Jobst who established the identity of theine and caffeine.

J. R. Johnson (60, p. 194) obtained Honourable Mention for his extract of "munjeet." This is a substitute for madder, furnished by the roots of another plant, *Rubia cordifolia*.

William Joseph Kane, of Dublin (53, p. 193), exhibited salt-cake (sulphate of soda), made in brick furnaces, with complete condensation of the muriatic acid, in a concentrated state; also bleaching powder, made from the muriatic acid so obtained. The manganese used by Mr. Kane is found in the Glandore Mines, Cork, and contains 90 per cent. of the pure binoxide.

Thomas Keating (102, p. 197) exhibited the flowers of the *Brayera anthelmintica*, from Abyssinia (a celebrated remedy for tape-worm), also Matico, a new astringent and styptic, and other pharmaceutical substances, which obtained Honourable Mention.

James Henry Kent, of Stanton, near Bury St. Edmunds (90, p. 196–97), obtained the Prize Medal for his dried pharmaceutical plants. This is a beautiful collection: the dried flowers of colchicum, digitalis, and malva, retain the brilliant hues of the fresh flowers; the powder of conium is of a beautiful green colour.

John King, Hurlet and Campsie Alum Company, Glasgow (13, p. 188–89), was awarded the Prize Medal for his alum and prussiates of potash. All the salts were remarkable for their beauty and purity. The crystals of the red prussiate were not coloured dark and rendered impure by any admixture of insoluble cyanide of iron, and were perhaps the finest in the English Department. The alum was prepared from the alum-shale of the Scotch coal-field by the old process.

William Waudby King (84, p. 196) exhibited his effervescent citrate of magnesia.

Kinzelberger and Co., of Prague (27, p. 1008), obtained Honourable Mention for a complete collection of the colours used by painters.

Krimmelbein and Bredt, of Barmen, Prussia (457, p. 1076), exhibited a good series of chemical products and colours for dyers and calico-printers; among which was included red prussiate of potash. A curious circumstance has been stated respecting the prussiates, namely, that red prussiate is sent from Germany to England, while the yellow prussiate is imported into Germany from England in considerable quantity.

Kuhlmann, Brothers, chemical manufacturers, of Lille (555, p. 1205), obtained the Prize Medal for an interesting assortment of salts of the alkalis and earths, in which, besides the usual articles of great consumption in a pure form, was included caustic baryta, which is prepared at a singularly low cost from the nitrate,—the nitrous fumes being economised in the sulphuric acid chamber. The baryta is employed to precipitate sugar from the juice of the beet-root, in Dubrunfaut's new process of purification. Also, artificial carbonate of baryta, prepared from the sulphate, which is first converted into sulphide of barium, and then exposed in a damp state to the action of carbonic acid gas, obtained by the combustion of coke. Professor F. Kuhlmann has discovered that the hydrosulphuric acid, set free in the operation referred to, can be economically converted into sulphuric acid, by transmitting a mixture of that gas and air in sufficient quantity through nitric acid. Among the less usual products are sulphite of soda and sulphite of lime, obtained by exposing crystallized carbonate of soda, or hydrate of lime, to the fumes of burning sulphur. A liquid ammoniacal mixture for manure was also exhibited, which is produced by conducting the non-condensable gases from the leaden chamber through channels kept moist by the ammoniacal liquor of gas-works or by urine.

Dr. L. Kunheim, of Berlin (13, p. 1048), was awarded the Prize Medal for an elegant collection of chemical products, chiefly of the class used in dyeing,—such as crystals of sugar of lead, nitrate of lead, acetate of lime, stannate of soda, cyanide of potassium, oxide of uranium and tungstic acid in large quantity. The latter substance is exhibited by several manufacturers, probably with the view of having it tried as a substitute for peroxide of tin, in some dyeing processes.

C. A. Kurtz, of Cornbrook Works, Manchester (9, p. 187), had the Prize Medal accorded to him for new colouring matters and preparations for printing and dyeing cotton, linen, silk, and wool.

Kutzer and Lehrer, of Prague (24, p. 1008), obtained Honourable Mention for the ultramarine which they exhibited. They also presented chrome-orange and chrome-yellow of fair quality.

Count F. de Larderel, of Tuscany (35, 1294), obtained the Council Medal for his highly-successful manufacture of boracic acid.

Henry Lamplough (71, p. 195) exhibited a variety of pharmaceutical preparations, together with residual salts from the destructive distillation of animal substances.

William Lawrence (56, p. 193) exhibited specimens of cod-liver oil manufactured by him.

Alfred Lea (105, p. 198) exhibited "myrrhine," a preparation for medical use.

F. M. C. Leal, of Portugal (p. 1308), exhibited a collection of metallic salts (65, 67, &c.), remarkable for its number and variety. Other exhibitors, of the same country, sent crude and purified cream of tartar—an important article of commerce in wine-growing countries like Portugal.

Charles Lee (69, p. 195) exhibited a new black dyeing material for dyeing silk, imported by him.

The Leeren Chemical Manufactory, near Drontheim (39, p. 1352), exhibited a well-crystallized sample of bichromate of potash, a salt which is produced there of excellent quality.

T. Lefebvre and Co., of Moulins-Lille (580, p. 1205), were awarded the Prize Medal for their superior white lead.

— Lefevre, sen., of Nantes sur-la-Fosse, Loire Inférieure (581, p. 1205), exhibited oxide of zinc of superior quality, for which he received Honourable Mention.

T. Leifchild, of Upper Clapton (67, p. 194), exhibited specimens of dyes for silk, manufactured by him.

— Leroux, Vitry le François, Marne (308, p. 1191), the discoverer of "salicine," had the Prize Medal accorded to him in acknowledgment of the value of that discovery. A large quantity of the substance, very white and finely crystallized, was exhibited, with a specimen of the willow bark from which it is derived.

C. Leverkus, of Wermels-Kirchen, Prussia (875, p. 1097), stood high as an exhibitor of ultramarine, and had the Prize Medal awarded to him for that substance.

G. Lindsay, of Sunderland (16, p. 189), obtained Honourable Mention for sulphate of iron, of superior quality, manufactured from the iron pyrites of coal mines, exposed to air and moisture, the excess of acid being saturated by digesting the lixivium upon waste iron. Copperas, so manufactured, is sought for by dyers, it is said, on account of its rapid oxidability in the atmosphere.

J. Linklater (82, p. 196) exhibited cod-liver oil.

The London Druggists (117, p. 199) contributed a large, systematic, and highly-instructive collection of drugs, which received the approbation of the Jury.

William Longmaid (Class I., 441, 162) illustrated his new soda-process, for which the Council Medal was awarded, by specimens of the rock-salt from Cheshire, and cupreous pyrites from Cornwall, employed by him; the salt and ore mixed and ground; sulphate-ash, the calcined product of the former, containing sulphate of soda, chlorides of silver and copper, oxides of tin and iron, &c.; black ash, crude alkali, and carbonate of soda, prepared from the sulphate of soda; sulphate of copper, obtained by oxidising precipitated copper, and treating it with sulphuric acid; bleaching powder, the chlorine of which was obtained by passing a current of dried air through a close furnace, heated externally, in which the ore and salt are in process of calcination.

Moritz Lucas, of Cunersdorf, near Hirschberg (8, 1, Zol., p. 1048), obtained Honourable Mention for his cinnabar, of which fine and deep-coloured specimens were exhibited.

Charles McCulloch (96, p. 197) exhibited an interesting collection of English and American dried herbs and roots.

J. F. Macfarlan and Co., of Edinburgh (107, p. 198), obtained the Prize Medal. They exhibited a series of preparations, on a large scale, illustrative of the manufacture of the salts of morphine, gallic and tannic acids, sulphate of beberine, from green-heart bark; all excellent specimens.

Maire and Co., of Strasburg (317, p. 1192), obtained Honourable Mention for their vinegar and other acetous products. They were, also, exhibitors of white lead, of good quality, and of purified alcohol from potatoes.

Dr. L. C. Marquardt, of Bonn (327, p. 1069), exhibited several remarkably pure chemical products, including chloroform, cyanide of potassium, bisulphide of carbon, and concentrated acetic acid, for which Honourable Mention was accorded.

Mrs. B. Mason (77, p. 195) exhibited Pooloo's Chinese cement.

Charles Mason and Son (22, p. 190) exhibited specimens of blacking, of French and waterproof varnishes, manufactured by them.

John Marshall, of Leeds (68, p. 194, 195), obtained Honourable Mention for his archil, and various other preparations from the lichens, and for lac-dyes.

Mathes and Weber, of Duisburg, in Prussia (464, p. 1077), were awarded the Prize Medal for chemical products, chiefly intended for the use of bleachers and paper-manufacturers, of which fine samples were exhibited, namely, hydrochloric acid, chloride of lime, sulphite, and other salts of soda, including caustic soda.

May and Baker, of Battersea (14, p. 189), had the Prize Medal accorded to them for their acids, salts, metallic and other preparations used in pharmacy, all of which appeared to be of excellent quality. Their refined camphor was beautifully transparent.

Charles Meissonnier, of Paris (916, p. 1224), had the Prize Medal awarded to him for chemical products of superior quality, including extracts and solutions for dyeing wool in a single operation.

The Melincrythan Chemical Company, of Neath, South Wales (2, p. 185), illustrated their manufacture of acetate of lead by a splendid exhibition of the crystallization of that substance, which obtained Honourable Mention.

Ménier and Co., of Paris (925, p. 1224), exhibited carefully-prepared pharmaceutical extracts, obtained by steam, and a variety of medicinal substances, reduced to impalpable powder, for which the Prize Medal was awarded.

Alfred Michel, of Puteux, near Paris (640, p. 1208), exhibited the extracts of various dye-woods of superior quality, for which the Prize Medal was awarded.

T. Miller (1, Class XXX., p. 820) exhibited a complete assortment of artists' colours and materials, which received Honourable Mention.

W. Moberley, of the Mulgrave Alum Works, near Whitby (17, p. 189), was awarded the Prize Medal for his alum, prepared from the alum-slate of that district, and sulphate of magnesia, extracted from the residual liquors of that manufacture.

A. Moreau, of Paris (325, p. 1192), exhibited products of distilled bitumen, for which the Prize Medal was awarded.

Morson and Son (106, p. 198) exhibited a beautiful collection, for which the Prize Medal was accorded, consisting chiefly of the rarer organic compounds; finely-crystallized salts of morphine, strychnine, cinchonine, and pure aconitine; also veratric, gallic, tannic, hippuric, salicilic, meconic, pyrogallic, and pyromeconic acids; creosote, the furfurol of *Fownes*, furfuramide, nitrate of furfurine, chloride of nickel, &c.

C. Mottet, of Paris (932, p. 1224), exhibited superior archil prepared for the use of dyers and calico-printers.

Sir James Murray, M.D., of Dublin (87, p. 196), exhibited various fluid and solid preparations of magnesia.

Professor C. **MUSSINI**, of Florence (37, p. 1294), obtained Honourable Mention for colours, mixed with a peculiar preparation, which prevents the action of the sun and the effects of moisture. The colours are used for encaustic painting and painting in fresco.

WILLIAM NAYLOR (35, p. 191) exhibited various varnishes of copal, sandarach, and mastic, and also specimens of deal wood stained in imitation of different woods, without the usual sizing.

NISSEN, HILLARY, and PARKER (36, p. 191), exhibited tinted paper, chemically prepared in the pulp, for printing cheques upon.

W. G. **NIXEY** (112, p. 199) exhibited a specimen of cement.

K. **OEHLER**, of the Grand Duchy of Hesse (8, p. 1126), received Honourable Mention for his products of gas-tar, obtained by fractional distillation. The term "creosote," is applied rather indefinitely, in Germany, to substances which may have an equal medicinal value, but differ considerably in properties. The crystallized creosote of this collection is hydrate of phenyl. The colourless oil appears from its odour to be chiefly benzole.

CHARLES OWEN, of Edinburgh (83, p. 196), exhibited specimens of pure cod-liver oil.

ROBERT OXLAND, of Plymouth (225 and 485, Class I., p. 143, 172), exhibited a variety of products derived from the distillation of peat in cast-iron retorts, which received Honourable Mention. The process invented by Mr. Oxland for the separation of tungstic acid from the ores of tin, by the action of sulphide of sodium and formation of soluble tungstate of soda, in a reverberatory furnace, also received the commendation of the Jury. Specimens of sugar were likewise exhibited, refined by means of acetate of alumina.

S. **OTLER** (113, p. 199) obtained Honourable Mention for excellent lint for surgical purposes, which he exhibited.

W. **PARROTT** (46, p. 192) exhibited illustrations, in oil and water colour, of a new brown, derived from the smut of corn, discovered by him, and recommended from his experience of it as an artist.

WILLIAM WATSON PATTINSON, of Gateshead, Newcastle-upon-Tyne (18, p. 189), in partnership with a Juror of this Class, exhibited large masses of crystallized alum, masses of the simple sulphate of alumina, known in commerce as "concentrated alum," with a specimen of bicarbonate of soda, prepared by exposing crystals of the carbonate to carbonic acid gas. All were manufactured at the Felling Chemical Works.

OTTO PAULI, of Carlsruhe (328, Zol. 1, p. 1069), had the Prize Medal awarded to him for his phosphorus and other chemical products. The substances exhibited were chiefly derived from bones and animal matters, and included sal-ammoniac and the ferrocyanide of potassium, beautifully crystallized. The last salt was remarkable for its pale sulphur colour, an indication of value, as it arises from the entire absence of the red salt, which, in some dyeing processes, makes the colour appear dull by forming the green cyanide of iron. The annual production of prussiate of potash, in this old and increasing establishment, is about 80 tons; of sal-ammoniac about 20 tons; and of phosphorus 80 cwt.

G. **PEACOCK**, of Southampton Docks (73, p. 195), exhibited wood, preserved by a chemical process peculiar to himself.

PELLEGRINI SNEIDER, of Rome (3, p. 1285), exhibited the native alum of the Roman States, purified by crystallization, showing that this ancient manufacture still maintains its ground, in competition with the enormous production of the same salt by the artificial processes.

MOSES HAIM PICCIOTTO (33, p. 190, 191) obtained Honourable Mention for specimens of gum-arabic, decolorized and purified by means of sulphurous acid.

PINTO, PEREZ, and Co. (121, p. 199), exhibited very fine acetate of lead, which received Honourable Mention.

THOMAS CADBY PONTING (25, p. 190) exhibited a marking ink.

PONTIFEX and WOOD (1, p. 185) obtained the Prize Medal for specimens of various colours and pigments employed by artists and paper-stainers, and for other chemical products. The crystallization of their tartaric and citric acids was truly magnificent, and also their sulphate of copper. They likewise exhibited a series of interesting chemical and metallurgical products, illustrating the different processes of separating lead from its ores, and its subsequent conversion into white lead.

POORTMAN and VISSER, of Schiedam, in Holland (2, p. 1142), one of the oldest houses in the white lead trade, obtained Honourable Mention for the superior quality of the samples of that substance which they exhibited.

M. **POUND** (108, p. 198) received Honourable Mention for the new drug, "Indian bael," the fruit of the Bengal quince, which he has introduced; and for other pharmaceutical preparations.

POWERS and WIGHTMAN, of Philadelphia, United States (262, p. 1452), had the Prize Medal accorded to them for a large and valuable collection of chemical substances; among which appeared piperin, narcotine, morphine, the valerianate of morphine, and a large quantity of a substance said to be menispermine.

A. **PRAT** and F. **AGARD**, Aix (Bouches du Rhône) (1682, p. 1257), exhibited (in illustration of the process of M. Balard for extracting potash from sea-water, for which the Council Medal was awarded) specimens of the various salts contained in sea-water; chloride of sodium in large crystals, obtained from spontaneous evaporation; and the same in a granulated condition, for table use, by dissolving in a hot solution of chloride of magnesium, and cooling.

The Rev. J. B. **READE**, of Stone Vicarage, Aylesbury (3A, p. 185), exhibited cyaniodide of iron, a new variety of soluble Prussian blue, and pure iodide of potassium. In the composition of the former substance, iodine is supposed to play the part of oxygen or cyanogen.

REEVES and SONS (7, Class XXX., p. 821) exhibited various water-colours, prepared with wax, and other pigments, which received Honourable Mention.

RICHARDSON BROTHERS and Co. (19, p. 189) exhibited specimens of refined saltpetre, or nitrate of potash, obtained chiefly from the East Indies. The Bengal nitre, so refined, is a remarkably pure potass-salt.

Professor **MICHELL RIDOLFI**, of Lucca (36, p. 1294), had the Prize Medal accorded to him for his improvements in the colours for encaustic painting; which were accompanied by paintings executed by him to show the effects of the colours.

E. **RILEY** (123, p. 199) exhibited hippuric acid, prepared in large quantity.

W. **ROBERTSON**, of Banff (81, p. 196), exhibited cod-liver oil, said to be extracted by steam-heat, and rendered almost colourless without the use of charcoal, or any other decolorizing agent; also skate-liver oil, manufactured in the same manner, which is preferred by some to cod-liver oil for medicinal use.

ROBERTSON and Co. (6, Class XXX., p. 821) exhibited various colours for artists, which received Honourable Mention.

J. **ROGERS** (240, Class I., p. 143) exhibited various products of peat, which received Honourable Mention.

F. **ROHR**, of Wiesbaden, Nassau (7, p. 1132), was an exhibitor of ultramarine, distinguished by a Prize Medal.

— **ROCHAZ**, of Mülheim on Ruhr (1 Zoll. 452, p. 1076), exhibited white oxide of zinc of good colour, produced directly from German calamine.

C. P. H. **ROSSELET**, of Paris (1452, p. 1245), exhibited a chemical preparation for restoring gold and silver embroideries, with illustrations; which received Honourable Mention.

ROWNEY and Co. (3, Class XXX., p. 820) exhibited the pigments used in oil and water-colour painting, with several new colours, which received Honourable Mention.

THE ROYAL SAXON CHINA MANUFACTORY, at Meissen (p. 1112), first prepared ultramarine in Germany; and has exhibited samples of remarkable beauty, for which a Prize Medal has been awarded.

THE ROYAL SAXON SMALT WORKS, at Schneeberg (p. 1105), contributed specimens of their well-known products.

RUSSELL and ROBERTSON, Holytown, Lanarkshire (59, p. 193), exhibited specimens of white lead, said to be produced by a new and rapid humid process; yellow chromate, and red dichromate of lead, for which they received Honourable Mention.

M. **Saluce**, of Sardinia (10, p. 1302), obtained Honourable Mention for his pharmaceutical collection, which included a series of stearoptens, well crystallized from oil of peppermint and other essential oils.

— **Sanin**, of the Government of Kaluga, Russia (28, p. 1367), received a Prize Medal for salts of lead of good quality, which he contributed, together with a small collection of other chemical products.

Ambrosio Saanto, of Matanzas, Cuba, Spain (242, p. 1344), exhibited an interesting collection of pharmaceutical preparations, which received Honourable Mention.

W. **Sattler**, of Schweinfurt, Bavaria (14, p. 1099), received Honourable Mention for a rich assortment of lac colours and other pigments.

J. **Setzer**, of Weiteneggk, on the Danube (23, p. 1008), represented the manufacture of ultramarine in Austria. He also exhibited the yellow sulphide of cadmium of great purity and intensity; with a collection of madder colours. An Honourable Mention has been awarded to him.

Savory and **Moore** (115, p. 199) exhibited *kousso*, imported from Aden, also *sumbul*, or musk-root, supposed to be the produce of an umbelliferous plant of Central Asia, the introduction of which into pharmacy in this country is due to the exhibitors.

C. **Schlippe**, of Moscow, Russia (27, p. 1367), had the Prize Medal accorded to him for superior prussiate of potash and alum. This exhibitor is known in science as the discoverer of the crystallized sulphostibite of sodium ($NaS . SbS_3$), and manufactures on a large scale. His chemical products are much esteemed in Russia. Besides those mentioned, the collection contained salts of tin; oxalic, tartaric, and acetic acids.

Schilling and **Sutton**, of Brighton (52, p. 193), exhibited samples of the soda, Seltzer, and Fachingen waters manufactured by them.

Struve and Co., of Brighton (52a, p. 193), exhibited specimens of the artificial mineral waters which they have long manufactured with so much accuracy, namely, waters of similar composition to the springs at Spa, Pyrmont, Marienbad, Kissingen, Seltzer, Fachingen, Püllna, and Vichy. These factitious chalybeates are said to contain carbonate of iron in solution, whereas in those imported a part or the whole is precipitated.

Schruck and **Uhlich**, of Bamberg, in Bavaria (15, p. 1099), received Honourable Mention for ultramarine of superior quality.

Schur and **Kohring**, of Brandenberg, contributed pure tartaric acid, well crystallized, and also in fine powder.

L. **Scott** (61, p. 194) had the Prize Medal accorded to him for white oxide of zinc, manufactured as a substitute for white lead.

H. **Siegle**, of Stuttgard (6, p. 1114), was awarded the Prize Medal for an assortment of rich and pure red lakes.

Selopsis Brothers, of Turin and Brozzo (Ivrée) (4, p. 1302), sustained the chemical reputation of Sardinia by the exhibition of a collection of salts, sulphur, saltpetre, and acids. They also exhibited fine samples of phosphorus.

Serzedello and Co., of Portugal (17, 38, &c., p. 1308), exhibited a full series of well-prepared salts, and other chemical products.

A. **Scharenberg**, of Neustrelitz, Mecklenburg Strelitz (3, p. 1134), exhibited a fine assortment of madder-lakes, prepared by a new process, which it is said resist the action of light; for which a Prize Medal was awarded.

A. E. **Schmersahl** (9, p. 187) exhibited different varieties of ultramarine of fine quality, for which a Prize Medal was awarded to him.

T. and H. **Smith**, of Edinburgh (94, p. 197), had the Prize Medal accorded to them for aloin, the cathartic principle of aloes, first prepared by them; and for cantharidin, of which a large quantity was exhibited in crystals.

— **Sorel**, of Grenelle, near Paris (1020, p. 1227), obtained the Prize Medal for his various qualities of oxide of zinc. M. Sorel has contributed most materially to the rapid advance which the oxide of zinc has lately made in France and elsewhere, as a substitute for white-lead.

Messrs. **Spence** and **Dixon**, of Pendleton Alum Works, near Manchester (7, pp. 185, 186), received Honourable Mention for their alum, prepared from gray schist by the action of sulphuric acid and the addition of sulphate of ammonia. Sulphate of iron, prepared by combining sulphuric acid directly with the residuary oxide of iron of burnt pyrites, was also exhibited; together with a hydraulic cement prepared from the refuse gas-lime, united with the refuse of the shale, after the alumina has been extracted; and the refuse of Wicklow pyrites, after its use in the manufacture of sulphuric acid—from this latter substance the mortar obtains oxide of iron. The metallic salts present are said to prevent the growth of moss upon the surface of this cement.

John Alexander Spencer (31, p. 190) had the Prize Medal accorded to him for the various products of his chemical manufactory, including naphthaline, sulphate of magnesia, benzoic acid, hydriodate of quinine, and samples of cod-liver oil, which have kept their colour well for one or two years.

T. **Spurgin**, of Saffron Walden (38, p. 191), exhibited the roots, stems, flowers, and stigmata of saffron.

Peter Squire (93, p. 197) was awarded the Prize Medal for a variety of pharmaceutical extracts and preserved juices of medicinal plants prepared with great care; and for other chemical products.

Henry Stevens (74, p. 195) exhibited samples of deal stained in an ornamental manner, by colours manufactured by himself.

J. C. **Stevenson**, of the Jarrow Chemical Works, South Shields (122, p. 199), illustrated the crystallization of carbonate of soda by a magnificent specimen of that salt, which was received too late to be placed among the articles referred to the Jury.

William Stevenson, of the Jarrow Chemical Works (20, p. 189), received Honourable Mention for bicarbonate of soda, prepared by exposing crystals of soda to carbonic acid gas.

Stohmann and **Wüstenfeld**, of the Chemical Manufactory of Neusalzwerk (460, p. 1077), had the Prize Medal accorded to them. They operate chiefly upon the mother-liquor of salt springs, as at the older establishment of Shönesbeck. The great variety of substances produced in Germany at the same works may be judged of by the following enumeration of the articles exhibited by this house, with their respective prices. The thaler may be taken at 2*s*. 10*d*., and contains 30 sgrs.; the sgr. will be equal to 1·33 of a penny:—

Pure sulphate of zinc, per lb., 3¼ sgr. Acetic acid (1·040 and 1·060), phosphoric acid, chloroform, respectively 26 sgr., 1 thaler 13½ sgr., and 1 thaler 25 sgr. per lb. Nitric, sulphuric, purified hydrochloric acid (1·120); per 100 lbs., respectively 10, 12½, and 5 thalers. Carbonate of soda (99·95, and 99 per cent. pure carbonate); per 100 lbs., 7, 6½, and 6 thalers 5 sgr. Ditto crystallized, pure crystallized, and sesquicarbonate of soda; per 100 lbs., respectively 2 thalers 25 sgr., 10 thalers, and 8 thalers. Sulphate of soda; per 100 lbs., 1½ thaler and 2 thalers. Ditto purified; per 100 lbs., 4 thalers 1 sgr. Hyposulphite of soda, per lb., 8 sgr. Nitrate of soda; per 100 lbs., 11 thalers. Seignette salt, per lb., 7½ sgr. Acetate of potash, purified, per lb., 27½ sgr. Carbonate of potash, per 100 lbs., 14 thalers and 30 thalers. Ditto purified, per lb., 1 thaler. Prussiate of potash, per lb., 20 sgr. Sulphate of potash, per 100 lbs., 9½ thalers; crystallized, 40 thalers. Cyanide of potassium, prepared according to the process suggested by Liebig, per lb., 1 thaler 10 sgr. Soda-salt, of the salt water of Rehme, per 100 lbs., 3 thalers; mother-lye, of the same, 180 quarts, 5 thalers. Bleaching powder, 100 lbs., 6 thalers. Sulphate of soda; per 1,000 lbs., 2 thalers 5 sgr.

Stratingh and Co., of Gröningen, Holland (3, p. 1142), old makers of white-lead by the Dutch method, obtained Honourable Mention for the superior quality of their samples.

J. and E. **Sturge**, of Birmingham (119, p. 199), exhibited the red or amorphous phosphorus of Schrötter, manufactured by them; for which the Prize Medal was awarded.

Joseph Sturges, of Kettering (88, p. 196), exhibited a preparation for preserving the turnip plant from the ravages of the fly (*Haltica nemorum*).

M. B. Tennant, of Brighton (101, p. 197), exhibited a species of varnish of a silvery hue, for labels or artists' designs.

Tennants, Clow, and Co., of Manchester (7a, p. 186), exhibited a good collection of calico-printers' salts; including sulphate of copper, sulphate of zinc, chloride of tin in crystals, bichloride of tin, nitrate of lead, bichromate of potash, yellow and red prussiates of potash, chlorate of potash, garancine, stannate of soda, soda-ash, bisulphate of soda, sal-ammoniac, and pink salt, for which they received Honourable Mention.

J. Trix, of Exeter (125, p. 199), exhibited extract of henbane, prepared from the wild herb.

Truman, Hanbury, Buxton, and Co. (91, p. 197), illustrated ale and porter brewing by specimens of the materials employed, and of the products obtained.

A. T. Tulloch, of the Royal Gunpowder Mills, Waltham Abbey (21, p. 189), obtained Honourable Mention for the magnificent and extremely remarkable crystallizations of sulphur which he exhibited.

J. Tustian, of Melcombe, near Banbury (97, p. 197), exhibited petals of the red rose, confection of the red rose, and extract of henbane, prepared by him.

Tustian and Usher, of Melcombe, near Banbury (98, p. 197), exhibited English rhubarb grown by them. This Banbury rhubarb is the produce of the *Rheum rhaponticum*.

The Vieille Montagne Zinc Mining Company, of Liége, Belgium (26, p. 1152), obtained the Prize Medal for fine white oxide of zinc.

Wagenmann, Seybel, and Co., of Vienna (19, p. 1007, 1008), had the Prize Medal awarded to them for a fine collection of salts chiefly used in pharmacy.

O. W. Waldthausen, of Clarenburg, near Cologne (320, p. 1069), manufacturer of white lead, contributed superior specimens of that article.

Dr. N. Wallich, of London (pp. 884, 885), had the Prize Medal awarded to him for his great collection of Indian woods, which included specimens of the trees furnishing dye-stuffs, resins, oils, and different medicinal substances.

John Ward, of Ramelton, County Donegal (89, p. 196), was awarded the Prize Medal for the usual products from kelp, including iodine, chloride of potassium, sulphate of potash, and alkali-salt, all of superior quality.

Ward, Smith, and Co., of Glasgow (54, p. 193), exhibited iodine of good quality, with the salts of kelp, which they manufacture.

William Watt, of Dunchattan Chemical Works, Glasgow (32, p. 190), obtained the Prize Medal for iodine and salts of kelp, viz.: sulphate of potash, chloride of potassium, and crude carbonate of soda.

John Watts (103, p. 198) obtained the Prize Medal for various chemical and pharmaceutical substances manufactured by him, including an interesting collection of extracts prepared in open vessels at a temperature of from 110 to 130 Fahr. The collection embraced the acetic extract of colchicum, from the fresh corms; extract of gentian, from the dried root; pure aqueous extract of aloes, from hepatic aloes; extract of deadly nightshade, from the flowering plant; extract of liquorice, from the fresh root; extract of Turkey rhubarb, from the dried root; extract of fetid goose-foot, from the flowering plant; extract of hemlock, from the flowering plant; elaterium, from the fresh fruit when nearly ripe; inspissated ox-gall; extract of henbane, from the flowering plant; extract of white poppies, from the fresh capsules; extract of dandelion, from the fresh roots, obtained monthly from October to February.

G. D. Weber, of Venice (18, p. 1007), exhibited samples of fine crystallized cream of tartar, for which he received Honourable Mention.

J. H. Weiss, of Mühlhausen (684, p. 1088), exhibited an assortment of the finest madder lakes, for which the Prize Medal was awarded.

Wesenfeld and Co., of Barmen, Prussia (461, p. 1077), had the Prize Medal accorded to them for a collection of chemical salts, among which, the sulphide of soda, used as an antichlore, was conspicuous.

Wetherell and Brother, of Philadelphia (43, p. 1435), exhibited a good collection, upon a considerable scale, of salts for pharmaceutical purposes, which was awarded Honourable Mention.

A. Wiesmann and Co., of Augustenhütte, near Bonn (334, p. 1070), had the Prize Medal accorded to them for the products of distilled schist. Their liquid products are suitable for illumination; they also obtain paraffin, in quantity, and make good black varnishes for coating iron, &c.

John Wilson and Son, of Hurlet, near Glasgow, (6, p. 185), were awarded the Prize Medal for their alum, of which magnificent specimens were exhibited, together with a rich series of shales, hair-salt, and other illustrations of the manufacture. Fine sulphate of iron, obtained from the same shale, with sulphate of ammonia from the ammoniacal liquor of gas-works, and fine crystals of naphthaline, formed part of the collection.

Winsor and Newton (28, p. 190) also had the Prize Medal accorded to them for artists' pigments, of which a most extensive collection was exhibited both in the raw and manufactured states.

Wolff and Co., of Schweinfurt (17, p. 1099), contributed to the display of ultramarines,—remarkable for their cheapness,—for which Germany is distinguished.

Wood and Bedford, of Leeds (47, p. 192), had Honourable Mention accorded to them for their manufactured products from lichens. The preparations used in dyeing were accompanied by several pure chemical principles of the lichens, namely, erythric acid, lecanoric and roccellic acids, pycroerythrin and orcin.

J. Young, of Ardwick Chemical Works, Manchester (7, p. 187), obtained the Prize Medal for his stannate of soda, prepared by the action of caustic soda, aided by heat, upon the native peroxide of tin.

C. Zimmer, of Frankfort-on-the-Maine (3, p. 1121), was also awarded the Prize Medal for the alkaloid "quinidine," of which he is the discoverer. M. Zimmer is generally allowed to be the largest manufacturer of the other alkaloids of cinchona bark in Germany or any other country.

J. Zuber and Co., of Rixheim, Haut Rhin (1536, p. 1536), had the Prize Medal awarded to them for their ultramarine, which is remarkable for its fine division and beautiful violet tint. They also supplied a green variety of ultramarine, and a collection of paints.

London, January 1852.

THOMAS GRAHAM, Reporter.

CLASS III.

REPORT ON SUBSTANCES USED AS FOOD.

The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.

Jury.

EDWARD DE LODE, *Chairman*, Russia; Member of the Institute for the Administration of the Domains of the Empire.
Sir J. P. BOILEAU, Bart., F.R.S., *Deputy Chairman*, 20 Upper Brook Street.
JOSEPH D. HOOKER, M.D., R.N., F.R.S., *Reporter*, Royal Gardens, Kew; Botanist.
COMTE HERVÉ DE KERGOLAY, France; Secretary of the Central Jury, &c.
JOHN LINDLEY, Ph. D., F.R.S., 21 Regent Street; Professor of Botany, University College.
ASHBEL SMITH, United States; Planter.

IN conducting their duties, the Jurors have adhered to the arrangement of materials proposed by the Royal Commissoners in the Classified Catalogue, with the following exceptions:—

Opium;
Fruits preserved in sugar;
Starches used for manufacturing purposes;
Glue and gelatine;

all of which have been included in other classes.

The Jurors, in the choice of "Experts" (under Instructions, Art. 7, and General Decisions, Art. 29), have been assisted by various eminent merchants, and other persons having the confidence of the public and of the Jury, and who were in no way connected as exhibitors, or otherwise, with the Exhibition.

The "Experts" thus selected, in every instance, promptly placed their services at the disposal of the Jury; and by their zeal and alacrity, by the knowledge and ability they have displayed, the general unanimity of their opinions, as among themselves, and with the Jury—they have rendered to the latter both a service and a kindness, great, in proportion to the responsibility of the duties in which all were engaged.

The divisions of the Sub-classes were considered separately by the Jury, and are separately reported upon here. Allusions have, here and there, been made to "the state of industry of each nation as shown in this Exhibition" (see General Instructions for Juries, Art. 5). Where the materials for any such notices are insufficient, the deficiency is specified. The articles and exhibitors are arranged under—1. British; 2. Colonial; and 3. Foreign contributions; commencing with the Old World.

There were meetings of the Jurors held on about 40 days, their duration averaging about five hours at each meeting, and on no occasion was a day lost from the absence of a quorum.

A. I.—COMMON EUROPEAN CEREALIA.

Of the cerealia, commonly cultivated in Europe, viz., wheat, barley, oats, and rye, the Jurors have examined about 500 samples, many of great excellence. These are exhibited in various qualities, and with different objects; some are ears on spikes, for scientific illustration; some, mere specimens, in boxes or bottles, forming important portions of the series of vegetable products that various countries have contributed; and, lastly, there are sacks and barrels of different grain from England, the colonies, and exporting countries in general.

These are unequally distributed, and afford no general information as to the relations between the countries and their produce, nor much as to the importance of their cultivation in the various parts of the world exhibiting them.

Thus, of oats, rye, and barley, which are the staple crops of northern and mountainous Europe and Asia, but very few samples are in the Exhibition: comparatively speaking, wheat is very insufficiently represented from the United States; better, from our cold and temperate colonies; indifferently from England, Scotland, and Ireland; and hardly at all from the continent of Northern India, where it is a most important winter crop.

There are three collections which appear prominently interesting in this division, and require a particular notice; they are those of Messrs. LAWSON, Mr. MAUND, and Mr. H. RAYNBIRD.

Messrs. LAWSON'S collection (105, p. 206) exhibits the ear, grain, &c., &c., of every variety of cereal, and also models of all the roots which it has been found practicable to cultivate in Scotland: the specimens are beautiful, and the arrangement scientific and excellent. No consideration of cost or trouble has been allowed to interfere with providing all that is necessary to render this collection a true and complete illustration of the vegetable products of Scotland. A Council Medal has been awarded to Messrs. LAWSON "for their admirably-displayed, very complete, instructive, and scientifically-arranged collection of the alimentary products of Scotland."

Mr. B. MAUND'S (79, p. 205) and Mr. H. RAYNBIRD'S (74, p. 205) collection of hybrid cerealia are of great interest, from the importance of the process in other departments of the vegetable kingdom, and the known difficulty of hybridizing the cerealia in particular. This arises from the pains required to extract unexpanded anthers from one parent, and to replace them with the pollen of another; preventing at the same time the stigmas to be fertilized from receiving any other pollen than that artificially applied, and guarding them afterwards from the attacks of birds, and a variety of disturbing operations. The result appears, in most cases, to be an offspring stronger than either parent. Cone wheat has been principally experimented with by Mr. MAUND, and it contains much gluten; but its extended culture has been discontinued by farmers, owing to a preference for wheats from which a whiter bread may be made. Mr. MAUND'S object is, by crossing this cone wheat, to obtain an offspring equally productive, but with more starch in the grain. A Prize Medal has been awarded for the series exhibited. Mr. H. RAYNBIRD exhibits a similar series, for which a Prize Medal is also awarded. This gentleman commenced his experiments, in 1846, with two wheats of very opposite character, the "Hopetoun," a white wheat of long ear and straw, and fine grain—and the "Piper's thickset," a coarse red wheat, with thick clustered ear and stiff straw, very productive, but apt to mildew. A few shrivelled ears were first produced. These were planted, and the young plants divided. The produce was copious of all intermediate varieties, some so very like their parents as to be rejected. Picked grains being selected, abundant crops of both white and red hybrids were produced, partaking of the best qualities of both parents.

There are no wheats exhibited superior to the South Australian. This is probably owing to climate, for it appears, after a careful examination of many samples from the best wheat-growing climates, that Spain and certain districts of southern Russia produce hard wheats, equalling the Australian; whilst the produce of England, of the south of France, of the United States and Canada, hardly fall short of the same high standard. Large allowances have, in many cases, to be made for faulty agriculture, carelessly collected or insufficient samples, and for inefficient methods of threshing, &c., the grain. Such circumstances affect the adjudication of awards, but not perhaps the original value of the crop from which the samples were collected.

1. British Department.—R. Webb's "Talavera" wheat (72, p. 205) has been awarded a Prize Medal; it is a splendid specimen of English wheat, equalling in value any brought to the market.

H. Payne's "Revitt" wheat (82, p. 205) has also a Prize Medal; it possesses great value, and should wholly supersede the cultivation of the Egyptian Revitt, which is far too abundant in the English market.

J. MacKillican, of Cawdor (Scotland), a Prize Medal for excellent white wheat (114, p. 206).

H.R.H. Prince Albert exhibits samples of his farm produce (107, p. 206), consisting of "White Chidham" wheat, "Augusta beans," and "Winter oats." The collection deserves a special notice, each of the samples being of excellent quality. A Prize Medal has been awarded to H.R.H. for the oats and beans, the wheat appearing to the Jury to be a little deficient in colour and quality, when compared with other market samples of the same description.

Amongst the other British samples there is little above mediocrity, except the following, of which Honourable Mention is made:—

A. Sheppard, Ipswich, for good wheat, malt, and barley (70, pp. 204, 205).

The Truro Local Committee, for samples of various cerealia (71, p. 205) cultivated in Cornwall.

C. Gibson, Pitlochry, Scotland (102, p. 206), for barley grown at an altitude of 600 feet.

J. Sutton and Sons, for naked barley (112 p. 206).

Moses, H. E. and M., exhibit Australian wheat in this department, also deserving of Honourable Mention.

But few malts are exhibited; the samples shown by Taylor and Son (77, p. 205) receive Honourable Mention. A sample of porter malt prepared by a "patent process" was exhibited by S. R. Poole (146, p. 193*), in which the "torrefaction or roasting" was not carried so far as in the ordinary brown malts, and which is said to contain in consequence a larger proportion of unchanged saccharine matter.

2. British East India.—Wheat (870) has from time immemorial been a staple crop in the plains of northern India, and especially in the Punjaub; and since the establishment of the studs at Buxar, Ghazepore, &c., oats have been extensively cultivated. Both are winter (cold weather) crops. The climate and soil are well fitted for these cereals, but owing to defects and carelessness in the agriculture and harvesting, the crops, though excellent, fall short of what most corn-growing countries produce. Further, owing to foul boats and granaries, and to the moist heat of the months immediately succeeding harvest, the wheat reaches England in a state too dirty and weavelled for market. There are two samples in the Exhibition, one of hard and one of soft wheat, of which the former is most prized by natives of India, probably for no better cause than that the hardness of the grain more closely resembles their favourite food, rice. Barley is most extensively cultivated in the Himalaya and Tibet, replacing in many districts the wheat, and producing an admirable flour; both are desiderata (as are the oats), which is much to be regretted.

3. Australasia.—From this quarter of the globe, including Van Diemen's Land and New Zealand, there are splendid samples of wheat, some of barley, and a few of oats.

Port Adelaide stands pre-eminent for wheat and barley. Prize Medals have been awarded both to R. Hallett and Sons (South Australia, 5, p. 991), and to Heath and Burrow (9, p. 999), for wheat, which may be considered perfect as regards growth, equality of grain, colour, weight, and quality.

Swan River Colony and Port Philip also send good wheats, but Van Diemen's Land seems to rank next to Port Adelaide, though much that was apparently excellent from the former was spoiled during the voyage. From Van Diemen's Land fine white wheats are exhibited by Messrs. Deane, Dray, and Deane, and also by Messrs. M'Pherson and Francis (359, p. 1000), to whom Prize Medals are awarded; the malt also of E. Tooth, Bagdad (47, p. 993), is considered worthy of Honourable Mention.

New Zealand is represented by wheat, barley, and malt, all of good character. The barley exhibited by Hugh Martin and by Thomas Renwick, and the malt exhibited by Hooper and Co. (39, p. 1002), severally receive Honourable Mention.

4. Canada sends a fine supply of wheats, all of the ordinary English kinds, but every sample of more than average excellence. One barrel of D. Christie's white wheat (35, p. 962), sent by the Agricultural Association has been awarded a Prize Medal, as has one of Polish oats (38, p. 962.), of admirable quality, exhibited by R. M. Watts. The barley is very good. All have the advantage of bearing their prices in the Canada market, showing to what profit they may be exported.

Nova Scotia sends some good red wheat.

5. Cape of Good Hope.—The soft white wheat exhibited by J. A. Bam (46, p 951) is of great excellence, and has been awarded a Prize Medal.

6. Jersey contributes a collection of specimen ears, of 104 varieties, &c., of wheats (2, p. 940), accompanied by remarks on the seasons, nature of the crops, &c. A Prize Medal has been awarded to Colonel Le Couteur, the exhibitor.

7. Malta.—Honourable Mention is made of the white wheat (4, p. 944) of G. Pulis, Montebello.

8. Belgium.—Although a large display of wheats (there being fully 70 samples exhibited, p. 1150), there are none of any striking superiority. The red wheats are, in general, superior to the white; some "froment blanc d'hiver" is, however, good. Oats and rye are also of fair quality.

9. France.—There is no bulk of corn exhibited in this department; and the few samples there are seem chiefly intended as illustrations of manufacturing processes, where gluten is the constituent desired.

A Prize Medal is awarded to Bazin's wheats in the ear, &c. (1073, p. 1229); an important collection of agricultural produce, containing a new variety of wheat.

Honourable Mention is also made of Magnin's hard wheat, of Auvergne, used in the manufacture of his pâtes and macaronis (1337, p. 1240); also of Mabire's English and Russian wheats (1334, p. 1240).

10. Algeria sends wheat of great promise, amongst which, one, that of Lepelletier (33, 1261), has been awarded a Prize Medal. It is a soft fine-coloured wheat of much value.

11. Spain.—The Spanish wheats, though generally dirty, are unusually fine in quality. Many bottles full are exhibited, but the samples contained are insufficient, and almost universally mixed.

To one particularly fine sample from the Mayor of Medina del Campo (66, p. 1333), a Prize Medal has been awarded. In another bottle the Jury recognized the original stock of the Talavera wheat, probably of a very fine description, but not in a sufficiently satisfactory state for a correct judgment to be pronounced upon it.

12. Portugal illustrates her agricultural resources by 80 bottles of cerealia, all of fair, but none of particular merit. Her colony of Madeira also sends a sample of wheat.

13. The Zollverein States, Austria, and Tuscany, send scarcely any agricultural produce worthy of notice.

14. Denmark.—Barley is now very extensively exported by this country, and is of an excellent description. A sack of good quality is exhibited by H. Puggaard and Co. (1, p. 1355), and was found worthy of Honourable Mention.

15. Russia.—The collection of Russian cerealia is the finest in the Exhibition, forming a most attractive and prominent display. It consists of fine sheaves of the grains in ear, as cut, and abundant samples of the seeds in bowls; all well arranged and catalogued. Count

Kouchelеff (32, p. 1367) has sent the greatest variety, and a Prize Medal has been awarded to his collection in general, in which the black wheat and naked barley, &c., are worthy of particular notice and Honourable Mention. Hard white wheat, from Odessa (42, p. 1367), exhibited by Colonel Shabelsky, has been awarded a Prize Medal. This wheat yields a very large crop, and is never grown on manured land, which is considered prejudicial to it. A fine sample of wheat (Arnaout) from the Government of Saratoff, exhibited by — Baguer (39, p. 1367), has been awarded a Prize Medal. Black wheat (37, p. 1367), a very valuable cereal, cultivated chiefly by the Cossacks of the Azoff Sea; these samples are from the estates of Petroffskaja and Novo Spasskaja, and are awarded a Prize Medal.

Oats from English seed, exhibitor M. Selivanoff (52, p. 1368), a Prize Medal.

The following are considered worthy of particular notice and Honourable Mention:—

Hard wheat of Koubanka (60, p. 1368), Lieut.-General Ershoff; and of Arnaoutka (35, 1367), M. Klepatsky; pearl barley, Baron Ropp (47, p. 1368); oats, M. Ouskovsky (54, p. 1368).

A polentum of half-ripe rye demands notice as a novelty to England, though extensively consumed in Russia.

16. Turkey.—A large series of considerable merit illustrates the agriculture of this country. It is composed of samples of grain in bottles, too scanty for accurate examination; and many are dirty and carelessly collected. Nevertheless as a collection it is well worthy of attention, and one of the samples, a hard wheat (2149, p. 1386), has been awarded a Prize Medal.

17. Egypt.—This country grows more millets than corn, but both are copiously illustrated. One sample of white wheat, exhibited by H. H. Abbas Pasha (52, p. 1409), is of admirable quality; it is very large in the grain, and soft, and has been awarded a Prize Medal. The barley is good.

18. Tunis.—The cereals resemble those of Egypt in kind. Good hard wheats are exhibited, considered of unusual excellence in that country. The skinless barley deserves notice.

19. United States of America.—The Agricultural Society of New York receives a Prize Medal for a well-arranged and instructive series (83, p. 1438) of the wheat corn (in ear), generally cultivated in America. This is illustrated by remarks relating to the seasons, soils, and produce, and suggestive of various improvements in agriculture.

Among many barrels of fine wheats there is one of particular merit, to which a Prize Medal has been awarded; it is a soft white wheat from T. Bell, of Genessee (103, p. 1440), slightly injured by the voyage, but hardly inferior to any in the Exhibition. Among other cerealia of the same exhibitor, the red Mediterranean wheat deserves notice. Honourable Mention is made of the wheat exhibited by W. Hotchkiss (342, p. 1456).

A. II.—Cerealia rarely cultivated in Europe.

Rice, maize, and the *Croix lachryma* (Job's tears) are the chief products that appear to come under this head—millets, &c., being placed in a separate sub-class. As an article of import, rice holds a very prominent place. Maize, on the other hand, has not found much favour in Great Britain, its flour, however cheaply imported, having never perhaps been sufficiently appreciated.

1. Great Britain.—Rice requires more summer heat than this climate ever affords. Maize has been repeatedly experimented upon, and has been, up to the present time, the fruitful subject of speculation and discussion. Though occasionally successful, the crop is very uncertain, and always scanty. A fair sample is exhibited by the Truro Local Committee (71, p. 205).

2. British East Indies.—Copious samples of about 50 Indian rices are exhibited by the Honourable East India Company, and to them a Prize Medal is awarded. Many are of good quality, but more are dirty, small, broken in the grain, and unequal; characteristic of the slovenly state of the Indian bazaars. The quality of many appears only after boiling. In size, colour, and fineness of grain, none are at all comparable to the Carolina and Northern Italy rices; several are however very curious, especially the mountain rices, grown without irrigation, at elevations of 3,000 to 6,000 feet on the Himalayah, where the dampness of the summer months compensates for the want of artificial moisture. The small reddish Assamese rices which become gelatinous in boiling, and the large, flat-grained, soft, purple-black "Ketana" rice of Java and Malacca are also very curious. The East Indian maizes are inferior in quality, and deteriorated. Borneo exhibits a large series of rices, some of them curious.

3. West Indian Possessions.—Rice and maize are the staple crops here, but except from British Guiana, the contributions are trifling.

4. Australasia.—Maize is exhibited from New Zealand, where it forms an indifferent crop; and from Norfolk Island.

5. The Cape of Good Hope exhibits maize of fair quality.

6. France.—The cultivation of rice in Europe is quite confined to the Southern States, and chiefly to the borders of the Mediterranean, where it is extensively grown, and is of good quality. Two varieties are exhibited from Bordeaux, by A. Féry (505, p. 1203), to whom a Prize Medal is awarded. One is a beautiful, soft, brittle-bearded rice, irrigated, and called "Nostrana;" the other, unirrigated, is bearded, harder, greyer, and larger in the grain, and is called "Chinese rice." Algeria contributes rice and maize of indifferent quality.

7. Spain.—The sample of rice from Valencia (72, p. 1333) is equally good with that of Bordeaux, and swells much in boiling; it has been awarded a Prize Medal. Some good maize is exhibited, as also a sample of the seeds of *Cenchrus spicatus*, a cereal little known in Northern Europe, and of no great value.

8. Portugal.—The Carolina rice of M. Belmontez, is of good quality, but badly husked and bruised.

9. Sardinia.—The Riz de Piémont (18, p. 1303), exhibited by Blondel, Gaston, and Co., of the same kind and quality as the Bordeaux, has been awarded a Prize Medal.

10. Austria contributes different varieties of maize.

11. Russia.—Much rice, and of good quality, is cultivated in the southern provinces of this empire. Two samples are exhibited, one unirrigated, from the mountainous districts of the Caucasus; the other in the state of paddy (unhusked) from Odessa. Of the latter, one specimen called Chaltik, from Khalil Beck (57, p. 1368), exhibited by Zilfoogar Beck Iskander Beck Ogli, is worthy of Honourable Mention.

12. Egypt.—Rice abundant, and of good quality; that cultivated in the Delta of the Nile, at Rosetta, is considered the best; the grain is broad, short, flat, and peculiarly striated.

13. United States of America.—The American rice, though originally imported from the old world, is now much the finest in quality. The Carolina sample of E. T. Heriot (172, p. 1448) is magnificent in size, colour, and cleanness, and has been awarded a Prize Medal. A beautiful sheaf of beardless rice is also exhibited. Maize is a more important crop in North America than in any other civilized country, being used most extensively for stock feeding; as flour for cooking; and in various forms at table—green, as well as ripe; toasted, boiled, or baked. The collections from America are very fine, particularly that of B. B. Kirtland (84, p. 1438), who exhibits 34 varieties, amongst which are to be found samples of nearly all those usually cultivated in the United States. A Prize Medal has been awarded to him.

A. III.—Millet and other small Grains used as Food.

Under this head, besides millets, the Jury have considered buck-wheats: neither are well represented in the Exhibition, though of great importance in many parts of the world.

Buck-wheat belongs to the temperate and arctic climates, and is cultivated in Northern Europe, Asia, and

America, and most abundantly in Central Asia and the Himalayah; in the latter country the different varieties are grown at various elevations, between 4,000 and 12,000 feet. The finest samples exhibited are from Canada, by E. Trenholme (52, p. 962); they are deserving of especial notice, and Honourable Mention. The United States, Russia, and Belgium, also exhibit small samples of good qualities.

Millets, again, are tropical or sub-tropical crops: in India they hold a second rank to rice alone; and in Egypt, perhaps, surpass all other crops in importance. In West Africa they are the staff of life. The Egyptian samples are the finest, and those numbered 90, 91, and 92, p. 1409, exhibited by H.H. Ilham Pasha, are deserving of Honourable Mention; they belong to *Holcus sorghum* and *H. saccharatum*, and are known to Europeans as "petit mais."

From India various samples are shown of the different species of Panicum, but not labelled in the manner such an instructive collection should be.

Ceylon exhibits millet of fair quality.

The red and white millets of Austria, Russia, and the United States are beautiful, particularly the Russian samples (60, p. 1368), exhibited by Lieut.-Gen. Eshoff, of *Panicum Italicum* and *miliaceum*, to which a Prize Medal is awarded.

Turkey abounds in small grains, and exhibits a large variety of them; but the samples are insufficient and dirty.

A. IV.—Pulses and Cattle Food.

Under this head the Jury have included all leguminous seeds, whether cultivated as food for man or cattle.

The importance of peas and beans is well appreciated, both by the horticulturists and agriculturists in Europe, and our temperate colonies, where, however, they are comparatively of less importance, than the smaller pulses and grains are in various tropical countries,—such as haricots in the Brazils and West Indies,—ground or earth-nuts in South America, and especially in Western Africa,—beans of various kinds amongst the miners of Peru,—gram (*Ervum lens*) and dhal (*Cajanus*), with innumerable varieties of beans and small lentils, among the natives of India and Egypt,—and the Carob bean or St. John's bread (*Ceratonia siliqua*) in the Mediterranean countries. The above are all more or less copiously represented in the Exhibition by the countries named.

In the British Department, Lawson's great collection stands pre-eminent for extent and scientific value; and there is also a large one of agricultural produce from Messrs. Gibbs. H.R.H. Prince Albert's "Augusta horse-beans," are magnificent, and have been awarded a Prize Medal as part of the collection of agricultural produce alluded to under A. I. W. P. Croughton's golden pod beans (92, p. 1206) are worthy of Honourable Mention. Raynbird's tick beans and those of Strange are good; as are also Fordham's prolific peas.

Canada sends peas, beans, and haricots, all of excellent descriptions; and no less remarkable for quality and colour than for cheapness. The blue imperial peas sent by D. Jones (41, p. 962) would command the highest price in any English market; they have been awarded a Prize Medal, and a like award is given to D. Limoges (40, p. 962), for his fine sample of white peas.

Belgium, Spain, Portugal, Turkey, Tunis, and Egypt exhibit, each, beans, peas, haricots, pulses, and legumes of all descriptions, but none except the Egyptian beans are worthy of especial notice.

Russia, besides many of these, exhibits green sugar-peas (dried unripe); those exhibited by Khokholkoff and Gregorjeff (63, p. 1368) are worthy of Honourable Mention for their excellent flavour and sweetness.

A. V.—Grasses, Fodder, Plants, and Agricultural Roots.

Of these, including clover-seeds, &c., there are but few specimens beyond those in the collections of Messrs. Lawson and Messrs. Gibbs. The splendid specimen of tussack grass from the Falkland Islands, exhibited by Messrs. Lawson, and in full flower, deserves especial notice.

Canada and the United States exhibit clover-seeds and timothy grass. Of these the timothy-grass seed (61, p. 93) of T. McGinn, Montreal, and the clover-seed (62, p. 93) of G. Jeffries, are worthy of Honourable Mention.

Of agricultural roots there are none worthy of mention, except the Portuguese *Cyperus esculentus* of the Marquis de Loulé (401 b) be included, which is worthy of Honourable Mention.

Belgium contributes hay of fair quality. Egypt exhibits samples of clover-seed, and Tunis of hay-seed.

A. VI.—Flours, and Preparations of the above Classes.

Under this comprehensive head, the Jury have considered, not only flours properly so called, but various biscuits and semolines, as also pâtes, macaronis, vermicellis, and other manufactured articles referred to them. It is difficult, in many cases, to determine, satisfactorily, which belong to this, and which to the starch series (F).

There are but few English wheat-flours exhibited; and the general remarks made under the head of "cerealia" are equally applicable here;—except that the United States contributions of wheat-flours are really magnificent. Pea and bean flours, and sundry alimentary substances prepared therefrom, find a place here.

1. Great Britain.—Amongst the various, but far from extensive, series of flours from this country, Prize Medals have been awarded to—Kidd and Podger, Isleworth Mills, for Australian wheat-flour (150, p. 193*). Edward Chitty, of Guildford, for flour of English white wheat (159, p. 193*). And to Buck and Son, of Bradford (162, p. 193*), for oatmeal-flour.

Honourable Mention for particular excellence is also made of the following:—

W. Juson, Shropshire (95, p. 206), for wheat-flour.
J. M'Cann, Drogheda (153, p. 193*), for oatmeal.

Ashley's flours of peas, groats, and pearl barley, exhibited by T. Styles (157, p. 193*), put up for long voyages, are sound and useful preparations. Inferior macaronis of English manufacture are exhibited by W. Levy (120, p. 207), and by J. P. Gentile (108, p. 206), together with glutens and other alimentary substances. A very fine collection of gluten preparations, chiefly of scientific interest, is exhibited by Madame St. Etienne (138, p. 208), who exhibits, also, some curious dried alimentary substances, composed partly of flour and partly of meat. Bullock's semola appears to be wheat-flour granulated with gluten. The rice gluten of Orlando Jones (128, p. 208) is obtained from rice-flour used for the manufacture of starch, dissolved by caustic soda, and then precipitated by an acid. Reckit and Son, of Hull, exhibit various starches and sagos (125, p. 208), all apparently derived from potato-flour. D. and W. Miller's pithina food, sago-flour, and Scotch fecula seem all referable principally to the same source.

Amongst the curiosities worthy of notice is the Typha meal prepared from the rhizoma of *T. latifolia*, by M. M'Callum, of Leith (133, p. 208).

2. Canada.—Various barrels of excellent flour are exhibited, and also of biscuits; Prize Medals have been awarded to—J. Simpson and Co. (48, p. 962), for wheat-flour; R. Squair (51, p. 962), for oatmeal-flour; J. Robb (126), for biscuits.

The buckwheat-flour exhibited by E. Trenholme (52, p. 962) is also very good, and deserves Honourable Mention.

4. Cape of Good Hope.—A sack of very fine flour from this colony merits Honourable Mention; it is from J. F. Fredericksen.

5. Australasia.—After what has been said of the cerealia of Port Adelaide, it is not surprising that the flours should prove of equal excellence, as is especially the case with those exhibited by H. E. and M. Moses (4, p. 997), to whom Honourable Mention is awarded. Van Diemen's Land contributes some barrels of excellent wheat flours; one of these from J. Walker (51, p. 993),

is deserving of Honourable Mention: the others appear to have been injured by the voyage. The NEW ZEALAND "Maori flour" (or flour produced by the natives) is deserving of notice. BISCUITS so extremely well made as to have been awarded a Prize Medal are exhibited by A. M. MILLIGAN (53, p. 993), of Van Diemen's Land;—these deserve especial notice, from the fact that, at a very recent period, the biscuit served out to the convicts, and to Her Majesty's Navy, when refitting in Tasmania, was said to be the refuse of the English Dockyards, and was certainly unfit for food.

6. DEMERARA exhibits maize and plantain meal of good quality.

7. FRANCE contributes a most extensive collection of flours and preparations therefrom; amongst which it is very difficult to select for awards—the specimens are of such variety, as to merit and kind.

The magnificent gruaux wheat-flour of M. D'ARBLAY, jun. (1576, p. 252), has occupied much of the attention of the Jury, not only as the best sample of European flour, but from the exhibitor being the inventor of the gruaux principle in grinding, whereby a great saving of the finest and most nutritive portion of the flour is effected, and any wheat flour made to contain more or less gluten in proportion to starch. Hard wheats of all kinds, especially Sicilian, Russian, and Sardinian, from the large percentage of gluten they contain, are the best adapted for this purpose. By means of D'Arblay's adjusting process, such grains are first ground high in the mill; the white middlings are then separated by coarse sieves, and reground low in the mill; finally, the flour is repeatedly passed through fine silk sieves. This process is evidently tedious and expensive; but the flour produced is of the very finest description, especially for pâtes, and other preparations of that description. The average produce of flour thus obtained is 25 per cent. from ordinary wheat. Such flour is extensively imported into this country, for bettering the inferior flours, especially the Irish. D'ARBLAY's household flour, obtained by the usual grinding process, is also of first-rate quality. A Council Medal has been awarded to Mr. D'ARBLAY, "for his gruaux and household flour, obtained by a novel and economical process, for the fineness of its quality and utility."

CABANES and RAMBIÉ have been awarded a Prize Medal for their "thirds flour" (1126, p. 1232), and ABEL LEBLANC's "household flour" (297, p. 1191) has been found worthy of Honourable Mention.

Among the great manufacturers of French pâtes, &c., &c., the following have been awarded Prize Medals. J. V. MAGNIN (1337, p. 1240), for macaroni, almost equal to the best Italian: and for wheat, already mentioned amongst the cerealia, and which, from its proportion of gluten, is particularly adapted for pâtes, &c. Mr. MAGNIN also exhibits various flours, with their applications to culinary purposes, all of great excellence. N. D. M. FEYEUX, of Paris, for a fine collection of fécules (209, p. 1193). VÉZON BROTHERS, of Poitiers, for their gluten granulé (1520, p. 1249) and other products; this gluten is composed apparently of flour mixed with gluten and water.

Honourable Mention has been made of the following:—

GROULT, jun., Paris (530, p. 1204), for an excellent collection of fécules, including those of rice, chestnut, and parmentines. C. CLOET, de Lille (456, p. 1200), for fine pearl barley, vermicelli, and other preparations. J. M. H. VIOLETTE, for ship-biscuits (1528, p. 1250), prepared by baking the dough in high-pressure steam.

Besides the above, there are various good collections of similar substances, as those of BEGON BROTHERS (49, p. 1173), who exhibit rice, lentil, and pea flours;—of MACHET, a fine series of wheat glutens;—and of NOVÉ, vermicellis and potato-flours, &c. (1342, p. 1242).

From ALGIERS, a good hard wheat-flour, from LAYA and Co., of Bab-el-Ouid (32, p. 1261), of admirable quality, merits Honourable Mention.

8. RUSSIA.—The flours of this country are proverbially good, and those exhibited equally excellent with the collection of cerealia. A Prize Medal has been awarded to M. ROUSSANOFF (66, p. 1368) for hard wheat-flour. Honourable Mention is made of the Smolensko grits of RATSHINSKY (49, p. 1368), prepared from buck-wheat, ground on the gruaux principle, being quite a novelty. Rice-flour is exhibited, as is also a very peculiar coarse Revitt wheat-flour.

9. AUSTRIA.—The wheat-flours of this country, and especially the Croatian, are exceedingly good. Two samples of apparently a gruaux flour, prepared by the PRIVILEGED STEAM FLOUR MILL COMPANY, Vienna (62, p. 1010), have been awarded a Prize Medal. JORDAN and BARBER, of Tetschen, Bohemia (68, p. 1010), exhibited a Croatian flour from a peculiar wheat, which is considered difficult to clean; it is said to yield six to eight quartern loaves per sack more than any other, and has been awarded a Prize Medal. There are various other good flours exhibited by Austria.

10. BELGIUM.—The samples of potato-flour are of unusual excellence, and Honourable Mention is made of that of G. BLYCKAERTS (78, p. 1153).

11. BAVARIA exhibits a peculiar flour from wheat-grits of exceedingly good quality, but not accompanied by any observations, and probably sent as a curiosity only, by CHRISTIAN AUGUST ERICH (p. 1099).

12. PRUSSIA.—The potato-flour and sago (332, p. 1070) exhibited by F. WAHL, are of great merit, and have been judged worthy of Honourable Mention for the beauty of the preparations. From the same country WITTEKOP and Co. exhibit a fine series of macaronis and pâtes (695, p. 1089), to which a Prize Medal has been awarded.

13. The NETHERLANDS and the DUCHY of HESSE exhibit pearl barley, groats, flour, &c.

14. SWITZERLAND and SARDINIA contribute pâtes of various kinds.

15. TUSCANY.—The MACARONIS of this country are the finest in the Exhibition, both for flavour, texture, and excellence of manufacture; those of F. PAOLETTI (40, p. 1294) have been awarded a Prize Medal.

16. SPAIN AND PORTUGAL both exhibit good flour of wheat, but the samples are insufficient. There are also macaronis from Portugal.

17. UNITED STATES OF AMERICA.—Very fine samples of flour are exhibited from this country, and of 10 barrels none fall below a high standard of excellence. Two have been selected as worthy of Prize Medals; one of HECKER and BROTHER (114, p. 1440), who also exhibit the maize farina; the other of RAYMOND and SCHUYLER (128, p. 1441). The extra-Genessee flour of M. S. and H. L. LEACH is also worthy of notice (155, p. 1446). Of maize-flour, commonly called "corn-meal," or "corn-flour," in the United States, the exhibition is very good. The article is extensively used for puddings and other purposes in that country, and is considered peculiarly wholesome and nutritious; more so than rice-flour, which is preferred in England for similar purposes.

HECKER and BROTHER'S farina has been considered worthy of Honourable Mention, as has, also, the fecula of the OSWEGO STARCH FACTORY (104, p.1440), which is produced at a very low price. These, and many other samples, testify to the great importance of this flour as an article of home consumption in America.

Malt made from maize is exhibited, perhaps more as a curiosity than an article of importance, by the OHIO BOARD OF AGRICULTURE (24, p. 1434). Good pearl barley is shown by RAYMOND and SCHUYLER (128, p. 1441).

A. VII.—OIL SEEDS AND THEIR CAKES.

Of this description of sheep and cattle food there is a tolerable supply in the Exhibition, but no samples of remarkable merit, and only one novelty, the cotton-seed cake. Among the various seeds used in the manufacture of oil-cake, flax (or linseed) is the most important. Rapeseed is also employed, but is considered heating. In the Lubeck department a sample is exhibited of the "dodder-cake," made from the *Camelina sativa*. A small portion of inferior poppy-cake is contained in the Indian collection. Walnut-cake is not represented at all.

1. GREAT BRITAIN.—The cotton seed-cake, exhibited by R. BURN (of Edinburgh), is a novelty worthy of

especial notice, and was awarded Honourable Mention. The seed is recommended on account of its cheapness, being usually thrown away as refuse by the cotton manufacturers; it is extensively used as a cattle food, in an unprepared state, in various parts of the tropical world, and to a limited extent in England; but its success is doubtful, and in the shape of oil-cake it has possibly not yet been fully tested. Several samples of linseed-cake from Yorkshire are exhibited, some of which are better than ever appear in the London market; they are, however, inferior to the American. Honorary Mention is made of the collection exhibited by T. Peterson (66, p. 204), consisting of samples manufactured by George Spurr of Boston, John Wood of Hull, Fea of Boston, Payne of Hull, Thirsk, jun., of Beverley.

2. British East Indies.—Flax is most extensively cultivated, especially in the northern province of India, but chiefly, if not wholly, for the oil expressed from the seed; the oil-cake, as a manufactured article, being unknown. Poppy-cake is, however, occasionally manufactured, and a specimen (of inferior description) is exhibited.

3. Canada exhibits excellent linseed; and the camelineseed of J. Fisher (59, p. 963) is considered worthy of Honourable Mention.

4. Belgium exhibits good oil-cakes of various kinds. Honourable Mention is made of the rapeseed-cake exhibited by Vercruysse, Brothers (91, p. 1154), and of the linseed-cake of J. L. Vercauteren (82, p. 1154).

5. Hamburgh.—The rapeseed-cake of J. Peterson (5, p. 1136) deserves Honourable Mention.

6. Austria, the Netherlands, Lubeck, and Egypt all exhibit, more or less, oil-cake of fair quality.

7. Sardinia exhibits very good oil-cake of Girardi, Brothers (5, p. 1302), considered worthy of Honourable Mention. (Mentioned also by Jury of Class IV.)

8. Russia sends various good samples of linseed and sesamum; also of rape-seed, of which the sample exhibited by E. Karnvitch (31, p. 1367) is deserving of Honourable Mention.

9. United States of America.—J. Bridge of New York (546), and Lee and Co., of Boston (530, p. 1467), both exhibit very fine oil-cake, worthy of Honourable Mention. These are much finer samples than usually reach the English market from America.

A. VIII.—Hops.

The best hops are produced in England, and are chiefly cultivated in Kent and Sussex; they are also grown to a limited extent in Surrey, Essex, Suffolk, Herefordshire, Worcestershire, and Staffordshire, the soil and climate of each district giving a peculiar character to the crop. On the continent of Europe hops have been extensively cultivated, but never to perfection, the flowers having generally a rank smell and flavour. The plant has also been introduced into Canada, Van Diemen's Land, and on the Himalaya mountains, with various success. The exhibition is, on the whole, good.

1. Great Britain.—A Prize Medal has been awarded to J. M. Paine, for his Farnham Golding's hops (62, p. 204), grown on the phosphoric marl. These are fully ripe, and of fine flavour. The soil of this district is the very finest for the production of hops, but the growers often pull them too green. A Prize Medal is also awarded to Richardson and Sons for their collection (59, p. 204), in which the Gravesend hill are fine and well flavoured; and both the Jones' and Worcester are worthy of notice. R. Golding's hops (63, p. 204) are considered worthy of Honourable Mention.

2. Canada sends the best hops that have ever been imported from that country, and which, had they less of the "currant-leaf" flavour, would fetch a good price in our market. The samples of B. Smith (64, p. 963), of Stanstead, have been awarded a Prize Medal, and that of Thomas Dawes and Sons (65) considered worthy of Honourable Mention.

3. Van Diemen's Land has grown hops for some years, and, it has been said, with success; but the specimens now exhibited are hardly recognisable, perhaps owing to defects in the packing, or accident during the voyage.

4. Belgium exhibits fair hops and of several varieties; these rank next to the Canadian in point of flavour. The best are the Poperinghe hops exhibited by L. Degryse (63, p. 1153), Widow L. Dequidt (64, p. 1153), Madame van Meries (65, p. 1153), which are severally considered worth of Honourable Mention.

5. Grand Duchy of Hesse.—The Mayntz hops are of good flavour, well harvested, though rather small, and have been awarded a Prize Medal; the exhibitors are Stein and Schröder (81, p. 1129). Some Strasbourg hops are also good, resembling Golding's.

6. Russia sends a sample of unripe hops, better than usual, and which, were they sufficiently ripened, would probably rank next to the English in quality. This appears to be a common imported variety of the English "grape hop," and is from Count Koucheleff (32, p. 1363):—it deserves Honourable Mention.

B.—Dried Fruit and Seeds.

The series of dried fruits is very extensive, and the articles generally excellent in quality. Little novelty, either in product or import, is remarked, and none of invention in preservation. The divisions of this Sub-Class (B.), proposed by the Royal Commissioners, are not here retained, the articles being considered in the aggregate under each exhibiting country. Those preserved in sugar have been referred to another Jury. (Class XXIX.)

1. Great Britain.—Fortnum, Mason, and Co.'s collection of dried fruits, seeds, and other articles used for dessert (55), claims the first place, and has been awarded a Prize Medal. Amongst many samples of the finest fruits are others of greater or less demand in the English market; as,—the Sapucaya, Souari, and Brazil nuts, cashew, jujube, litchi, hickory, pinus cembra, &c. Vanilla, nutmegs, Taffilah and Syrian dates, &c. John Clemens (56, p. 204) has been awarded a Prize Medal for magnificent raisins (Malaga) and Jordan almonds. R. and C. Faulkner (54, p. 204), also, have been awarded a Prize Medal for their preserved fruits in bottles, &c., which, though not dried, can only be introduced in this class. Copland, Barnes, and Co.'s collection of fruits (11, p. 201) deserves Honourable Mention. Batty and Feast also exhibit good fruits.

2. Ionian Islands.—Dried currants are exhibited from Cephalonia, by Mavroianni, equal to the Zante currants.

3. East Indies.—Pickled fruits of the "durion," a production of the Straits of Malacca, are exhibited, but no other preserved fruits, except tamarinds, which were extremely good, and some fine candied fruit of the Œgle Marmelos.

4. Ceylon exhibits tamarinds and myrobalans (the almond-like kernel of the nut of a terminalia); Java, tamarinds.

5. From the West Indian Islands there are fruits, entire, of the Brazil nut (*Bertholletia excelsa*), from Trinidad; tamarinds and cashew nuts from Barbadoes. Demarara sends excellent fresh souari (butter nuts), dry bananas in slices, sweet but very poor; the monkey-pot fruit entire; limes; and bilimbi fruit preserved in pickle.

6. Van Diemen's Land exhibits good dried apples grown in the colony.

7. Cape of Good Hope.—A Prize Medal has been awarded to the fine collection of dried fruits from the Cape Colony exhibited by R. Clarence (54, p. 952); of these the most remarkable are good sugary pudding raisins, and a small black kind from the Constantia grape; flat dried pears, good; soft-shelled white-meated walnuts of great merit; good but flavourless almonds with formidable shells, and dried sliced peaches and apricots.

8. France.—The contribution is small from this country, except of fruits preserved with sugar.

9. Wurtemberg.—Dried fruits for home consumption, and apparently much appreciated in the country, are exhibited; such as bilberries preserved in great quantities,

which are flavourless; also some apples, pears, and cherries, which are better.

10. Prussia exhibits a case of 24 bottles of dried garden and orchard fruits, good, and well flavoured.

11. Spain.—The collection of Spanish dried fruits deserves Honourable Mention for general excellence. There are dried raisins, dried peaches, prunes, and thin-skinned figs, walnuts of great size and good flavour; almonds, Barcelona nuts, ground-nuts, pistachio nuts, chestnuts, and belotes. Of these the following exhibitors have been considered worthy of Honourable Mention:—Don Juan d'Alvear; plums. Don J. R. Casalo; raisins (105, p. 1335). Don Joaquin Enriquez; figs (107, p. 1335). Don Jose Olmo; peaches (176, p. 1339). The pimientos de vico (Logroño), or sweet capsicum, of R. Manso (133, p. 1337), likewise merit Honourable Mention.

12. Portugal.—The series from this country is particularly fine, and consists of copious samples put up in large bottles, all of good quality. Those contributed from Villa Real (412–416, p. 1312), by Pinto da Fonseça Vaz, consisting of plums, figs, pears, peaches, and apricots, have been awarded a Prize Medal. A Prize Medal is also awarded to J. L. Gomes, for his magnificent figs (403, 418, 419, 420, p. 1312); and Honourable Mention is made of the dried pears (404, p. 1312) of Pinto da Fonseça Vaz. Besides the above, there are from these and various other exhibitors almonds, walnuts, filberts, chestnuts, belotes, raisins, plums, &c.

13. Greece contributes raisins, currants, and figs; but none of fine quality.

14. Tuscany sends pine-seeds, an article of great consumption in the Italian provinces.

15. Tunis.—The collection of dates exhibited by Etteib Mehsen (pp. 1415, 1416), including upwards of thirty varieties, all in excellent condition, and in great quantities, has been awarded a Prize Medal. Though dates are not imported into this country from Tunis, that part of Africa is celebrated beyond all others for the variety and excellence of this fruit. There are, also, almonds, raisins, pistachio-nuts, apricots, and figs.

16. Egypt.—There are seven kinds of dates in this collection, none remarkable. The fruit of the doom-palm (*Crucifera thebaica*) is a novelty; it is commonly called Alexandrian gingerbread, and is much eaten, though worthless as an article of food in English estimation.

17. Turkey exhibits an extensive series of fruits and small articles for dessert; but all in insignificant quantities, and very dirty. The jujubes are remarkable for size and variety.

18. Of cocoa-nuts there are very few exhibited, and none worthy of notice. Ceylon and the Mauritius contribute some. The "double" or "sea cocoa-nut" of the Seychelle Islands, sent from the Mauritius, is a curiosity, but not an edible one.

19. Betel-nuts are exhibited from Sarawak in Borneo, Ceylon, Singapore, and the East Indies.

Though not ranking as "dried fruits," olives and olive-oil have been included in this division by the Jury; of these the exhibition is admirable. The Spanish olives are magnificent, both those preserved in oil and in water; and Honourable Mention is made of the "manzanillas à la Rena" of Manuel Carabe, Seville (112, p. 1335). Portugal also exhibits admirable olives, of which the small black kind of the Viscount de Fonte Boa (441, pp. 1312, 1313) merits Honourable Mention. The other exhibiting countries are Egypt, Algiers, and Tunis. Olive-oil is abundantly exhibited by France, Algiers, Tuscany, Spain, Sardinia, Corfu, Portugal, Madeira, and South Australia; but, amongst great general excellence, there is no novelty or particular merit.

C. I.—Tea.

The exhibitors are few in this division, and have confined themselves to imports from the Eastern World, whence this product is, however, admirably illustrated. China tea is exhibited in abundance, and of the finest quality. The British Indian produce, again, has never before been displayed in England as it is here by the Assam Tea Company, and the Honourable Court of Directors of the East India Company, who send good samples of the Himalaya and Java growths in the best condition. The Jury regret the absence of samples from Madeira, and especially from Rio de Janeiro, as also from Chittagong, and various other countries in which the cultivation of tea has been attempted with more or less success.

1. *China Teas.*—The collection formed by P. W. Ripley (17, p. 1423), at Canton, expressly for this Exhibition, is quite unrivalled, whether we regard the excellence of the specimens, the completeness of the series, the rarity and costly nature of many of its perishable contents, or the scientific value it possesses from the admirable arrangement followed. Some of the teas exhibited have never before been seen in England, whilst these and others command prices, in the China market, six times greater than the most expensive fetch, when sold retail, in England. Some are so perishable that the voyage injures, and the subsequent keeping and exposure in the Exhibition ruins them; whilst all are curious and highly instructive; circumstances quoted to show how regardless of every consideration but the complete illustration of this branch of commerce Mr. Ripley has been.

The Jury regret to find that the rules of the Royal Commissioners preclude Mr. Ripley from receiving any stronger proof of the high estimation in which his collection is held than the award of a Prize Medal. The following scanty data are recorded for the information of the public on a branch of industry which has never before been adequately illustrated.

Full chests of various Pekoe teas are exhibited, some of which fetch 50*s.* per lb. in the China market; whilst 7*s.* is the very highest price any of the sort will fetch in England, and this only as a fancy article. The plain and orange-scented Pekoes now fetch little with us; but, as caravan teas, are purchased by the wealthier Russian families. The finest, however, never leave China, being bought up by the mandarins; for though the transit expenses add 3*s.* to 4*s.* per lb. to the value when sold in Russia, the highest market price in St. Petersburg is always under 50*s.* Among these scented teas are various Caper teas, flavoured with chloranthus flowers, and the buds of some species of plants belonging to the orange tribe, magnolia fuscata, olea flowers, &c.

The Cong Souchong, or Ning-young teas, are chiefly purchased for the American market. Oolong tea is the favourite drink in Calcutta, though less prized in England, its delicate flavour being injured by the length of the voyage.

For delicacy, no teas approach those usually called "Mandarin teas," which being but slightly fired, and rather damp when in the fittest state for use, will bear neither transport nor keeping. They are in great demand among the wealthy Chinese, and average 20*s.* per lb. in the native market. The pouchongs, souchongs, and congos better illustrate the English trade, and are of the most admirable description.

Of the Moyune district teas there are eight varieties; they are much prized in the American markets, but not so much so in England. Among the most important curiosities in the collection are the counterfeit teas of Canton. These are made of any refuse, such as moistened tea-leaves from the pot, beat up with gum and rice-water in a mortar, coloured with Prussian blue and gypsum, and curled, twisted, or granulated so ingeniously as to counterfeit the most costly varieties. The gunpowder and scented caper are over-done, the appearance of the counterfeit being more equal and beautiful than the genuine teas ever are.

Various curious teas used by the labouring classes of Chinese are exhibited; some are merely coarse, and bad, sun-dried leaves; better qualities, chiefly from Ankoy, are put up in baskets and boxes, and exported to the Islands of Java, &c. Curiously rolled and twisted samples, such as the "old man's eyebrows," "ball tea," and other fancy manufactures, are all illustrated. Medicine teas follow these in the series, and consist of cakes, lozenges, &c., made of leaves mixed with various drugs, herbs, liquorice, and sweetmeats.

Lastly, there are specimens of the plant itself, leaf, flower, and bud; models and drawings to illustrate the processes employed in its manufacture, packing, and shipment; samples of the materials used for scenting; tea-pots, cups, &c.

Another collection of merit is that of W. P. Hammond and Co.* (2, pp. 418, 419), which has also been awarded a Prize Medal. This contains, in 40 boxes, the various teas more or less abundantly imported into England; and is further illustrated by good paintings of the processes employed in the culture, husbanding, and manufacture.

2. *Java Teas.*—Exhibited by the Singapore Committee of the Honourable East India Company. These teas are good of their kind, but not equal in flavour to the Chinese, or even to the Kemaon. In respect of flavour, they resemble the Assam, but are inferior in strength.

3. *Kemaon Teas.*—Exhibited by the Honourable East India Company (p. 872), are not very fully represented. In flavour these rank next to the Chinese teas; and as a class, have rather the Ankoy flavour; being better adapted for green tea than black. The manufacture is much improved of late. Three samples are exhibited; imperial hyson, young hyson, and souchong; for the two latter of which a Prize Medal has been awarded.

4. *Assam Teas.*—Eight boxes are exhibited by the Honourable East India Company (p. 872); all full of well-made strong teas, superior in this respect to the Chinese, but much inferior in flavour, roasting, and scent. In point of manipulation they equal the Chinese. For mixing with the Chinese article they find a ready sale in the English market; and are in every respect superior to the ordinary tea, than which they command a much higher price. The quantities exhibited in these boxes are too small, and have consequently lost much of their flavour during the voyage and subsequent exposure.

The grey flowery pekoe is the best sample exhibited; in appearance and flower it cannot be surpassed by any China tea, but is rather wiry in the leaf, from the buds having been gathered too young; whence, perhaps, also its deficiency of flavour. It is of a much higher class than that of Kemaon and Java, and would command a high price in the English market. A Prize Medal is awarded to it.

5. *Brick Tea of Tibet.*—A sample of this curious product is exhibited by the Honourable East India Company (p. 872). It is formed of the refuse tea-leaves and sweepings of the granaries, damped, and pressed into a mould, generally with a little bullock's blood. The finer sorts are friable masses, and are packed in paper; the coarser, as this, sewn up in sheep-skin. In this form, it is an article of commerce throughout Central and Northern Asia, and the Himalayan provinces; and is consumed by Mongols, Tartars, and Tibetans, churned with milk, salt, butter, and boiling-water, more as a soup than as tea proper. Certain quantities are forced upon the acceptance of the western tributaries of the Chinese empire, in payment for the support of troops, &c.; and is hence, from its convenient size and form, brought into circulation as a coin, over an area greater than that of Europe.

6. *Assam Tea.*—Sent by the Assam Company, and exhibited in the British Department (143, p. 193*). This collection is contained in twelve chests: it is admirable, and in perfect order. As the indigenous plant has been manufactured in Assam, and the China plant has also been introduced and cultivated for the purpose, the exhibitors have judiciously sent samples of the different kinds of tea from each: thus enabling the Jury to establish the superiority of the introduced Chinese plant over the indigenous (or native Assam), for the manufacture. There is a decided advantage in point of flavour possessed by the Chinese leaf, though the manipulation appears perfectly equal in both.

A Prize Medal has been awarded to the Assam Company for this valuable collection of admirably-prepared teas.

C. II.—Substitutes for Tea.

Of these the Exhibition contains hardly any examples. One specimen of mate or "Paraguay tea" (*Ilex Paraguayensis*) is exhibited as a curiosity. This beverage is in universal use throughout Brazil, Uraguay, Paraguay, the Plate district, Chili, and Peru.

Dr. Gardner's prepared coffee-leaves (142, p. 193*) are worthy of notice, as affording a really palatable drink when infused as tea is; more so perhaps than coffee is to the uninitiated. That this preparation contains a considerable amount of the nutritious principles of coffee is evident from the analysis; but as the leaves can only be collected in a good state, at the expense of the coffee-bush, it is doubtful whether the coffee produced by the berries be not, after all, the cheapest, as it certainly is the best.

C. III.—Coffee, Cocoa-seeds, Nibs, &c.

Under this head the Jury have considered chocolates prepared for use, when plain, or if only sugared, for ordinary use; and have excluded such as are made into pâtes, as more properly belonging to the Confectionery Department.

Many good samples of coffee are exhibited from various parts of the world, and amongst them some of excellent description from British colonies, which have never before been known to produce this article. On the other hand, there is a deficiency of specimens from the most important producing countries, as Jamaica, Dominica, Berbice, St. Domingo, Costa Rica, the Brazils, Manilla, and Java.

Of cocoa the same may be said; the best producing countries export the choice of their produce for the markets of Mexico, Spain, France, and Italy; the high differential duty obliging our manufacturers to be contented with the inferior products of Trinidad, Granada, St. Lucia, &c. In chocolates (manufactured cocoa), France alone is well represented; England cannot here compete, for the reason just stated (under cocoa), and various adulterations are hence prevalent, the chief of which are potato-flour and sago.

1. Great Britain.—R. Snowden's patent purified coffee-nibs (28, p. 202) are the produce of an improvement in the method of preparing coffee for the table. The berry is split, and the husk (that formerly adhered to the whole berry), which is usually removed from all but the slit, is here extracted from that also: after which operation the berry is better adapted for roasting. The coffee thus prepared is of the finest quality. The illustration of the process is complete, and ample specimens are exhibited. A Prize Medal has been awarded to Mr. Snowden for his new method of separating the tough membrane from the folds of the seed.

J. S. Fry and Sons' case of raw and prepared cocoa and chocolate (31, p. 202) has been awarded a Prize Medal. This series is extensive, and of fine specimens; illustrating fully, by drawings and samples, the preparation of cocoa and chocolate of various kinds; also the plant in its natural state, with its history and manufacture, mode of packing and transport. The cocoa seeds and nibs are exhibited from St. Lucia, Caraccas, Trinidad, New Grenada, Guayaquil, Bahia, Peru, &c.

The chocolate of L. A. Monteiro (34, p. 203) has been awarded a Prize Medal for its excellent quality. It is, perhaps, a little over-roasted, if it has a fault.

Honourable Mention has been made of W. A. Benham (38, p. 203) for good chocolate. G. B. White (32, p. 203) for the same.

Other chocolates of fair quality are exhibited by the Paris Chocolate Company (30, p. 202), but the specimens are too sweet. Benjamin Gruts' cocoa (36, p. 203) is fine, but appears rather to be Magdalena than Caraccas, as it professes to be. J. T. Budds' extract of cocoa (37, p. 203) is apparently damaged by exposure. W. R. Lane's essence of coffee (35, p. 203) is worthy of notice, and has been pronounced equal, if not superior to any similar preparation, though still not so good as coffee prepared by the usual process.

2. East Indies.—The recently extended cultivation of coffee throughout our eastern possessions renders this

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* These exhibitors' names appear in list of Class IV., by which Jury they were also awarded a Prize Medal.

department of the Exhibition peculiarly interesting. The samples are, unfortunately, generally insufficient, dirty, and inaccurately labelled.

Java exhibits good coffee, but none of marked superiority. Honourable Mention is made of one sample, marked as from the Menado district, which has a good, bold, well-formed berry; and also to some samples from Sourabaya; both are contributed by the "Singapore Committee" of the Honourable East India Company. The Java coffee is only prized in the market for its delicacy of flavour, as in point of strength it falls short of the West Indian.

The samples of Aden coffee contributed by the Honourable East India Company (p. 873) are not superior, and more resemble the Berbera (Abyssinian) plant, usually called long-berried mocha, than the genuine mocha. The specimens are dirty, and not sufficiently garbelled (picked). Aden, alias Mocha coffee, is, along with the other coffees of the Red Sea, sent first to Bombay by Arab ships, where it is "garbelled" previously to its being exported to England. The bean is always broad and small, and the climate of India is supposed to improve its flavour.

The best East India coffees in the Exhibition are those from the Peninsula, the Wynaand especially, supposed to have been introduced from Dominica, and originally cultivated on the West Indian principle. Being always got up with great care, it fetches a good price in the market. Of this description of coffee Honourable Mention is made of the two samples from Mysore, both exhibited by Captain Morris. The berry is particularly bold and even in both.

Chittagong, and other excellent Bengal coffees, are not exhibited, which is much to be regretted, as the introduction of coffee into the eastern districts was effected many years ago, and is due to the enterprise of Sir W. Jones, since whose time the cultivation has been pursued with great success by private individuals.

Borneo coffee is exhibited from Mr. M'Henty's estate, Sarawak (p. 988), and is awarded a Prize Medal for its great superiority in colour and weight. It is the first sample from that country ever seen by the Jury.

Ceylon.—The great extent and importance of the cultivation of coffee (p. 937) in this island renders this department of the Jury's labours particularly interesting. The samples of both lowland and upland crops are, in general, excellent, and much useful instruction is conveyed by models of the drying-houses, sheds, and implements used in the manufacture of the berry (p. 938); together with the latter, itself, in the different stages of the process of cleaning and drying, removing the pulp and husk, of which a portion, it will be seen, always adheres to the slit, and is ground in the mill, except when removed by Snowden's patent process, already alluded to.

Honourable Mention is made of two samples; one from the Kirklees estate, at 4,500 feet above the sea, which is a good, bold, even, clean, heavy and well-formed berry; the other from the Hunasgiru estate, 3,000 feet above the sea, which exhibits good pearl-berry, or peaberry coffee, a small variety, for which hand-picking is resorted to. Superior samples to any of these are, however, always to be seen in Mincing Lane, and a Prize Medal, therefore, has not been awarded. The native wild or indigenous coffee of Ceylon is also exhibited, which, like the wild plant of Bengal, is of no value.

Norfolk Island sends an excellent sample of coffee, apparently of the Berbera variety; it is of good colour, well adapted for roasting, and is a most desirable novelty.

St. Helena.—There is an excellent sample of coffee from this island, from the private garden of Mr. S. Magnus (3, p. 955), of which Honourable Mention is made.

Mauritius.—A small sample of inferior cocoa.

Demerara, once the great coffee country, now cultivates very little indeed. Many samples, of various growths, are sent from the few remaining estates. None are of much merit; the best (that from the estate "Klein Pouderoyen" is good. Pearl-berry coffee is also exhibited, and poor samples of cocoa.

Barbadoes sends cocoa of no merit.

Trinidad exhibits very poor coffee, apparently degenerated from plants originally of mocha; and from its want of aroma, is probably badly cured or damaged. The cocoa from the same island is truly magnificent, and such as is never seen in our market. Mr. Purdie, of Her Majesty's Botanic Garden, Trinidad, to whom the public are mainly indebted for the whole Trinidad collection, sends cocoa as prepared for both the English and Spanish (p. 974). With regard to the Spanish, such has never been seen in England; every bean is very large, round, ripe, clean, and of a fine bright-red colour. The English is good of its kind, but is, literally, the refuse of the Spanish; the beans being lean, flat, half-ripe, flinty, and often bitter. A Prize Medal is awarded to the Spanish samples.

West Africa contributes indifferent coffee.

Portugal sends a very valuable series of coffees from various of her colonies; of ordinary description from St. Thomas; tolerably good from the Cape de Verd Islands; bad from Timor; worse (but curious from the very small size of the berry) from Mozambique; good from Angola; and excellent from Madeira.

France.—There is a very extensive collection of chocolates from this country, and some coffees also. Upwards of fifteen exhibitors contribute largely, and the task of selecting for award has been difficult. Prize Medals have been awarded to four, viz.:—F. A. Turpin (1046, p. 1228), who exhibits chocolate in every variety of form and flavour, in the highest perfection; E. Perron (343, p. 1193), for chocolate; De Sandoval and Co. (365, p. 1194) chocolate; Watrelot-Delespaul (738, p. 1215), chocolate.

Honourable Mention is made of the following:—C. Choquart (1149, p. 1233), for chocolate; Menier and Co. (925, p. 1224), for chocolate.

Honourable Mention is also made of the Cho'ca, a preparation of coffee and chocolate blended, sufficiently agreeable to the palate, and apparently wholesome and pleasant. The exhibitor is A. E. Lemolt (303, p. 1191).

Switzerland, Spain, Prussia, and the Netherlands, all exhibit fair chocolates. Turkey sends three samples of the Mocha variety of coffee, not remarkable, and of the usual or Egyptian class of berry.

C. IV.—Chicory and other Substitutes for Coffee.

Judging from the number of exhibitors and samples, the cultivation of chicory is far from being extensive or remunerative. Few of the specimens sent are of much value, and none can, under any circumstances, represent coffee in flavour. As an adulteration, the chicory may be profitable, and, supposing this to be its principal use, the exhibition of much was not to be expected.

Great Britain exhibits one sample only, and that very good indeed, meriting Honourable Mention. It is from Saunders and Gatchell, of Dublin (144, p. 193*).

Honourable Mention is also made of "*Moka en demi-graines*," of J. Lervilles, Lille (591, p. 1206), an admirably-prepared imitation of coffee, much superior to anything in the Exhibition; and of Catherine Sorokin, Russia, for beautifully cut and peeled dried chicory (69, p. 1368).

Besides the above, there are samples from Brunswick, Prussia, the Netherlands, and Hesse, none of much importance except the preparations from Prussia.

There is a curious seed exhibited from Turkey called "Kenguel;" it is said to be extensively cultivated in the Kair-ar-eh and Konah; and roasted, ground, and used like coffee. The plant is the "Gunelia."

D. I.—Fermented Liquors.

The Rules of the Royal Commissioners were opposed to the exhibition of any objects of this class, except such as were remarkable for novelty of invention or production, hence the number exhibited is very limited.

A Sardinian orange wine, "Vino di Arancio" (9, p. 1302), is quite a novelty, and apparently a valuable one. This wine is prepared by P. Garassini, of Genoa, solely from oranges that would otherwise be wasted; it is a remarkably agreeable beverage, strongly resembling fine

Lunel in flavour, aroma, and quality. A Prize Medal has been awarded to the manufacturer.

In the Zollverein Department is some well-fermented good beer (15, p. 1048), manufactured for long voyages, by **C. Christiani**. This was tasted, and found sound and good but too weak; and being flavoured with absinthium, was unsuited either for the English or Indian markets. Honourable Mention is made of it from its proving, on inquiry, to be highly relished by the beer-drinkers of Germany.

The Austrian "*bier stein*" is a hard, dry, and tough mass, fabricated from an extract of malt and hops only, not unpleasant to the taste, and fairly portable. There are two varieties, a pale and a dark, the latter flavoured probably with liquorice. Beer was prepared from each of these for the Jury, by the Exhibitor, after considerable delay, and though pronounced sound, sparkling, and free from any unpleasant flavour, was thin and not agreeable to the English palate. The preparation had certainly absorbed moisture in the Exhibition Building, which must seriously affect its qualities as a portable article; and the time (about a fortnight), space, and appliances required for preparing beer from it, render it, practically, of little value.

D. II.—TOBACCO.

The exhibition of raw and manufactured tobacco is (upon the whole) one of the most satisfactory of the class on which the Jury were called upon to decide. The import trade is very fully represented by numerous samples of excellent articles. The British, German, Algerine, and United States manufactured tobaccos for smoking and chewing are no less complete; and the products of the famous snuff-mills of Scotland, Ireland, Portugal, and Austria are all shown.

1. British Exhibitors.—The beautiful cases of **W. Benson** (39, p. 203) have been awarded a Prize Medal; they contain an epitome of the London tobacco trade; and amongst them a box of Havannah cigars, ticketed "Flor de Cabanas, Partagas, and Martinez manufacture," stands pre-eminent for evenness and perfection of manufacture. The variously-sized, coloured, and formed cigars in one box are stated to be all the produce of the same crop of tobacco: differences of colour and strength, and, in some degree, of aroma, also, depending upon the age of the leaf employed, and its position on the plant,—the oldest or lowest being used for the well-known (and extensively counterfeited) flat oily cigars called "Bravas."

Among other raw or leaf tobaccos, the American varieties are particularly well illustrated, but too insufficiently labelled to convey much information to the public, who would be glad to learn, from such a collection, that the commoner "shag tobacco" is prepared chiefly from the "Mason" county leaf; the mild kanaster and similar qualities from the thin, delicately flavoured, mild, Ohio leaf; the common strong ships' tobacco, extensively used in the royal navy, from the Virginia leaf, &c.

Hungarian tobacco, almost unknown in Great Britain, is also exhibited both in this and in the Russian Department. It is very fine, and of peculiarly delicate flavour, much more so than the tobacco usually cultivated in Turkey.

A Prize Medal has been awarded to **Ben. Jones** and Co. (43, p. 203) for their collection of Havannah cigars, illustrating the English market. These are selected from the Exhibitors' stores, and are somewhat unequal in quality, not being picked for exhibiting, nor are they dressed samples.

Cohen and **Orr** (49, p. 204) have been awarded a Prize Medal for their Havannahs, "Ugues" brand; a very good cigar, imported by this firm only.

English-made cigars are copiously exhibited.

E. Jonas and **Brothers** (42, p. 203) have been awarded a Prize Medal for their very fine collection of different varieties of cigars manufactured from the Havannah leaf. These are sold at a very cheap rate, are beautifully rolled, draw well, and are of fair flavour, the latter being a quality unattainable in perfection in England.

Lambert and **Butler** have also received a Prize Medal for their excellent tobacco, cigars, snuffs, and Cavendish (40, p. 203). The cigars smoke well, with a good white ash, and are of very fair flavour. The cut tobacco and snuffs are of excellent quality. Negro-head and Cavendish are also exhibited, and are successful imitations of the American produce, though inferior in flavour. They are prepared by a peculiar process from the best Virginian leaf. A specimen of English-grown tobacco from the same exhibitor is worthy of notice, as a curiosity: it was raised on a poor light soil in Cambridgeshire, and is an excellent specimen, but deficient in flavour.

Richardson Brothers, of Edinburgh (52, p. 204), have been awarded a Prize Medal for their very fine samples of pig-tail and twist tobacco. The leaf is universally used, in this form, in Scotland, both for chewing and smoking; and the exhibiting house supplies the market to a great extent both with this and Scotch snuffs, of which different qualities are exhibited. The specimens of Virginian leaf (intended to illustrate the article in a raw state) are very fine, and in the present state of the market, which is low (owing to bad crops and speculation), would fetch double the average trade price.

A Prize Medal is awarded to the snuff of Messrs. **Lundy Foot** and Co., of Dublin (44, p. 203), an article too well known to require more special notice, and of which the Exhibition samples are admirable.

Honourable Mention is made of the followin ibi-
tors:—**Sales, Pollard**, and Co. (47, p. 203), ti-
fully prepared leaves of Cuban (Yara) tob
quality. **Bremner** and **Till**, for their sa
tobacco as imported (41, p. 203), includin
rare specimens, seldom or never seen i
Amongst these are the Palatinate tobacco
Hungarian), Manilla, Pernambuco, and Y
the Havannah leaf, in the flat bundles called
in which it is originally put up for export.

M. Hyams' (p. 203) samples of Britis
and cheroots, from the New Granada leaf,
from their extraordinary cheapness, as do
of Columbian tobacco. The Jury also n
land and **Toplis** (48, p. 203), for their nea
cheroots of tobacco and other narcotic herbs
required as medicine or for luxury. A piece
the mouth extremity retains the oil effectually (a
vention). These cheroots draw well, but are very

The **Cape of Good Hope** exhibits cigars and ka
tobacco (36, p. 950), grown in the colony. The de
of the cigars seem to be in the manufacture and cho
of leaf, for they are spongy, tough, and leathery, mos
clumsily made, and smoke with a black ash. The flavour is, however, so far good, as to induce the Jury to encourage improvements in the colony, by the award of Honourable Mention to **N. Moss**, the exhibitor.

Canada contributes very fair leaf-tobacco for cigar-making, from **J. Levey** (73, p. 963), of which Honourable mention is made: it equals second-class Virginia-leaf, and will probably be much improved by care in the culture.

East Indies.—The **Honourable East India Company** contribute Sourabaya (Java) cheroots, of two qualities: the first, a dark-coloured sample, are very well flavoured, with a fair ash; they burn pretty steadily, and rather strong, and are better than any English-made cigars, but inferior to the Manilla. The lighter-coloured samples are weak and poor.

The Trichinopoly cheroots exhibited (p. 873) are singularly coarse and bad; these, never good in their own country, have possibly been injured on the voyage. Some "Calcutta Manillas," as imitation Manillas are generally called, are well rolled, of fine (almond) flavoured tobacco, burn with a white ash, and are equal to second-class Havannahs (p. 873). Honourable Mention is made of them, and of the Chinsurah Havannahs, manufactured probably from "Sand-head" tobacco, cultivated on the Arracan coast.

The Jury regret not having found in the East Indian Department, samples of Awallan and various other raw tobaccos, raised in different parts of our Eastern possessions; or of the Lunka cheroots, made from tobacco grown on the banks of the Godavery and Mahanuddy rivers, where its cultivation and manufacture are rapidly increasing, and the cheroots are superior to any others from that part of the world.

TRINIDAD sends cigars, very clumsily made, and deficient in aroma, but which have been awarded a Prize Medal, for their excellent mild almond flavour, and for the novelty of the manufacture, which is worthy of encouragement (p. 974).

A great deal of tobacco is exhibited from the Northern States of Europe, BELGIUM, the NETHERLANDS, &c.; of the manufactured produce, Honourable Mention is made of the cigars (69, p. 1145) of A. VAN DER LINDEN, of HOLLAND, which are composed, some of Dutch and some of Java tobacco. Also of the cigars of J. P. MULLER (11, p. 1126), of the Grand Duchy of Hesse. PRUSSIA exhibits various samples, generally of common and coarse cigars. Honourable Mention is made of those of A. F. CARSTANJEN SONS (468, p. 1077), which are better flavoured and more fragrant than any English-made article. AUSTRIA sends many fine snuffs.

The most important exhibition of German tobacco is that from Mannheim, sent by WM. SACHS, which, unfortunately, owing to the lateness of the crop, arrived too late to be placed on the Award List. It is but fair to the producer to state that it has been pronounced superior in flavour, and in point of curing, to any European tobacco known in the English market. The Agricultural Society of Baden has encouraged the culture of this crop, which has rapidly increased to 200,000 cwt., annually grown on the banks of the Rhine. The cultivation is carried on by small proprietors, and employs 20,000 hands; and the produce is sold at a very cheap rate. It is exported in leaf, in vast quantities, to England, Belgium, Spain, and, in bad seasons, to the Havannah itself; and the cigars are consumed in the United States to a great amount. Great attention is paid to the selection of fine covering leaves, upon the goodness of which the burning and drawing so materially depend; and in this the manufacturers, judging from the samples exhibited, seem to have been eminently successful. Though still inferior to the best American tobacco, it surpasses much that is brought into the market.

The SPANISH Department excels all others in the beauty and variety of its cigars. The Havannahs are here alluded to, for the Manilla cheroots are scarcely represented in the Exhibition, which is very much to be regretted.

The best Havannah tobacco farms are confined to a very narrow area on the south-west part of the great island of Cuba. This district, 27 leagues long and only 7 broad, is bounded on the north by mountains, on the south and west by the ocean, whilst eastward, though there is no natural limit, the tobacco sensibly degenerates in quality. A light sandy soil, and rather low situation, suit the best. Of the small collection of cigars shown, two exhibitors have been awarded Prize Medals. The one, Don BUENAVENTURA GONZALEZ ALVERA, for his "Ramas" cigars (126, p. 1336); these are considered the best it is possible to produce, and fetch 30*l.* per 1,000 in the Havannah. They proved extremely fine in flavour, and perfect in burning qualities, but they were so tightly rolled as to draw with difficulty, which is rather considered an advantage by the Spaniards in this cigar. The other Prize Medal was given to a much milder cigar, drawing freely, and considered equally deliciously flavoured, by the Jury; the exhibitor is known as DE CABANAS and CABAZAL (126n, p. 1336).

There are also in the Spanish Department a few Manilla cheroots, some beautiful samples of the Manilla leaf, from the three principal districts of the island, Visagas, Ygarotes, and Cagayan, and some admirable cigarillas.

PORTUGAL exhibits cigars, cigarettes, cut tobaccos, and snuffs; of which the latter are very good, and well cured. There are two qualities of cigars, the one is too mild, but excellent in flavour, and burns well; the other is a compressed darker cigar, resembling the Havannah "Bravas," delicately flavoured and sufficiently strong. A Prize Medal is given for these cigars (1203 & 1207, p. 1318), fabricated at the Royal Tobacco and Snuff Company. There is also a great number of snuffs from the same Company, and from other manufacturers; of the former, Honourable Mention is made of Nos. 1172 & 1183 (p. 1318). The others are, for the most part, too much flavoured with orris-root. The cigarettes are very inferior to the Spanish.

ALGIERS contributes an extensive assortment of tobaccos of many kinds: it is becoming the great tobacco mart of France. Both the Havannah leaf, the Syrian, and the Manilla, appear to be cultivated and cured by Arabs as well as colonists: the specimens sent are from exceedingly well-grown, beautiful crops: the curing is perfectly well conducted, and the rolling, &c., of the cigars is sometimes faultless; all are, however, utterly deficient in flavour and strength, being small, poor in quality, and very pale-coloured. The Krachenu's cigars are the best, and of the tobacco, a sample from Oran, resembling the Shiraz. Some Philippine Island leaf, exhibited by M. MOHIN, of El Biar, is very fine, but in appearance only. There are some cigars made from the imported Havannah leaf, sold at an extraordinarily cheap rate, and cigarillas still cheaper.

A Prize Medal has been awarded to the magnificent TURKISH collection of bazaar tobaccos: it is extensive, and the samples are all particularly fine and abundant. Latakia of the best quality is exhibited here, dark in colour, and if a good tarry flavour. The Moldavian tobacco is also particularly fine. The Jury much regret their inability to give any detailed account of this admirable collection, information being wanted on the subject of the growth of the finer qualities of Oriental tobaccos particularly.

PERSIA is justly renowned for the quality of its tobaccos, both mild and strong: of these, the most celebrated amongst the milder perfumed sorts, is called "Aburika," or "Father of Perfumes:" two samples are exhibited; one, the ordinary dark-coloured, in leaf; the other, loosely twisted into a roll, is paler, more prized in the country, and given as presents amongst the nobles. It is much too mild for appreciation in England, however delicate the flavour. The Damascus tobacco is of the same quality as the celebrated Shiraz, pale-coloured, but rather thick and firm in the leaf, and very strong.

EGYPT sends two bales of "Gerbali tobacco," cultivated, we believe, in the Delta of the Nile, and made into cigars ordinarily used in Egypt; but even there considered very inferior.

RUSSIA.—The exhibition is small, but the samples all of good quality, especially the cigarillas of A. SPIGLAZOFF (76, p. 1369), which are as large as ordinary cheroots, and supplied with a short broad reed-tube at the mouth end, a pleasant contrivance. The tobacco used is Russian-grown, very mild, and rather sweet-flavoured, though not equal in aroma to the Havannah cigarillas. A Prize Medal is awarded them. Honourable Mention is made of the Turkish tobacco (75, p. 1369), grown in the Circassian Provinces by MUSTAPHA IDAROF, which is equal to the best grown in Turkey.

UNITED STATES OF AMERICA.—The exhibition is chiefly of Cavendish tobaccos, and is both extensive and admirable; the contributions of many makers attesting the importance of the manufacture, and the prevalence of chewing, for which these are principally used in the United States, whilst in England they are most prized as the strongest and best flavoured for smoking. The finest Virginia leaf is used in the manufacture, which consists chiefly in curing and pressing the leaf into flat square cakes of various sizes, a little molasses or sugar being sometimes added. Prize Medals have been awarded to—

DILL and MULCHAHEY (273, p. 1452) for their Cavendish; JAMES H. GRANT (284, p. 1453), Black Cavendish; POITIAUX ROBINSON (265, p. 1452), Cavendish.

Honourable Mention has been made of MOOKLAR and CHILES (8, p. 1433); OYLER and ANDERSON (305, p. 1453); THOMAS and Co. (268, p. 1452), for Cavendish:—JAMES THOMAS (528, p. 1467), for Negro-head. Also of the Maryland leaf tobacco and cigars, exhibited by the MARYLAND COMMITTEE (included in Prize Medal awarded by Jury of Class IV.)

E.—SPICES AND CONDIMENTS, VINEGAR AND PICKLES.

CINNAMON, CASSIA, &c.—This product is at present confined to the Continent and Archipelago of India, whence various samples are sent; none, however, equalling that from Ceylon, for which a Prize Medal is awarded to the Exhibitors, Messrs. Albrecht, Greenhill, and Co. (p. 937). The East India Company also exhibits Ceylon cinnamon, and various allied products from Assam, and the peninsula of India, such as many varieties of cassia bark and leaves. Some of the cinnamons, or rather cassias, from the north-east frontier of Bengal are of a particularly fine quality, and are sold abundantly in the Calcutta market as Ceylon produce. Great boxes from the Khassya hills, especially, have been sent home to Europe, covered with a thin layer of the Ceylon article. Malacca and Java both exhibit inferior cinnamon. In the Chinese Department is a sample of the famous cassia of that country, exhibited by Mr. Reeves, whose perfume and flavour are incomparably superior to those of any spice of its class. Its native place is unknown, though supposed to be the interior provinces of China. The market price is said to be 5*l.* per lb.

Nutmegs, &c.—There are two general collections of spices, which have been awarded Prize Medals. Messrs. Travers' (53, p. 204), which illustrates the London spice trade, and that of Oriental spices, from the East India Company. Travers' collection is particularly fine, the specimens admirable, and in beautiful order. The Indian Collection, again, is far more extensive, but, as a whole, inferior in quality: it includes 12 bottles of nutmegs from various quarters, 5 of maces, 4 of gingers; cloves from Malacca, Tinnivelly, and Madras; 6 bottles of capsicums, besides turmeric, &c. The Malaccas, Borneo, Ceylon, and New Granada, all exhibit nutmegs: those from the latter country are particularly splendid, and as the product is almost unknown, and the culture deserving of great encouragement in the West Indies, a Prize Medal is awarded to H. Grose (1, p. 976), the Exhibitor.

Trinidad exhibits a fine collection of both East and West Indian spices, many of them cultivated in the Royal Botanic Garden of that island, by Mr. Purdie, to whom a Prize Medal is awarded for excellent nutmegs, fine cloves, mace, ginger, black, white, and Cayenne pepper, turmeric and vanilla.

Messrs. Hammond's collection (2, p. 988) of Eastern Archipelago spices deserves Honourable Mention: the cloves are of the very finest description, and the nutmegs, mace, ginger, and peppers are all good.

Pepper, Ginger, &c.—These articles are more or less abundantly exhibited in the collection of spices mentioned above, whilst other exhibitors have confined themselves exclusively to these products. Norfolk Island exhibits a box of Cayenne pepper (27, p. 993), shown by Sir W. T. Denison,[*] of very superior quality, which has been awarded a Prize Medal. Fortnum and Mason's ginger in the case of dried fruits, for which a Prize Medal is given, is unrivalled. Payne and Son's spices (22), especially pickles and curry-powders, are very good, and Honourable Mention is made of them. Ginger, cardamoms, and turmeric are chiefly exhibited from Ceylon. Black, white, and capsicum pepper, of innumerable varieties, from Borneo, Penang, and West Africa; and, in the New World, from the United States, Demerara, Trinidad, and Barbadoes. The now little-known Guinea pepper is exhibited, from Demerara and West Africa, its native country. Vanilla is found in Fortnum and Mason's case, in the Trinidad Collection, and amongst Fry's series of articles used in the manufacture of cocoa, chocolate, &c.

Portugal sends capers of a fine description. Egypt and Turkey exhibit large collections of aromatic seeds, used as condiments; such as anise, cumin, fennel, cardamoms, &c.

Mustards are exhibited abundantly from France, the celebrated "Moutarde de Maille" being, perhaps, the finest in the Exhibition. T. Dewar's preparations of mustard (119, p. 207) have received Honourable Mention. In the United States this plant seems to be very extensively cultivated, and the specimens are good from Burrows, M'Allister, and Tannichille, of Kentucky; and J. D. McCullagh, of Kentucky, sends samples of wonderful pungency. The Spanish mustards of Santarella, and the Russian are also excellent. Mustard-seed is exhibited from the Cape of Good Hope, Egypt, India, Portugal, and Spain, where, as also in India, it is cultivated more for the oil contained in the seeds than for any other purpose.

Vinegars are scantily exhibited: some of the malt vinegars of Hills and Underwood (7, p. 201) are particularly delicate, and a Prize Medal is awarded for the collection. The wood-vinegar of Gillespie and Co., of Canada (133, p. 966), is worthy of Honourable Mention, as is the raspberry-vinegar and capillaire of J. Fletcher (127, p. 966), of Canada. A Prize Medal has been awarded to the admirable French aromatized wine-vinegar of Maille and Segond (1339, p. 1240); and Honourable Mention has been made of that of two other exhibitors in the French Department, Courtin Raoult (1570, p. 1252), and Rigault, jun. (1686, p. 1257). For pickles, a Prize Medal is awarded to the splendid collection of Batty and Feast (116, p. 207). The Van Diemen's Land pickles and sauces are worthy of notice.

F.—Starches.

The various flours having been reported under A. 6, starches for manufacturing purposes being excluded from this class altogether, and there being no lichen food exhibited, there remains nothing to be considered under this head but a few miscellaneous feculæ, farinæ used in tropical countries, or produced there for export; as sago, arrowroot, tapioca, &c.

Arrowroot is largely exhibited, especially from our tropical colonies. That from the Bermudas, imported by B. C. T. Gray and Son, is admirable, and worthy of Honourable Mention; as is a Montserrat sample. This substance is also shown among the products of Guernsey, Demerara, Trinidad, Singapore, Java, Borneo, Ceylon, and Norfolk Island; that from the last-mentioned place being of a superior description. From Canada a sample was exhibited by R. Buck, which received Honourable Mention.

Plantain Meal, prepared from bananas, sliced, dried, ground, and washed, has lately attracted some notice in England: samples are exhibited both from Demerara and Madras. Honourable Mention is made of the Demerara samples exhibited by W. Davison (12, p. 978). Tous les Mois flour, of excellent quality, from the root of Canna, is sent by M. Chapel from Algeria (16, p. 1260), of which Honourable Mention is made. Specimens of the same articles are also sent from Barbadoes.

Cassava Meal and Bread, prepared from the roots of two species of euphorbiaceous plants are exhibited from Demerara; the bitter cassava, from *Janipha manihot*, and the sweet from *Jatropha Loefflingii*. Manicca flour (also from *Jatropha manihot*), a very similar substance, is exhibited from Trinidad, Ceylon, and Angola, which last also sends tapioca, sago, coarse and fine, with a specimen of the palm-tree: pearl sago, and sago flour, are sent from the Eastern Archipelago and Borneo, also from Ceylon. Sago cake is exhibited from the Moluccas. Honourable Mention is made of the pearl sago exhibited by the Singapore Committee of the Honourable East India Company, imported from Borneo and Sumatra.

There are two remarkable and closely-allied substances, brought together from countries almost at the antipodes of one another, and both new to the Jurors: the one is a starch washed from a species of Zamia, found wild in St. Domingo, and exhibited by Sir R. Schomburgk (p. 1429): the taste is odd and salt, as if it had been immersed in lime; in its present condition it can be regarded as a curiosity only. The other is a starch from a West Australian Zamia; this would appear, in quality, to rival arrowroot, which, in every respect of feel and taste, it resembles.

Various other small samples of *feculæ* are scattered through the Exhibition, but do not appear important.

G.—Sugar.

A very limited number of samples of this article are exhibited, and the deficiency is most marked in the contributions from the principal sugar-growing countries. For instance, Jamaica, Tobago, St. Vincent, and every other West Indian colony, except Trinidad, Demerara, and Barbadoes, have failed to send specimens. There are none from the foreign possessions in the Old World, Porto Rico, the Brazils, or Havannah, none from Manilla and China, whilst Java and Madras send little more than one sample each.

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[*] This exhibitor has been awarded a Prize Medal by the Jury of Class iv., in whose list his name appears.

In refined sugar the British manufactories are wholly unrepresented.

A specimen of sugar, from cane grown in England, deserves notice as a curiosity. The sample was made without filtration, by Dr. Evans, from cane grown by H. Perkins, Esq., in Surrey.

East Indian Possessions.—A sample of Ganjam (Madras Pres.) (pp. 875, 876) sugar in the Honourable East India Company's contribution has been awarded a Prize Medal: it is exhibited by Mr. O. P. Onslow, Aska Sugar Factory. The colour and grain leave nothing to be desired. There are two specimens of Rohilcund sugar from Carew and Co.'s manufactory at Shah-jehanpore; of which one, said to be manufactured by a European process, is excellent, and worthy of Honourable Mention; that prepared by the native process is very inferior. Various kinds of a good description are exhibited by the Astagram Sugar Company, to whom a Prize Medal has been awarded. Sundry raw sugars are exhibited from the Deccan, apparently manufactured on the Mauritius principle; they are good, and well crystallized, but are not remarkable. One sample has received Honourable Mention; it is a white refined sugar, in the form of bricks, not clean, but apparently a good useful article. It is possibly a date-palm sugar.

Java exhibits two fair samples from Sourabaya, to which a Prize Medal has been awarded: both are clayed sugars: one is said to be manufactured on a new (undescribed) plan, the other by the low-pressure vacuum-pan process; both are superior to the ordinary Dutch sugars. A Prize Medal is given to the Mauritius sugar (3, p. 956), from the Phœnix estate of Webb Brothers and Co.: it is a splendid sample, dry, well crystallized, produced by the vacuum-pan by a single process; but perfectly granulated and free from colouring matter. A Prize Medal is also adjudged to the very fine Siam sugar of W. P. Hammond and Co.

Demerara.—A Prize Medal is awarded to the fine, well-crystallized sample produced by the vacuum-pan, and exhibited by G. Anderson and Co. (36, p. 979). Trinidad sends good samples: one is curious, from its being purified with animal charcoal. Barbadoes exhibits fair specimens.

France.—The collection of beet-root sugars, especially the refined, is very good from this country, and presents much both of novelty and interest. Two of them demand particular notice; they are the produce of MM. Numa Grar and Co. and MM. Serret Hamoir and Co., for both of which Council Medals have been awarded.

MM. Serret Hamoir and Co. are awarded the Council Medal for beet-root sugar (1485, p. 1247); the processes employed in their manufactory having enabled them to sell the sugar at a lower price than any other article of the same quality, and not being open to practical objection. The principle of MM. Serret Hamoir and Co.'s success is the use made of the refuse molasses, from which potass and alcohol are procured in sufficient abundance, and of such a quality as to be very remunerative.

M. Numa Grar receives the Council Medal for sugar (667, p. 1211) obtained from beet-root by the barytic process. It is stated to be applicable to the refuse molasses of any manufactory, precipitated with barytes, and afterwards wholly freed from this poisonous ingredient. The molasses thus treated yields a large percentage of sugar.

Three Prize Medals have been awarded to Exhibitors of refined beet-root sugar, viz.:—

T. Crespel-Delisse, of Arras (465, p. 200), for excellent beet-root sugar, prepared by the ordinary method.

Jeanti Prevost and Co. (1277, p. 1328), for sugar prepared in moulds by stamping.

Rousseau Brothers (1457, p. 1245), for several samples prepared "sans raffinage."

Spain exhibits a few good sugars of native and colonial growth, for which three Prize Medals are awarded: to J. N. Enriquez (176, pp. 339, 340), for refined sugar made from Malaga-grown cane; to J. J. De Arrieta, (295, p. 1347), for various samples of Havannah-grown sugar, refined on the estate itself; and to J. De Zulueta (179a, p. 1340), also for excellent Havannah sugar.

Austria contributes good beet-root sugars A Prize Medal is awarded to Anton Richter and Co. (57, p. 1009), for five tips (or noses) of double-refined beet-root sugar in small loaves, beautiful in quality and colour; also for good sugar-candy. Honourable Mention is made of the Moravian beet-root sugar of the Brothers Chevaliers de Neuwall (56, p. 1009), and Robert and Co. (55, p. 1009). Also of the Prince Ferdinand von Lobkowitz, Bohemia (58, p. 1009), and of the sugar manufactory at Tlumacz, in Gallicia (60, p. 1010).

Belgium exhibits in every respect the finest sugar-candy (81, p. 1151) which has ever been seen by the Jurors. A Prize Medal is awarded for it to Messrs. Claus and Carron, of Gand (81, p. 1154), who exhibit also a fine series of coloured and other sugars. These are probably all cane produce, judging by their appearance, weight, and hardness.

Russia and Prussia exhibit a few sugars, but none of any great merit, except the beet-root sugar of Hirshmann, Hirshendorf, and Ravitch (79, p. 1369), and that of Brumme and Co. (687, p. 1088), of both of which Honourable Mention is made.

United States.—A good sample of cane Muscovado (397, p. 1462) is exhibited by M. White, of New Orleans, for which Honourable Mention was awarded.

Maple Sugar.—This substance, which is abundantly used in America for common purposes, has hardly had a fair trial in England, owing to the cheapness of the colonial cane sugars, and the difficulty of depriving the maple produce of its peculiar flavour. If it promised success, the cultivation of the sugar-maple tree might be almost indefinitely extended in Canada over a large area, well suited to this tree, but unfit for pasture and agriculture. There are few samples exhibited, but to three of them Prize Medals are awarded; two—in the United States,—to W. Barnes (246, p. 1452) and L. Dean (245, p. 1452); the other to A. Fisher, of Canada (69, p. 963), for the sample of double-refined sugar, which is of superior colour and grain. Honourable Mention is also made of that from J. Bales, of Canada (67, p. 963).

Palm Sugars.—These are exhibited chiefly as curiosities, and consist of Gomuti-palm sugar (*Arenga saccharifera*) from Java; date-palm sugar from the Deccan; Nipa sugar (from stems of *Nipa fruticans*), probably from the Sunderbunds, exhibited by the Honourable East India Company; (pp. 875, 876), and sugar from the fleshy flower of *Bassia latifolia*, an East Indian tree, from whose fleshy flowers, after fermentation, an ardent spirit is distilled.

Grape Sugar is exhibited of fair quality from Tunis and from the Zollverein States; also, as molasses, from Spain.

Liquorice.—Nothing of any importance is contributed of this description. The Spanish is almost the only sample: it is very good.

ANIMAL KINGDOM.

H. I.—Preserved Alimentary Substances.

It is impossible to over-estimate the importance of these preparations. The invention of the process by which animal and vegetable food are preserved in a fresh and sweet state for an indefinite period has only been applied practically during the last twenty-five years, and is intimately connected with the annals of Arctic discovery. The active measures taken to discover a north-west passage, and to prosecute scientific research in all but inaccessible regions, first created a demand for this form of food; and the Admiralty stimulated the manufacturers to great perfection in the art. As soon as the value of these preparations became generally admitted in cold climates, their use was extended to hot ones, and for the sick on board ship under all circumstances. Hitherto they had only been employed as a substitute for salt beef or pork at sea, and, if eaten ashore, it was, at first, as a curiosity merely. Their use in hot climates, however, speedily became evident, especially in India, where European families are scattered, and where, consequently, on the slaughter of a large animal, more is wasted than can be consumed by a family of the ordinary number. The consumption of preserved meats became, at once, enormous: hundreds of tons are annually transported to the East Indies and all our colonial possessions, and many are consumed by our fleets.

The cheapness of these preparations is most remarkable. This arises from the processes and materials for the cases being inexpensive, and from there being no waste of the meat: all that is good goes into the case, which is always filled. It is affirmed by the manufacturers and others, and probably with truth, that meat in this form supplies troops, and the fleet, with a cheaper animal diet than salt provisions, from avoiding the expense of casks, leakage, brine, bone, shrinking, stowage, &c., which are all heavy items, and entail great waste and expenditure: added to this, the damage of one cask of salt meat risks the loss of all its contents: whilst the meat canisters are, comparatively speaking, imperishable, and an accident to one occasions a loss of at most but from 2 lbs. to 4 lbs. of food.

Several hundred canisters of meat are exhibited from various countries, and in some of these by many different persons. Their merits were tested by a selection from each: the cases were opened in the presence of the Jury, and tasted by themselves; and, where advisable, by associates. The majority are of English manufacture, especially the more substantial viands; France and Germany exhibiting chiefly made dishes, game, and delicacies—of meat, fish, soups, and vegetables.

The Jury desire to draw attention to the fact of viands of this description being extensively prepared in Australia, Tasmania, the Cape of Good Hope, Canada, &c., of equally good description with the English. Animal food is most abundant and cheap in some of those colonies. In Australia, especially, during seasons of drought, it is wasted in extraordinary quantities: flocks are slaughtered for the tallow alone, and herds for their bones and hides. Were the meat on these occasions preserved, it cannot be doubted that it could be imported into England, and sold at a cheaper rate than fresh meat in our metropolitan markets, to the great benefit of the lower classes.

Among all the preparations exhibited by France, England, &c., there is no perceptible difference either in the mode or perfection of preservation. To seal, hermetically, full tin canisters is the general principle adopted: and it is effected by plunging them in boiling water, and soldering a small orifice left purposely, by which all the air is expelled; this principle, variously modified, being the same throughout.

The contents of all the cases, of whatever kind, have lost much of the freshness in taste and flavour peculiar to newly-killed meat: they are always soft, and, as it were, overdone: the nutritious principles are, however, perfectly preserved. As nutriment they are unexceptionable: they are wholesome and agreeable, and often pleasantly flavoured. Vouchers are given for some of the samples tasted by the Jurors having been preserved for twenty-five years and upwards: these were in a perfectly sound state, and did not perceptibly differ from the contents of canisters only a few months old. So long as the sealing remains sound, the viands appear to undergo no change. Any difference between the contents of the properly-prepared cases is to be attributed to the state of the food before preparation, or to the cooking, and not to the
In method employed for preserving, which is simple and
sively equally applicable.
Burrows, M[illegible]les. preserved in a similar manner, have been
[illegible] the Jury with the animal food. Generally
[illegible]our is fresher than that of the meats,
[illegible] those abounding in saccharine
parsneps, salsafy, which preserve to advantage. The more farinaceous do not preserve so well, such as green peas, &c.; whilst those abounding in volatile oils are hardly worth preservation at all (especially cabbages, turnips, and celery), except as anti-scorbutics.

M. E. **MASSON**'s dried compressed vegetables (1348, p. 1240) demand especial notice, as showing one of the most remarkable discoveries of modern times in this branch of manufacture: they have been awarded a Council Medal. By M. Masson's process, the most bulky, soft, and succulent vegetables are reduced to a fraction of their volume, and are preserved in a dry, indestructible state. After boiling for a rather longer time than usual, they are restored to something of their original form and consistence, retaining all their nutritious principles, and much of their flavour. Chollet and Co., the manufacturers of these preserved vegetables, use only desiccation and compression in the process, which is Masson's invention. According to a statement published in the "Comptes Rendus," as read before the Paris Academy, the vegetables are reduced seven-eighths in weight, and proportionally in bulk. They require to be boiled for one hour and a-half to one hour and three-quarters, and on cooling, are found to have regained nearly all their evaporated juices.

If, as the Jurors have reason to believe, these preparations retain their good qualities for several years, they cannot be too strongly recommended to public attention. It would probably be necessary for long voyages that these square cakes be packed in perfectly dry casks or tanks, as biscuits are.

In the British Department, J. H. **GAMBLE** (12, p. 201) and **RITCHIE** and **MCCALL** (15, p. 202) exhibit very fine samples of preserved viands and vegetables, and to each a Prize Medal is awarded for excellence of material and preservation. Richie and McCall's articles deserve especial notice for the great size of the pieces of meat, combined with all the firmness of texture that is attainable. All are said to be prepared by Goldner's process, the results of which are equal, but not superior, to the ordinary process, as far as the Jury could decide, after a very protracted examination and comparison.

COPLAND, BARNES, and Co. (11, p. 201) exhibit few meats, but abundance of fish, hams, and vegetables, dressed in various ways. A Prize Medal has been awarded for these in conjunction with the admirable tart-fruits referred to elsewhere.

A preserved pig, entire (14, p. 202), a conspicuous feature in the English Department, deserves notice as a remarkably successful instance of curing on a large scale.

J. and J. P. **LEONARD**'s fresh meats (26, p. 206), prepared on Toplin's principle, are not so successful a sample of preserved animal food as would be imagined from their appearance of freshness and goodness. **WHITNEY**'s fresh beef (grated?) (26, p. 202) looks sound, but is not exhibited in sufficient abundance, and particulars of trial are wanting.

MADAME D. ST. ETIENNE exhibits specimens of vegeto-animal substances, meat flours, &c., prepared for long voyages; also a bottle of dried and pulverised spinach (138, p. 208), of which Honourable Mention is made. It is a curious preparation, resembling M. Masson's; but the quantity exhibited is too small, and the general applicability of the process is not known.

CANADA demands very prominent mention for the abundance and excellence of the preserved viands exhibited; but all are of the ordinary description of cured meats, and none have any peculiar merit or novelty to entitle them to reward, except the hams of G. **REINHARDT**, of Montreal, which have been awarded a Prize Medal. There are barrels of beef, pork, and tongues, cases of smoked hams, bacons, and sausages, kegs of lard, &c., all produced at a remarkably cheap rate.

NEW BRUNSWICK and **NOVA SCOTIA** contribute excellent fresh salmon, preserved in tin canisters, and quite equal to the English. Honourable Mention is made of that of T. **HOLLIDAY**, of Halifax, and W. J. **FRASER**, of Miramichi (24, p. 969).

AUSTRALIA.—H. E. & M. **MOSES** (101) are exhibitors of excellent preserved fresh meats, in all respects equal

* This exhibitor has be[illegible] Jury of Class IV., in whose [illegible]

to the English, but exhibited in small quantity and in no variety. Honourable Mention is made of them. The Newcastle (N.S.W.) Preserving Company (7, p. 989) contributes admirable boiled mutton in tin cases, whose especial goodness is evidently owing to the excellence of the material, for the process is the ordinary one, and its peculiarities are the same as the English. A Prize Medal has been awarded the Company. Some excellent spiced beef hams were exhibited by J. Briears (2a, p. 989), which have received Honourable Mention.

Van Diemen's Land sends excellent hams, prepared by Marshall, of Hobarton, and exhibited by F. Lipscombe (297, p. 992), of which Honourable Mention is made. Also good preserved meats prepared by Adcock, of Hobarton (p. 992).

New Zealand.—Some dried mullets are exhibited from this colony, cured for the China market, which appear sound, but not high flavoured.

The Cape of Good Hope sends casks of salt beef and pork, both of good description.

France.—The collection of hermetically-sealed meats is very extensive and good, but differing from the English in the same degree as a French table differs from an English one, namely, in the smaller quantities preserved, in their being generally made-dishes, and in a greater proportion being objects rather of luxury than of common use. A Prize Medal has been awarded to Guihéry, Des Landelles, & Co. (1262, p. 1237), for a very fine series of preserved meats and vegetables, and to Chevet, jun. (121, p. 1177), for preserved meats and vegetables, especially truffles. Of the latter there are many exhibitors in the French Department, and all are good. Honourable Mention is made of the "mouton rôti," and sardines in oil, of J. Peneau (950, p. 1225), also of the preserved game of Gremailly (246, p. 1188).

For vegetables in particular, Honourable Mention is made of the preserved green peas of F. Rouchier & Son (994, p. 1226), and of the salsafy of Rödel & Son* (992, p. 1226), which were the two best amongst many samples of all kinds of preserved vegetables exhibited by them in this department.

Fish are abundantly exhibited, and the Jury have made Honourable Mention of the sardines in oil of A. Gillet (521, p. 1204), Pellier Brothers (948, p. 1218), and M. Camus (789).

Austria is almost the only other contributor of fresh meats preserved by hermetically sealing. Honourable Mention is made of the preserved larks of C. Weill (25).

Spain sends a good supply of beef, pork, bacon, and hams, all of excellent quality. The hams are particularly good, especially the Montanchis hams (139b, p. 1337), to which a Prize Medal is awarded: it is exhibited by, and sent from, the Borough of Aviles. There is also some good Spanish salt butter.

Lubeck contributes a selection of hermetically-sealed provisions in tin cases, all very good. A Prize Medal is awarded to the exhibitor, D. H. Carstens (2, p. 1140).

Switzerland.—Some fish and meats dried and preserved in a fresh state by simple desiccation, are very remarkable. They are exhibited by H. Baup (52, p. 1269, 1270), to whom a Prize Medal is awarded. They want flavour, and are discoloured, but both the muscle and fat of the meat are perfectly sweet and fresh. Simplicity and cheapness of preservation are the great recommendations of these articles, to which may be added the absence of any foreign matter. They will apparently keep well, but they want testing by exposure to a damp tropical climate, and by confinement in bulk.

Russia exhibits dried fish, apparently in exceedingly good order.

United States.—The hams are of a very superior description indeed, and have been pronounced by competent judges to be unsurpassable. Prize Medals have been awarded to two contributors of this article, Charles Duffield, of Louisville (363, p. 1459), and Schooley and Hough, of Cincinnati (200, p. 1449). The lard is exceedingly fine, and Honourable Mention is made of that of G. Dominic (21, p. 1434), also by Jury of Class IV.

H. II.—Portable Soups, Concentrated Meats, &c.

A more simple, economical, and efficient form of portable concentrated food than the American meat biscuit of Gail Borden (524, p. 1467) has never been brought before the public. The inventor combines the best wheat flour with the nutriment of the finest beef, and presents them for use as food in the form of a dry, inodorous, flat brittle cake, which will keep, when dry, for an unlimited period. It only requires hot water and seasoning to the taste to produce a first-rate agreeably-flavoured, highly-nutritious soup, somewhat of the consistence of sago. One pound of the biscuit contains the nutritive matter (fat excepted) of five pounds of prime beef, mixed with half a pound of the best wheat flour. One ounce of the biscuit grated, and boiled in a pint of water, forms a rich nutritious soup. It is averred by the inventor, and he is supported by authority satisfactory to the Jury, that 10 pounds of this substance, with a proper allowance of water, afford, both in bulk and nutriment, food sufficient to support the physical and mental powers of a healthy working man for a month. The Jury further believe it to be as portable and unchangable as the inventor declares.

Chemical analysis shows the proportion of meat to starch to vary in different samples, but that in all cases the meat is perfectly sound and free from putridity, and the starch unaltered. On an average it contains 4·9 per cent. of nitrogen, or 31·85 per cent. of flesh-forming principles. A Council Medal is awarded to this excellent preparation of Mr. Gail Borden.

The osmazome of G. Warriner (Cl. III., 21, p. 202) is the nutritious matter or juice of meat which is set free during the operation of boiling down fat for tallow in Australia. This is afterwards concentrated and preserved in the form of sausages. A great amount of nutriment is thus obtained in a portable form, and when boiled with gelatine, it forms a palatable diet. The price is very moderate, 1s. per lb., and it hence commands a market, and is much used to form a gravy to meat. The exhibitors declare that one pound weight is the equivalent of the nutriment of 30 lbs. of fibrine, which argues a high economic value. Chemical examination gives 2·1 per cent. of nitrogen, or 13·65 per cent. of flesh-forming principle. Honourable Mention was awarded.

Du Liscoet & Co.'s "biscuit beef," in the French Department (1328, pp. 1239, 1340), in form resembles ordinary coarse ship-biscuit, of a large size, and has an animal, salt, and not very agreeable taste. It is exhibited in two forms, the ordinary biscuit above mentioned, and another marked P., which is to be ground up and boiled, 30 or 40 minutes, as soup. 600 grammes (equal to 1·322 lbs. avoir.) are stated to be the equivalent of a soldier's complete daily rations.

Preserved Milks.—Several specimens of these valuable preserves, possessing various degrees of merit, have been submitted to the attention of the Jury. Of these the "Concentrated Preserved Milk" of E. D. Moore (139, p. 193*) has received a Prize Medal. It contains all the nutritious qualities and much of the flavour of fresh milk. J. H. Gamble (12, p. 201), and Ritchie and McCall (15, p. 202), both exhibit preserved milks in hermetically-sealed cases, but the samples from each vary considerably in quality.

Honourable Mention is made of Martin de Lignac's consolidated milk, France (922, p. 1224). That of V. B. Fadeuilhe (Cl. III., 140, p. 193*) is also worthy of notice as a curious preparation; but it appears to attract moisture, and has a decided flavour of cheese. The preparation of Oudin & Co., of Paris (1375, p. 1242), and the Lubeck preserved milk (2, p. 1140), are too much sugared.

H. III. and IV.—Caviare, Trepang, &c. Swallows' Nests, &c.

Russian caviare of the very finest quality is exhibited by Nikita Vsevolodowitch Vsivolosjky (338, p. 1382). It receives Honourable Mention.

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* These exhibitors were awarded a Prize Medal by the Jury of Class XXIX., in whose list their names appear.

Borneo and Singapore both supply trepang (bêche de mer, or sea-slug), in considerable abundance; and magnificent specimens are exhibited in the Chinese Department by H. Hamilton Lindsay (11, p. 1422).

Swallows' nests, used extensively for soup by the Chinese and natives of the Eastern Archipelago, are exhibited of very high quality, by H. H. Lindsay (11, p. 1422), in the Chinese Department, together with an excellent model of the mode of attachment to the sea-cliffs, adopted by the birds for their nests. The material used is believed to be a sea-weed, resembling in form and substance the Carrageen moss of the Irish seas, which becomes glutinous when thrown up on the beach and decomposing; a peculiar fluid secreted by the swallow aids in the process of constructing the nest. Borneo and Ceylon supply inferior nests, and Java some of good quality.

Malacca, Singapore, and Macassar, all send agar-agar, a very similar natural production to that from which the swallows' nests are formed, and employed for the same purposes.

New Zealand, Manilla, and Malacca send sharks' fins, which are another favourite article of food with the Chinese.

H. V.—Honey.

There is a considerable variety of specimens of honey, both in the comb and run; also of hives, simple and complicated, for practical or scientific purposes, but no novelty of importance. Among 38 hives exhibited, none present any practical improvement. Only one, which dates upwards of two centuries ago, is really adapted to the requirements of the bees. To this the depriving system (which deprives the bees of a portion of their honey, without destroying them) was added a century later. Much ingenuity has since been expended, chiefly in complicating hives with various contrivances for ventilation, &c., in no instance producing a return correspondent to the increased expenditure, the chief result being a hindrance to the extension of bee culture.

British.—Among many hives and exhibitors, one alone has been selected as worthy of a Prize Medal; viz., J. Milton (Cl. IX., 291, p. 402), who sends an improved cottage hive, with single glass and cover. Simplicity and adaptation to practical purposes are here the objects aimed at; the hive is cheap and available for all classes. Mr. Milton also exhibits bees well managed and working profitably in a "mansion of industry," a leaf-hive, on Hubert's plan, for scientific investigation;—of merit, for its correct proportion and adaptation to the purposes required; also beautiful honey.

Of the various samples of honeycomb, that of W. C. Kitchener, Newmarket (Cl. III., 5, p. 201), has been selected as of great superiority, that in the upright glass being perfect in every point. The glass of honey in comb, exhibited by Miss Mortlock, is of equal beauty. Both have been rewarded with Honourable Mention. Fortnum and Mason's exhibition of various honeys (55, p. 204) is good and curious, and well worthy of attention; it is the result of much pains to illustrate this branch of trade.

2. Canada (131, p. 966) exhibits honey, but coarse, and of dark colour.

3. British Guiana.—The produce of a native bee, said to be of easy domestication, is exhibited from Woodland's Plantation (Mahaica River) (124, p. 986). Its qualities appear remarkably good, particularly as to flavour and sweetness, but it has undergone fermentation. The honey is the produce of a stingless bee; it is deposited in pouches, from which it is extracted by puncture, after which the bee stops up the orifice and refills the pouch.

4. The Cape of Good Hope sends excellent honey (52, p. 952), fit for the English market, firm, finely granulated, rather opaque, but of good pale-yellow colour, and delicate flavour. Honourable Mention was made of the exhibitor, J. G. Joubert.

5. Tasmania produces excellent honey; and several samples were forwarded to the Exhibition, but the jars arrived in a broken state.

6. France.—Chevalier De Beauvoys (47, p. 1173) exhibits a large series of bee-hives and apiarian apparatus, all manufactured for practical purposes. The workmanship, generally good, is in parts unequal. Some of the appliances are better suited to the climate of France than of England. A Prize Medal is awarded for the hive on Huber's plan, well adapted to the climate of France. The same exhibitor sends various honeys and straining apparatus.

The artificial honeycomb of M. Damainville, of Cressy (153, p. 1178), is a clever and apparently new contrivance, well adapted to the breeding of bees, though perhaps it would be better so if the cells were less deep. It has been rewarded with a Prize Medal.

Honourable Mention is made of a coopered cask of run honey, of the finest quality as to granulation, consistency, delicate colour, and fine flavour. It is properly exhibited in bulk (1558, p. 1251), sent by Chailloux Lepage and Pochon.

An equally fine and perhaps higher-flavoured honey, from the Basses Alpes, is exhibited by M. Laugier (1640, p. 1255).

7. Spain.—Much of the honey from this country is admirable; but it is to be regretted that all the samples in the Catalogue are not forthcoming, particularly the Hinojos honey, said to be the chief product of the district. The El Moral virgin-honey (180, p. 1340), exhibited by A. Molina, is excellent, of good colour and granulation, delicate and highly flavoured, and of remarkable sweetness in after-taste. It is rewarded with Honourable Mention.

Many of the orange-flower honeys are good, especially those of Guadalajuna, the great orange-flower honey producing district of Spain; but all are injured by transference to stoppered bottles.

8. Portugal.—All the honeys, six samples, are deteriorated by being put in stoppered bottles. Honourable Mention is made of No. 593 (p. 1314), from J. B. De Mattos.

9. Sardinia sends two samples of honey, one sweet, and one bitter.

10. Switzerland contributes a beehive, neat, strong, and larger than those of English make. It is on the depriving system, consisting of a conical stock-hive, with a cap, and is exhibited by L. Destraz (71, p. 1271), of whose invention Honourable Mention is made.

11. Germany exhibits fair wood-hives, on the storied principle, probably well fitted for the climate.

12. Greece.—A jar of Hymettus honey, from A. Tsitzimbakos, of Athens (13, p. 1402), deserves Honourable Mention. The specimens were brought over in the original jars, and part removed into glass jars, whereby the quality is injured. The Rhodomeli honey, from Carzeto, in Eubœa, exhibited by the Bishop of Eubœa (14, p. 1402), also receives Honourable Mention. It is rather more aromatic and pungent than that of Hymettus.

13. Austria sends honey, and a Carniolian apiary: neither is remarkable.

14. Egypt.—Various honeys, in large jars, dirty, of lead colour, and peculiar flavour, and all in a state of fermentation.

15. Turkey.—The honeys are generally of good colour and flavour. Of one sample (2918, p. 1386) Honourable Mention is made: it is of a fine rose flavour, yellow, and semitransparent.

16. Tunis exhibits a sample of honey of the Egyptian character, and not fitted for the European market.

17. Russia.—A strong straw hive is exhibited.

18. United States.—Joseph Hall, Burlington, New Jersey, sends a hive of living bees.

H. VI.—Preparations of Blood.

The only examples are those of P. Brocchieri (16), who attempts to utilise the nutritious principles of the blood of animals killed for food, by reducing it to a concentrated and dried state, for preservation during long periods. The first step is to prepare a liquid, considered innocuous and antiseptic by the exhibitor, by which various bloods are kept fluid and apparently fresh. Samples of these are exhibited. Another series of specimens shows the solid parts forming the crassamentum, or clot, in a dried and semicrystalline state. These solid constituents, including the gelatine, albumen, and fibrine, are next produced, combined with small proportions of flour, in the form of light dry masses, like loaves, cakes, or biscuits. Lastly, they are shown combined with sugar, as cakes and bon-bons.

The larger masses, uncombined with sugar, are inodorous, almost flavourless, and may be made the basis of highly-nutritious soups. They are very uniform in composition, containing half the nitrogen of dried blood, or 44 per cent. of dry flesh, the equivalent of double the nutritive value of ordinary butcher-meat. Both the bull's and calf's blood gave 6·6 per cent. of nitrogen, equal to 43 per cent. of flesh-forming principles.

The value of M. BROCCHIERI's process depends on the power of preserving the results, in an undecomposed state, during lengthened periods, &c.; and though the Jury have understood that the preparations have been advantageously employed in long voyages with some success, the evidence is not complete; and the condition of some of the specimens of mixed blood and sugar, once in the Exhibition, was unsatisfactory. The uncombined dried cakes seem, however, adapted for this purpose. Hence, as a first attempt,—carried perhaps to a successful issue,—to render available for food and portable in form, the otherwise wasted blood, M. BROCCHIERI's experiments deserve encouragement and commendation; and the Jury have felt called upon to award him a testimonial of Honourable Mention.

H. VII.—ISINGLASS.

Regarded as an alimentary substance, isinglass had little claim upon the attention of the Jury. They have, however, to report most favourably of the EAST INDIAN isinglass, obtained from the air-bladder of a siluroid fish called *Polynemus plebeius*, and exhibited by Dr. MACCLELLAND. In quality this proved, after repeated tests, to be fully equal to the finest Beluga samples, and has received a Prize Medal. A similar distinction was conferred upon Mr. JAMES VICKERS (Cl. XV., 117, p. 204), for some very finely-prepared Russian isinglass, both in the whole and cut state, which the Jury satisfied themselves was of uniformly good quality. They are unable to express a favourable opinion of the Brazilian isinglass of the same exhibitor. (See Report, Jury, Class IV.)

Kew, August 1851.

J. D. HOOKER, REPORTER.

CLASS IV.

REPORT ON ANIMAL AND VEGETABLE SUBSTANCES, CHIEFLY USED IN MANUFACTURES, AS IMPLEMENTS, OR FOR ORNAMENTS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

Professor RICHARD OWEN, F.R.S., *Chairman and Reporter on the Animal Substances*, College of Surgeons, Lincoln's Inn Fields; Curator to the College of Surgeons.

A. PAYEN, *Deputy Chairman*, France; Member of the Institute, Professor to the Museum of Arts and Sciences, Member of the Central Jury, &c.

Judge E. S. DUNCAN, United States.

Dr. J. F. ROYLE, F.R.S., Heathfield Lodge, Acton; Professor of Materia Medica, King's College.

RAMON DE LA SAGRA, Spain; Corresponding Member of National Institute of France.

Professor E. SOLLY, F.R.S., *Reporter on the Vegetable Substances*, 15 Tavistock Square; Lecturer on Chemistry at Addiscombe.

N. WALLICH, M.D., F.R.S., 5 Upper Gower Street, Bedford Square; formerly Curator of the Botanical Gardens, Calcutta.

F. WEYHE, Zollverein; Councillor of Home Economy.

Associate.

GEORGE PETERSON, Russia; 22 Craven Street, Strand; Member of the Scientific Committee for the Administration of the Domains of the Empire. (Juror in Class XXVIII.)

PRELIMINARY REMARKS.

FOR the "Raw Materials" from the Vegetable and Animal Kingdoms mankind owes more to the powers and operations of Nature than to the inventions and appliances of Art, and in the series of the various organic products of almost every climate which are exposed to view in the "Exhibition of the Works of Industry of All Nations," the relative excellence of the objects to be compared might be deemed to be due rather to peculiarities of soil and sky than to the individual merits of the Exhibitors.

Almost every vegetable or animal substance may, however, be modified, and, in relation to its utility to man, improved by a change of the circumstances under which it is naturally developed, the modifications being suggested by a patient study of the respective influences of those circumstances upon the useful properties of such substance.

A further improvement may be effected by carefully defending the raw material during the progress of its development from all external influences calculated to deteriorate or injuriously affect it.

The value of every organic product in commerce is much influenced by the mode of its collection, or removal from the animal or plant when developed, and by the processes for separating the useless or less valuable parts or heterogeneous matters from the marketable constituent. In the sense in which the term 'Raw Material' has been extended in its application to that section of the Exhibition assigned to the Jury of Class IV., great scope for both chemical and mechanical skill has been afforded in the extraction and preparation of several of the vegetable and animal substances applied "in Manufactures, as Implements, or for Ornaments."

In the examination and comparison of the very numerous and diversified substances confided to their judgment, this Jury have been guided and influenced by the consideration of the invention, ingenuity, skill, and industry manifested in the amelioration and perfection of these several substances, and by the degrees in which unfavourable conditions of soil and climate have been thereby overcome: and in deciding on individual merit, they have carefully taken into account the natural facilities which may have favoured, and the natural difficulties which may have opposed, the realization of the desired qualities in the raw produce transmitted for exhibition.

After a preliminary general survey of their field of operations had shown its vast extent and the great practical importance of the objects to be compared, the Jury, having regard, also, to the earnest desire expressed for expedition in their decisions, resolved themselves into two Committees, one for the Vegetable, the other for the Animal Kingdom; reviewing and testing from time to time in general meetings the evidence of the special examinations confided to those Committees. In preparing their Report of the results of these labours, it has been deemed advisable to divide it into corresponding sections, the classification of the subjects in each being made, as far as it was practicable, in accordance with that of the original "Jury Lists;" the chief differences being, that—"Dextrine" or starch-gum, and "Starch" as employed in manufactures, have been added to the "Gum and Resin" series, at the recommendation of the Jury of Class III., and that spermaceti, stearine, stearic acid, with the consideration of the various processes, partly chemical and partly mechanical, employed in the preparation of these substances, have been referred to the Jury of Class XXIX., in relation to the manufacture of candles and other practical applications of these substances, already under the review of that Jury. The "Vegetable Charcoal" has been added to the "Animal Charcoal," at the request of the Jury of Class I. "Quills" were transferred to other articles of stationery, the subjects of Class XVII. Lastly, the subdivision C, including the "Vegetable Acids," such as acetic, citric, tartaric, oxalic, and other organic acids employed in the arts being, in almost all cases, the products of distinct chemical operations, have been brought under the consideration of the Jury of Class II. Subject to these changes, therefore, in the list of objects originally assigned to this Class, the present Report will be subdivided, as respects the Vegetable Kingdom into eight heads, and as respects the Animal Kingdom into five heads; with a preliminary section explanatory of the grounds on which the awards of the Council Medal have been recommended.

RECOMMENDATIONS FOR THE COUNCIL MEDAL.

Among the numerous samples of Raw Produce contributed by different countries, there are several collections of especial value, which derive additional merit from their completeness, and from the fact that they illustrate the trade and manufactures of an entire country. The importance of such collections, not only in a commercial, but in a statistical and scientific point of view, is very great; and the Jury, therefore, being desirous of expressing their approbation of the practical benefits to be derived from the formation and study of such collections, and the advantages which the commercial and manufacturing community may obtain by their means, have determined to recommend the award of the Council Medal to the Governments of those countries the natural produce of which were thus so instructively and completely exhibited.

The Jury have, accordingly, recommended the award of a Council Medal* to the HONOURABLE EAST INDIA COMPANY for the very valuable and important collection of the raw produce of the Indian empire exhibited by them (pp. 876-878), which illustrates in a remarkable manner the vast and natural resources of that empire, and places before manufacturers a number of valuable new or little-known substances, many of which are likely, hereafter, to become considerable articles of import.

The Jury have, on the same grounds, recommended the award of a Council Medal* to the TURKISH GOVERNMENT for the very valuable and important collection of the raw produce of the Turkish empire (p. 1386), shown in the Turkish Department, and which, from its extent and completeness, is most interesting and instructive. Both this collection and that of the Hon. East India Company derive additional value from the fact, that the specimens are not merely picked samples of fine produce, but really represent the average quality of each article; and also from the exhibition of specimens showing the different degrees of goodness, and the comparative superiority or inferiority of the productions of different districts.

A Council Medal has also been awarded to the Government of SPAIN* for the valuable and extensive collection of raw products, illustrating the natural resources of that country (pp. 1337, 1338).

The Jury have also recommended the award of a Council Medal* to the FRENCH MINISTER OF WAR for the very complete and well-arranged collection of Raw Produce of Algeria (p. 1259), remarkable for excellence in many respects, and affording a good example of the progress and improvement of a young colony—in the amelioration of the native productions, and in the successful introduction and cultivation of new branches of industry—by the judicious application of practical science to the development of the raw materials used in various manufactures.

After comparing together the various samples of American cotton, and contrasting them with those of other countries, the Jury were desirous of testifying their admiration of the unrivalled excellence of the long-staple cottons of the United States, depending not merely on the length, strength, and silky fineness of the fibre, but being also due to the improved modes of culture, cleaning, and packing—the results of long experience and repeated efforts. The Jury found it quite impossible to decide between the minute shades of difference of the individual bales of cotton; besides which they considered that the merit was due not to any one exhibitor, but rather to the cotton-planters of America generally; they, therefore, recommended the award of a Council Medal* TO THE GOVERNMENT OF THE UNITED STATES for the excellent samples of long-staple cotton shown, which exhibit such marked and superior excellence as to leave hardly any further improvement to be desired (p. 1431).

On the same grounds the Jury were desirous of testifying their sense of the peculiar value and excellence of the felting wools (p. 1005), adapted to the manufacture of the finest kinds of cloth, which are exhibited in the Austrian Department, by recommending the transmission of a Council Medal* TO THE GOVERNMENT OF THAT EMPIRE. And with regard to the superior quality of the raw silks shown in the French Department, the Jury, by their recommendation of the award of the Council Medal* to the "CENTRAL SOCIETY OF SERICICULTURE OF FRANCE," have desired to testify their admiration of the specimens exhibited by many members of that Society, and their appreciation of the important influence which it has exercised in the improvement of this beautiful and valuable product of the animal kingdom.

Two other collections, though not quite analogous to these, were, for similar reasons, deemed worthy by the Jury of the highest commendation, and have been accordingly recommended for the award of the Council Medal;* namely, the collection of Messrs. LAWSON of Edinburgh,† and the series of Liverpool Imports. The former consists of a most complete and well-arranged collection of the vegetable productions of Scotland, the value of the whole mainly depending on the excellent systematic manner in which the specimens are arranged and classified; the careful and accurate information which accompanies the different samples; the manner in which the practical uses of each raw product are shown and illustrated; and the valuable catalogues which have been drawn up by Messrs. Lawson.

The LIVERPOOL COLLECTION OF IMPORTS (Class XXIX., p. 803), though it does not of course represent either the exports or the imports of any individual country, is nevertheless, owing to the extensive trade of that port, and the large number of imports which it includes, a fair representation of a very large portion of the commerce of the country: like the preceding collection of Messrs. Lawson, it derives much of its practical value from its arrangement, and from the useful information which accompanies each specimen. Much valuable knowledge, which no book can give, is to be obtained from the attentive study of this collection, as the different productions of various countries are, in it, placed side by side, with a memorandum appended to each, showing the quantity of it imported into Liverpool during the last ten years.

The Jury also recommended the award of a Council Medal to the 'Royal Society for the Improvement of the Cultivation of Flax in Ireland' (p. 203*), for their persevering and successful efforts to improve the growth and preparation of flax in the British empire. The Jury believe that the rapid and progressive advance which, during the last dozen years, has been made in the cultivation of flax in Ireland, is mainly, if not entirely, due to the exertions and influence of this valuable institution.

In the class of vegetable raw produce, the following subject was found to be of sufficient importance, in the opinion of the Jury, to merit special commendation, namely, MERCER'S Process for Modifying the Fibre of Cotton (Class XVIII., 48, p. 56); this was considered so valuable and so important a discovery that the Jury determined to recommend it as worthy of the distinction of a Council Medal. The process, itself, consists principally in steeping cotton in a dilute solution of caustic soda, the effect of which is, to alter the physical and chemical properties of the fibre in a very remarkable manner, causing each single fibre to reassume, to some extent, its original character and microscopic appearance, exchanging the ribbon-like or flattened appearance which cotton ordinarily presents, for one of a more or less distinctly cylindrical character. The shrinking of the fibre which is thus caused, whilst it produces a most remarkable difference in the appearance of all woven fabrics, does not at all decrease its strength, but, on the contrary, renders it even stronger. At the same time that these physical alterations are produced, the chemical nature of the cotton is likewise modified, and its relation to colouring matter and mordants is changed in an equally remarkable manner; the prepared cotton taking the dyes more easily and far more perfectly than that which has not been prepared, so that the colour dyed in the same vat is far superior with the prepared than with ordinary cotton.

Among the vegetable charcoals which this Jury were requested to examine and report upon, they found worthy of special notice the following series, exhibited in France.

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* Owing to technical objections, these Council Medals were not passed by the Council of Chairmen.

* Owing to technical objections, this Council Medal was not passed by the Council of Chairmen.

† This Medal was given conjointly with the Jury of Class III., in whose Award List it is inserted.

No. 1404, by M. Popelin Ducarre (p. 1243); viz., specimens of prepared charcoal in cylindrical masses, called 'charbon de Paris;' specimens of carbonized twigs and small branches of trees and of carbonized tan, accompanied with models of the machinery employed in the manufacture of the prepared charcoal.

The first merit of the ingenious invention here illustrated, and that which renders it of special importance in countries dependent on wood for fuel, is the modification of the ovens for carbonizing, without incineration, those small ligneous portions of plants and shrubs which had previously been of no value in the formation of charcoal, and were regarded as the waste of the forest: this mode of carbonization is equally applicable to underwood, furze-bushes, cane-brake, and even to the refuse tan of many manufactures. The charcoal thus produced, together with the dust from ordinary charcoal magazines, is then converted into a kind of artificial coke, in a manner analogous to that by which coal-dust has been for many years past converted into similar fuel in England. The produce of the ovens in M. Popelin Ducarre's extensive works is pulverized, mixed with a certain proportion of coal-tar or gas-tar (goudron de houille), and moulded into small cylinders, which are a second time submitted to carbonization. The machinery effecting these purposes is remarkable for its ingenuity and efficiency; and the result is a regular, solid, hard, heavy, but porous charcoal-coke, which is used with economy and success, as is amply testified by the Reports of the "Central Jury" of the Exposition at Paris in 1849, of the "Society of Encouragement," and of the "Central Society of Agriculture," of France, and by the written testimonials of many eminent manufacturers in France, requiring large quantities of an economical fuel. The "charbon de Paris" is peculiarly adapted for those manufactures in which a low and long-sustained heat is required to be maintained, and it is sold at a rate one-fourth cheaper than ordinary charcoal.

The Jury, appreciating the value of this invention of the ingenious Exhibitor, especially to countries which, like France, are not abundantly supplied with coal, have recommended the award of the Council Medal to M. Popelin Ducarre.

Amongst the series of wools shown in the French Department are specimens characterised by a well-skilled English Expert as "a wool of singular and peculiar properties—the hair glossy and silky, similar to mohair, retaining at the same time certain properties of the merino breed." This wool is exhibited under No. 245 (p. 1188), by J. L. Graux, of the farm de Mauchamp, Commune de Juvincourt (Aisne), as the produce of a peculiar variety of the merino breed of sheep.

The Jury entered into an inquiry, not only into the commercial value and application, but into the particulars of the production of this new kind of wool, and finding it to be one of the very few instances in which the origination of a distinct variety of a domestic quadruped can be satisfactorily traced, with all the circumstances attending its development well authenticated, a brief statement of these has been deemed appropriate in the present Report.

In the year 1828, one of the ewes of the flock of merinos in the farm of Mauchamp produced a ram which became remarkable for the long, smooth, straight, and silky character of the fibre of the wool, and for the smoothness of its horns: it was of small size, and presented certain defects in its conformation, which have disappeared in its descendants. In 1829 M. Graux employed this ram with a view to obtain other rams having the same quality of wool. The produce of 1830 included only one ram and one ewe having the silky quality of the wool; that of 1831 produced four rams and one ewe with the fleece of that quality; in the year 1833 the rams with the silky variety of wool were sufficiently numerous to serve, of themselves, the whole flock. In each subsequent year the lambs have been of the two kinds; one preserving the characters of the ancient race, with the curled, elastic wool, only a little longer and finer than in the ordinary merinos; the other resembling the rams of the new breed, some of which retained the large head, long neck, narrow chest, and long flanks of the abnormal progenitor, whilst others combined the ordinary and better-formed body with the fine silky wool. M. Graux, profiting by this partial resumption of the normal type of the merino in certain of the descendants of the malformed original variety, at length succeeded, by a judicious system of crossing and interbreeding, in obtaining a flock combining the long fine silky fleece with a smaller head, shorter neck, broader flanks, and more capacious chest. Of this breed the flocks have become sufficiently numerous to enable the proprietor to sell examples of the breed for exportation. The crossing of the Mauchamp variety with the ordinary merino has also produced a valuable quality of wool, known in France as the "Mauchamp-merino." The fine silky wool of the pure Mauchamp breed is remarkable for its qualities as combing-wool, owing to the strength as well as the length and fineness of the fibre. It is found of great value by the manufacturers of Cachemere shawls, being second only to the true Cachemere fleece in the fine flexible delicacy of the fabric, and is of particular utility, when combined with the Cachemere wool, in imparting to the manufacture qualities of strength and consistence in which the pure Cachemere is deficient.

Although the quantity of the wool yielded by the Mauchamp variety is less than that given by the ordinary merinos, the higher price which it obtains in the French markets (25 per cent. above the best merino wools*), and the present value of the breed have fully compensated M. Graux for the pains and care which he has manifested in the establishment of the Mauchamp variety.

The Jury, considering the quality of invention which has been superadded to the skill and industry requisite for obtaining the finer qualities of wool under any circumstances, in the development of the new variety of sheep yielding the specimens exhibited in No. 245, have recommended that the Council Medal be awarded to J. L. Graux.

The most remarkable progress in the economical extraction and preparation of pure gelatines and glues from the waste remnants of the skins, bones, tendons, ligaments, and other gelatinous tissues of animals, has been made in France, where the well-organised and admirably-arranged establishments for the slaughter of cattle, sheep, and horses in large towns, give great and valuable facilities for the economical applications of all the waste parts of animal bodies. Among the beautiful productions of this industry, the specimens exhibited by its chief originator, L. F. Grenet, under No. 247 (p. 1188), merit peculiar approbation. They include different kinds of gelatine in thin layers, adapted for the dressing of stuffs, and for gelatinous baths, in the clarification of wines which contain a sufficient quantity of tannin to precipitate the gelatine; pure and white gelatines cut into threads for the use of the confectioner; very thin white and transparent sheets called papier glacé or ice paper, for copying drawings; and finally, a quantity of objects of luxury or ornaments formed of dyed, silvered, or gilt gelatines, adapted to a variety of purposes, and to the fabrication of artificial or fancy flowers. M. Grenet, who was the first to fabricate on a large scale, out of various residues of animal bodies of little value, these beautiful and diversified products, many of which had previously been derived from isinglass, has been deemed by the Jury to merit special notice in the present section of the Report, and they have recommended to him the award of the Council Medal.

A considerable number of collections of raw produce from various countries are exhibited, each including a number of different specimens, many of which, taken singly or in groups, are of importance, either from their novelty, their superior excellence, or the locality from which they are sent; the Jury considered it most advisable to treat each of these collections as a whole or unit, and they accordingly awarded Prize Medals for the following collections respectively:—

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* According to the able Report of M. A. Yvart, Inspector of the Veterinary Schools and National Sheepfold of France, p. 42.

To Hon. Lieut.-Colonel Butterworth, Governor of Prince of Wales' Island and Singapore, for a collection of raw produce from Singapore and the Straits (876-890).

To Major F. Jenkins, Chairman of the Assam Committee, for the collection of the raw produce of Assam.

To the Agricultural Society of the Cape of Good Hope, for the collection of the raw produce of that colony (No. 1 to 55, pp. 950, 952).

To the President of the Montreal Committee, for the collection of the timber and other woods of Canada (80, pp. 963, 964).

To the Royal Agricultural and Commercial Society of British Guiana, for the collection of the raw produce of that colony (977).

To His Excellency Lord Harris, Governor of Trinidad, for the collection of the raw produce of Trinidad (pp. 973, 975).

To His Excellency Sir W. T. Denison, Governor of Van Diemen's Land, for the collection of the raw produce of that colony (p. 993).

To Messrs. W. P. Hammond and Co., for a collection of the raw produce of Siam and the Indian Archipelago, including fine specimens of caoutchouc, gutta percha, gamboge, gums and resins, terra japonica, shells, ivory, isinglass, &c. (2, 988).

To the Colonization Assurance Corporation, per W. B. P. Wood, for a collection of the raw produce of Western Australia (988).

To Sidi Mahmoud Bentad of Tunis, Commissioner for the Government of Tunis, for a collection of the raw produce of that country (1412).

To Abdul Hamid of Alexandria, Commissioner for the Government of Egypt, for a collection of the raw produce of that country (1408).

To the President of the Maryland Committee, for a collection of specimens of the principal raw produce of that state (U. S. 371, p. 1459).

To the Agricultural Board of Valencia, for the collection of raw produce (173, 209, pp. 1339 & 1342).

To the Agricultural Board of Saragossa for the collection of raw produce (148, pp. 1337, 1338

To Sir Robert Schomburgk, H. M. Consul to the Dominican Republic, for specimens of the raw produce of that republic (1428).

To the Royal Technological Institute of Tuscany, for the collection of the raw produce of that country (47, p. 1294).

Part I.—VEGETABLE KINGDOM.

From the fact that the Exhibition is the first attempt to bring together a complete collection of the natural raw produce of all parts of the globe, and from the very different views which were entertained in various countries as to the nature of the Exhibition, and the kind of substances which it was desirable to collect and exhibit, it necessarily follows that the collection, viewed as a whole, is very incomplete. In some cases, abundant and numerous specimens have been sent of all the various kinds of raw produce, constituting the staple productions of the country, their value and importance having been evidently felt and acknowledged; whilst, in other instances, it is apparent that the mere raw materials of any manufacture have been regarded as of comparatively little importance, and are consequently either not shown at all, or else are but imperfectly and inadequately exhibited, in the form of small or inferior samples. This circumstance, whilst, on the one hand, it has perhaps somewhat diminished the labour of the Jury, has, at the same time, rendered their task even more difficult than it would have been had the entire collection been more uniform and complete. It is therefore necessary to bear in mind, that as the duty of the Jury was only to consider and decide on the individual merits of the different specimens exhibited, so it necessarily happens that in some cases they have to report,—as being the best sample shown,—a specimen of second-rate quality, and one, even, decidedly inferior to what is often met with in commerce as an import from some other country, specimens of which, however, do not happen to be shown in the Exhibition. Every substance was examined carefully and considered separately; and in awarding a prize, it was only compared with substances of a similar nature. It is, of course, evident, that the award of a medal to two different things does not infer that they are of equal merit or importance; but, merely, that each taken separately, and upon its own merits alone, was found worthy of high commendation and approval. It is also right to observe, that as the value of any sample of raw produce does not rest merely on its own intrinsic superiority, but depends on a number of different circumstances, which may modify its value; so, even a second-rate sample, either from a new locality, or prepared by a new and more advantageous method, may have more real merit, and be more fully entitled to favourable mention, than a superior sample possessing no peculiar novelty, and deriving its excellence rather from accident than from either the skill or the ingenuity of the producers. These remarks apply to all the classes of subjects brought under the consideration of the Jury; but in no instance do they apply more strongly than in the case of gums and resins.

Section I.—Gum and Resin Series.

A great deal of practical inconvenience and confusion is caused by the indiscriminate manner in which the term "gum" is used in commerce and the arts: it would certainly be an advantage if the distinctions employed in scientific books were to be generally adopted by merchants and drug-brokers, the term "gum" being solely applied to those natural vegetable exudations which soften or dissolve in water, and yield a more or less perfect mucilage, but which are wholly insoluble in spirit;—the term "resin" being applied to those fusible and combustible vegetable substances which are quite insoluble in water, but which soften and dissolve in ether, the "essential oils," and "spirit of wine;" and the term "gum resin" being used to designate those mixtures of gum and resin, which are intermediate in properties, and partake of the nature of each, being partially and imperfectly soluble both in water and in alcohol.

"Gum," properly so called, is used in large quantities for a number of purposes in the arts: it is generally distinguished into soluble gum or gum-arabic, which readily and perfectly dissolves in water, forming a clear mucilage, and cherry-tree gum or gum-tragacanth, and those difficultly-soluble kinds of gum, which, though they soften easily, do not readily form mucilage. Gum is extensively used in finishing and giving lustre to crapes, silk goods, &c., by calico-printers, shoemakers, and in other trades. A very large quantity of British gum, "dextrine," or starch gum, is artificially prepared by roasting starch, and is extensively used as a cheap and strong form of gum for various purposes, especially in calico-printing, and in the manufacture of adhesive labels. The resins are, for the most part, used in the formation of varnishes and lacquers, for various purposes in dyeing, and in the manufacture of size for paper-makers, sealing-wax, &c. Those resins, which naturally contain a portion of volatile oil, such as the balsams, or oleo-resins like common turpentine, are used as sources of the volatile oils. Gum resins are chiefly used in medicine.

The total quantity of "gum" imported into England in 1848 and 1849, as shown by the Custom-house returns, was,—

	1848.	1849.
	Cwts.	Cwts.
Arabic - - - - - - -	24,022	33,136
Senegal - - - - - - -	7,404	6,577
Copal and anime (resins) -	2,958	4,315
Tragacanth - - - - - -	234	314
Total - - - - -	34,618	44,342

The largest import of gum, therefore, is of Arabic, and under this head a considerable variety is probably included; the countries from which the 33,136 cwts. were imported in 1849, are as follows:—

	Cwts.
The East Indian Empire	13,687
Egypt	6,232
Morocco	6,064
South African Colonies	4,876
Italy	664
Gibraltar	460
Aden	397
Australia	372
France	212
Miscellaneous	172
Total	33,136

Of the resins and oleo-resins, the most important are turpentine and lac. Of the former, 412,042 cwts. were imported in 1849, nearly the whole of which was brought from the United States. The quantity of lac imported in 1849 was 14,786 cwts.; of this, 14,556 cwts. were the produce of the East Indian empire.

The collection of resins exhibited by E. REA (116, p. 204*), shown as illustrations of the chief substances used in the manufacture of varnish and lacquers, &c., is complete and interesting, comprising a tolerably numerous series of the various resinous substances employed by manufacturers. The specimens are good, well arranged and shown. The collection includes a good series of lac, namely, the insects themselves, the *Coccus lacca*, which, living on the branches of various trees, cause the lac to form and collect as an incrustation on the young shoots and twigs. The chief varieties of lac known in commerce, both from Siam and from Bengal, namely, stick lac, seed lac, orange and ruby shell lac, lump and button lac; lac dye, and the various colours prepared from it; and white or bleached lac, together with samples of the lac wax, which separates from it during the process of purification. Of the hard resins, there are good specimens of copal, anime, kauri gum or New Zealand copal, dammer or East Indian copal, colophony or rosin, the resin of common turpentine, sandrac or sandarach, mastic, dragon's-blood, and the fine resin of the black-boy or grass tree of Australia, *Xanthorhœa Australis*. Two perfectly distinct resins are obtained from the Xanthorhœa, namely, the "black-boy gum," a dark red brittle brilliant resin; and the "yellow gum," an orange yellow resin resembling gamboge, which contains benzoic and cinnamic acids. These valuable resins, it is said, may be had in large quantities, and at a low price; they are gradually coming into use in the manufacture of varnish, and for other purposes; being in some respects quite as good, if not superior to, shell lac. Bleached lac is extensively used in the manufacture of the finer sorts of sealing-wax: the wax which separates during the purification of the lac is comparatively little known; it is a hard substance, readily fusible, and may be well employed in taking casts, which it does with great sharpness. It is probable also that it might be advantageously used to mix with other and more fusible materials in the manufacture of candles. Of the oleo-resins and balsams there are varieties of common turpentine and Canada balsam, elemi, and thus or frankincense. The Jury awarded a Prize Medal for this collection.

A series of the ordinary turpentines of commerce is shown by ENGLISH'S PATENT CAMPHINE COMPANY of Hull (61, p. 199*), accompanied by samples of resin, and refined oil of turpentine, and an interesting collection of the various insects found in crude turpentine. The specimens of resin are by no means first-rate; they serve merely as illustrations of the ordinary articles as commonly met with in commerce. The collection also contains a number of samples of oils and oil-seeds (see page 80). The Jury deemed the whole series worthy of Honourable Mention.

Some very capital specimens of various resins and gum-resins are exhibited in the interesting collection of the LONDON DRUG TRADE (Class II. 117, p. 199). These are especially valuable because several samples of each substance are shown, those of first-rate quality being contrasted with the ordinary commercial products. The Jury considered this part of the series well worthy of Honourable Mention.

In the very admirable and instructive collection of LIVERPOOL IMPORTS (see page 69, &c.) there is a numerous series of gums, resins, and gum-resins. The chief of these are enumerated in the following Table; the last column shows the quantity of each substance which has been imported into Liverpool during the last two years.

Name.	Plant which yields it.	Whence Imported.	1849	1850	
			Tons.	Tons.	Cwts.
Ammoniacum	Dorema ammoniacum	Bombay	14	17	0
Anime	Hymenæa courbaril	"	14	17	0
Assafœtida	Narthax assafœtida	"	7	2	0
" 2nd quality	" "	"	–	–	
Benzoin (drop)	Boswellia thurifera	"	–	–	
Benzoin	Styrax benzoin	Singapore	4	7	0
" 1st quality	" "	"	–	–	
" 2nd quality	" "	"	–	–	
" 3rd quality	" "	"	–	–	
" 4th quality	" "	"	–	–	
Black-boy resin	Xanthorhœa arborea	Swan River	–	–	
Burgundy pitch	Abies excelsa	Hamburg	–	0	10
Canada balsam	Abies balsamea	Quebec	–	0	17
Caoutchouc	Siphonea elastica	Maranham	40	500	0
Copaiba balsam	Copaifera sp.	Para	7	11	0
Copal, African	Hymenæa sp. (?)	Sierra Leone	14	17	0
Copal, New Zealand	Dammara Australis	New Zealand	14	17	0
Copal, Brazil	Trachylobium Martinianum	South America	–	8¼	0
Dragon's-blood	Dracæna draco	Calcutta	–	0	18
Dragon's-blood (tears)	Dorema ammoniacum	"	–	0	5
Elemi		Hamburg	–	0	17
Frankincense	Abies excelsa	"	–	0	6
Gamboge, pipe	Hebradendron	Africa	–	–	
Gamboge, lump		Siam	–	–	
Guaiacum	Guaiacum officinale	Jamaica	4	7	0
Gum-arabic	Acacia vera, Arabica, and other species	Turkey	27	32	0
Gum-arabic elect	" "	"	–	–	
Gum-barbary	Acacia gummifera (?)	Mogadore	–	–	
Gum-oomrawuttee	" "	East Indies	14	17	0
Gum-gedda	" "	Gedda	–	–	
Gum-senegal		Africa	–	–	
Gum-tragacanth, or dragon	Astragalus gummifera and other species	Smyrna	–	15	0
Gutta percha	Isonandra gutta	Singapore	200	280	0
Lac, stick	Coccus lacca	Calcutta	1	22	0

Name.	Plant which yields it.	Whence Imported.	1849	1850	
			Tons.	Tons.	Cwts
Lac, lump	Coccus lacca	Calcutta	90	440	0
Lac, seed	" "	"	10	16	0
Lac, plate	" "	"	–	–	
Lac, liver plate	" "	"	–	–	
Lac, garnet	" "	"	–	–	
Lac, livery orange	" "	"	–	–	
Lac, orange	" "	"	–	–	
Mastic	Pistacia lentiscus and atlantica	Constantinople	–	0	12
Myrrh	Balsamodendron myrrha	Persian Gulf	–	0	30
Myrrh	" "	Turkey	–	–	
Olibanum	Boswellia thurifera	East Indies	–	5	0
Peru balsam	Myrospermum peruiferum	Lima	–	0	2
Rosin, American	Abies sp. and Pinus sp.	United States	600	500	0
Rosin, American, pale	" "	"	–	–	
Sandarach, or Juniper	Callitris quadrivalvis	Mogadore	–	–	
Scammony, Virgin	Convolvulus scammonia	Smyrna	–	–	
"	" "	"	–	0	12
Turpentine	Pinus palustris	United States	100	120	0
Turpentine, common	" "	"	300	175	0
Turpentine, 2nd quality	" "	"	100	100	0
Yellow gum	Xanthorhœa hastilis	Swan River	–	–	

In the collection of imports, exhibited by the **HULL COMMITTEE**, there are samples of common turpentine and of rosin from the United States; of the former, about 30,000 barrels, and of the latter, about 2,000 barrels are annually imported into Hull. Turpentine is separated by distillation into oil or spirit of turpentine, sometimes called camphine, and resin or colophony. In its raw state turpentine is of very little use; it is chiefly important as yielding those substances.

The collection of gums and resins exhibited by the **EAST INDIA COMPANY** (pp. 376, 377) is very extensive and interesting, and forms an important division of the great collection of the raw produce of the Indian empire, for which the Jury have recommended the award of a Council Medal. The series is so numerous, and many of the substances which it contains are so little known in Europe, that it would hardly be possible, at present, to give any detailed report on the individual samples. In the following remarks, therefore, only a few of the more striking substances are noticed, whilst a great number of substances are necessarily reserved for future study and investigation. Even a slight examination of the natural raw produce of India shows the immense resources of the country; and when we remember the varied and abundant productions which may be had in almost unlimited quantities, and at very little more trouble than the mere cost of collection (for in such a soil and climate nature needs but little artificial aid), it is not saying too much to assert that no portion of the globe is more highly favoured by nature, or more able to supply those substances which minister to the wants and luxuries of mankind. With a fertile soil and a generous climate, vegetation of all sorts is rapid and luxuriant; and as labour is cheap and abundant, everything seems most favourable to agriculture and the growth of all vegetable products. There are, however, several great obstacles which have ever retarded the increasing prosperity of India, and which present the most serious difficulties in the way of its commercial development; especially the inert, careless, and indifferent habits of the natives, confirmed and kept up by religious peculiarities and long-established prejudices. Not only are the natives of India wholly ignorant of the value of many of the natural productions of the empire, and therefore quite indifferent to their very existence, but at the same time, also, the manufacturers of Europe being unacquainted with many of these substances, or being ignorant that they may be had in almost unlimited quantities from our eastern possessions, do not avail themselves of the advantages which are in fact within their reach. Many of the natural productions of India will unquestionably become important articles of trade to this country, when their value is better known; and this result, whilst advantageous to our own country, will, at the same time greatly benefit India, and will lead to the construction of good roads, or other modes of transit, by means of which, internal traffic, and the speedy, cheap, and safe carriage of merchandize may be effected. The continued and persevering efforts of European skill and capital, will no doubt in time, to a great extent, remove or diminish these obstacles; but, in the mean time, the evil effect which they produce on the natural advantages of the Indian empire is enormous.

Among the East Indian resins there are some interesting specimens of lac; the sample of shell-lac in large, thin orange sheets is of very superior excellence, and is altogether far above any met with in commerce.

The specimens of lac from Singapore, which is stated to be abundant in the jungles of the Peninsula, but has not hitherto been collected as an article of commerce, though not first-rate, are still highly commendable, and worthy of encouragement. The Jury deem them deserving of Honourable Mention.

Good samples of lac are also contributed from Bombay; from Ganjam, by **A. P. ONSLOW**; by **G. G. NICOL**, from Siam; from Nepal, by His Highness the **MAHARAJAH of NEPAL**; from Beerbhoom, specimens of the two varieties called bala and chauch; and from the Rajpootana States, samples of bur-lac, or lac produced on the *Ficus indica*, also lac from the *Ficus religiosa*, *Zizyphus jujuba*, and the *Acacia concinna* or *Mimosa abstergens*. An interesting series of samples from Assam, illustrating the formation, collection, and uses of lac, is contributed by **Dr. C. HUFFNAGLE**. For this series, together with several other small collections of raw produce shown in illustration of the native manufactures of India, the Jury awarded a Prize Medal to Dr. Huffnagle.

The samples of gutta percha from Johore, Malay peninsula, contributed by **W. KERR**, of Singapore, together with the illustrations of the native modes of working the substance, and the purposes to which it is applied, are interesting and important. It is to be regretted that the same careless and wasteful mode of collecting this valuable substance, is, for the most part, still employed, as was originally the case when it was first introduced into Europe eight years since by Dr. Montgomerie, of Singapore; namely, recklessly cutting down the large trees for the sake of a few pounds of the substance; from this, it naturally follows that the tree gradually becomes less abundant, and, consequently, ere long the price of the article will probably increase so much as to preclude it altogether from being used for many purposes. The Jury awarded a Prize Medal for this series. Some of the first samples of gutta percha (*Isonandra gutta*), sent over to the East India Company by Dr. Montgomerie, and for the introduction of which he received the Gold Medal of the Society for the Encouragement of Arts and Manufactures, in 1843, are exhibited by Col. **BONNER** of the East India House.

The specimen of gutta trap from Singapore, a substance evidently allied to gutta percha and caoutchouc, and employed there in the manufacture of bird-lime, is interesting. It is stated to be the inspissated juice of an *Artocarpus*; and it is highly probable that there are a number of similar vegetable productions, such as the Atti jegota, *Ficus racemosa*, and Mangegatu, *Ficus indica*, from Vizagapatam, which might be advantageously introduced into commerce, and which could be profitably employed in the arts for similar purposes to those for which caoutchouc and gutta percha are now so extensively employed. The Jury deemed the specimen of gutta trap worthy of Honourable Mention.

The samples of caoutchouc or India-rubber are of considerable interest: those from Sumatra and Java, in particular, are deserving of notice. A considerable number of specimens of caoutchouc from different localities, and prepared in different manners, is shown by Dr. Royle (p. 869), including samples of India-rubber, obtained from the *Ficus elastica* in Assam by Captain Veitch, and some prepared by Dr. Scott; and a portion of the wood and juice of the *Urceola elastica*, from Singapore, is contributed by W. Brockedon, as well as a young plant of the *Ficus elastica*. A good series of samples of the different forms of India-rubber, commonly known in commerce, is also exhibited by Messrs. Mackintosh, in illustration of the various useful and beautiful applications which are made of it in the arts. Many of the specimens of East Indian caoutchouc, however, show that unfortunate "tackiness" which so greatly diminishes the value of some forms of India-rubber. The samples from Assam, in particular, illustrate the great importance of care and attention in the preparation of caoutchouc: the specimens sent over some years since by Captain Veitch are of excellent quality, and have not undergone any change since they have been in England. They were evidently formed from many successive layers of sap, each layer being allowed to dry before a fresh one was applied. On the other hand, many of the more recent specimens are sticky and in a partially decomposing state. These have plainly been formed by the coagulation of a considerable bulk of the sap rapidly collected; a little time and attention have thus been saved, but at the sacrifice of the most useful properties of the caoutchouc. All samples of India-rubber from new localities, where there is any probability of a large quantity being obtained, are valuable.

In connexion with these specimens, particular attention should be drawn to the Cuttemundoo, or Kattimundoo, a highly-interesting substance exhibited from Vizagapatam by Mr. W. Elliott, and obtained from the Akoo Chenroodoo, or Bramha Chemoodoo, the *Euphorbia antiquorum* of Roxburgh. It is of a dark-brown colour, opaque except in thin pieces, is hard and somewhat brittle at common temperatures, but easily softened by heat; in boiling water it is perfectly insoluble, but it becomes soft, viscid, and remarkably sticky and adhesive, like bird-lime; as it cools it reassumes its original character. Heated, it melts and burns with a bright and smoky flame, at the same time giving out a peculiar odour, somewhat resembling that of burning caoutchouc or gutta percha.

This remarkable substance appears to be a hydrocarbon, closely resembling caoutchouc and gutta percha in chemical composition, but considerably different from both in physical characters. It is said to be used as a cement for joining metal, fastening knife-handles, &c.; and there is little doubt that it might be advantageously employed for a great number of purposes in the arts. Cuttemundoo merits a minute and careful examination; it promises to prove a valuable addition to the India-rubber series; and the Jury have accordingly awarded a Prize Medal to Mr. Elliott for its introduction.

Excellent samples of the different forms of caoutchouc usually met with in commerce, are shown by Lockington, Bunn, and Co. (Class XXVIII., 77, p. 1783); and some fine specimens of gutta percha, both in its rough state as imported, and also in the various stages through which it passes in the process of purification, are exhibited by the Gutta Percha Company (Class XXVIII., 85, pp. 1783, 1784): both these series of specimens, however, are merely shown in illustration of the various uses to which these substances are applied.

The sample of dragon's-blood from Sumatra, called Heraducean, being of superior quality, was deemed worthy of Honourable Mention.

Amongst the other collections of gums and resins, the specimens shown by J. Loch, Esq. (88, p. 669, &c.), and contributed by His Highness the Rajah of Travancore, are considered worthy of Honourable Mention. Besides these, the turpentine from Churra Poonjee, in the Dacca division (p. 669, &c.): the Bombax resin; the Saul gum, from the *Shorea robusta*, from Beerbhoom and from Bhaugulpore; the Theetske resin, from Arracan; the Kerelu resin, from Assam, contributed by Major Hannay; the Dammar, from Malacca, Sumatra, Java, and other places, deserve notice. The numerous series of resins, &c., from Sarawak must also not be omitted; the names of these are as follows:—

1. Melosampang.
2. Meruka.
3. Morkubong.
4. Mintangor jenkar.
5. Klabit.
6. Singut.
7. Menliarut.
8. Godoh.
9. Sampang.
10. Urat mata.
11. Liong sundok.
12. Mata kuchin.
13. Sarak balachan.
14. Neranli boya.
15. Supok.
16. Meng kabang.
17. Miniak kapur.
18. Rusuh.
19. Garmyong.
20. Sulutong.
21. Kandis.
22. Rabae-rior.
23. Gutta percha.
24. Taboo.
25. Gayu.
26. Bulan yok.
27. Gutta bintangor.

In the following list the chief Indian gums and resins, &c., are necessarily placed under one common head, as, without a minute examination, it would not be possible to class them more accurately.

1. Babool gum, gond babool, &c., obtained from the *Acacia arabica*, or babool tree; an inferior sort of gum-arabic from Bengal.

2. Gattie gum, a variety of the babool gum, largely produced in the Deccan, Concan, and Guzerat; well known in commerce as East Indian gum-arabic; a specimen is also contributed from Bombay.

3. Kheir gum, the produce of *Acacia catechu*, closely resembling the preceding; from the Rajpootana states.

4. Jumma jegota (*Acacia leucophlæa*); from Vizagapatam.

5. Keekur gond, babool tree (*Vachellia farnesiana*); from Bengal; both closely resembling the babool gum, and consequently varieties of arabic.

6. Wood-apple gum, obtained from the wood-apple, or *Feronia elephantum;* from Vizagapatam; a good and useful gum.

7. Margosa gum, from the margosa tree (*Melia azadirachta*); from Madura, Tinnevelly, and Palamcottah; inferior.

8. Mallaga jegota, from the *Moringa pterygosperma;* from Vizagapatam.

9. Pagada jegoto (*Mimusops elengi*); from Vizagapatam.

10. Tanjada jegota (*Cassia auriculata*); from Vizagapatam. These three appear likewise to be soft, with difficultly soluble, and inferior gums.

11. Ballee gond, or spurious tragacanth, obtained from the *Sterculia urens;* sent from Bombay.

12. Kuteera (*Cochlospermum gossypium*), like the preceding, a sort of inferior tragacanth; contributed from Meerut.

13. Vateria resin, an excellent resin obtained from the *Vateria indica*, from which it exudes as a balsam in a semi-fluid state, constituting the peynie varnish; it soon becomes hard when exposed to the air. This resin is shown both in the fluid state and also when solidified; from Malabar and Canara.

14. Dhoona, or Saul dammar, a good resin abundantly obtained from the saul tree (*Shorea robusta*), common in the northern parts of Hindostan; contributed by his Highness the Maharajah of Nepal, and from Bengal and Bhagulpore, in the Moorshedabad district.

15. Soondroos, or copal; imported from Africa through Arabia, and often called anime.

16. Guggilam (*Vatica tambugaia*); from Canara and Vizagapatam (p. 876).

17. Tendoo resin (*Diospyros sp.*); from the Rajpootana states.

18. Gaup resin, obtained from the Gaup tree (*Embryopteris glutinifera*); from Bhagulpore.

19. Mekae-sta Dhoona, or Kerelu resin; from Assam.

20. Odina resin, a resinous substance obtained from the *Odina Wodier*; from Calcutta and from Meerut.

21. Nareeda jegota (*Eugenia jambolana*); from Vizagapatam.

22. Olibanum, saleh gond, Loban (*Boswellia thurifera*); from Chota Nagpore, and Patna.

23. Cumbi resin, or Dikamali (*Gardenia lucida*); from Bombay.

24. Dammar (*Dammara orientalis*); from Malacca, Java, Sumatra, and Borneo.

25. Jilladi pulu (*Calotropis gigantea*); from Vizagapatam.

26. Ammoniacum; imported from Arabia.

27. Assafœtida (*Narthax assafœtida*); imported from Persia and Sindh.

28. Bdellium (*Amyris commiphora, Balsamodendron Agallocha*). Of this two or three varieties are exhibited: the solid gum resin, and an oleo-resin or balsam, said to be obtained from the same tree; the former is frequently met with in commerce, being falsely called "myrrh," and sometimes under the name of "galbanum."

29. Myrrh; imported from Africa through Arabia, &c.

30. Dragon's-blood; imported from Aden, also from Borneo.

31. Gamboge; from Singapore, Mysore, Canara, &c.

32. Camboley (*Morus indica*); from Paulghat.

34. Manudi jegota (*Mangifera indica*).

35. Dadinia jegota (*Punica granatum*); from Vizagapatam.

36. Benzoin (*Styrax benzoin*); from Sumatra; specimens of a similar resin, also called benzoin, are contributed from Malabar and Canara.

37. Storax; from Rajpootana states.

38. Turpentine (*Pinus Khasyana*); from Churra Poonjee, in the Dacca division, and from Ullwar.

39. Moochrus (*Bombax heptaphylla*), a gum; from Calcutta bazaars.

41. Manjegota (*Ficus indica*); from Vizagapatam.

42. Atti jegota (*Ficus racemosa*); from Vizagapatam.

43. Nepalapi pulu (*Jatropha curcas*); from Vizagapatam and Ganjam.

44. Coorg resin, a pale green and very excellent resin; from Coorg, contributed by His Highness the RAJAH of TRAVANCORE. It seems to deserve further inquiry and examination, as it might probably be well adapted for varnishes, &c.

Besides these, a very considerable number of other Indian resins, gums, and gum resins, is included in Dr. ROYLE's extensive collection of the raw produce of India; amongst these are many of the preceding ones, and also the following:—

45. Galbanum; from Surat.

46. Cherry gum (*Prunus puddum*); from Surat.

47. Sem ke gond, or gota gond (*Bauhinia Vahlii*); from Deyra and Rajpore.

48. Labdanum, or ladun (*Cistus ladaniferus*); from Surat.

49. Mastic, or mustagee (*Pistacia lentiscus*); from Caubul.

50. Scammony, or sukmoonya (*Convolvulus scammonia*); from Surat.

51. Kunnee gond, or jingun ke gond (*Icica resinifera*); from the Khera Pass.

52. Toon ke gond (*Cedrela toona*).

53. Sohunjue ke gond (*Moringa pterygosperma*).

According to Mr. Thomas, the "gum" of Coimbatore is a mixture of various gums and resins: he mentions twenty-four different plants, the natural exudations of which are collected; and he observes that they are said to be nearly all collected promiscuously, and sold in the aggregate as gum—the mass being, of course, very impure; but that, when dissolved in a large quantity of water, and strained through a fine cloth, it yields a solution from which a good and very adhesive gum may be obtained by evaporation. The plants from which these various substances thus associated together are collected, are, according to Dr. Wight—

Vilvey pissin	Ægle marmelos	Good arabic.
Avarum pissin	Cassia auriculata	Brown and soft.
Vullam pissin	Feronia elephantum	Good arabic.
Vel Vaila marum	Acacia ferruginea	Inferior.
Vaypum marum	Melia azadirachta	Tolerable.
Mah marum	Mangifera indica	Inferior.
Curvalala marum	Acacia arabica	Inferior.
Ellipie marum	Bassia longifolia	Inferior.
Yellandie marum	Zizyphus jujuba	Not a true gum.
Murungoo pissin	Moringa pterygosperma	Soft, difficultly soluble.
Kerray vaugay marum	Acacia odoratissima	Tolerable.
Vellay nagah marum	Conocarpus latifolia	Tolerable.
Choar Kullie marum	Soymeda febrifuga?	Tolerable.
Mullee vemboo	Melia azadirachta	Inferior.
Vellay bootallie	Sterculia urens	Inferior tragacanth.
Vengay marum	Pterocarpus marsupium	Inferior kino.
Kodawah porsh	Chloroxylon Swietenia	Inferior.
Cat oolungoo marum	Bombax malabaricum	Good colour, but inferior.
Carabemboo marum	Garuga pinnata	Inferior.
Vunny marum	Prosopis spicigera	Good arabic.
Curun Gallie marum	Acacia sundra	Very good arabic.
Vidah vullie marum	Vachellia farnesiana	Soft, red, inferior.
Wadallee marum	Acacia catechu	Inferior.
Peru marum	Ailanthus excelsa	A resin.
Woody marum	Odina Wodier	Tolerable.
Narvallie marum	Cordia Rothii	Inferior.

From this list it is evident how much the value of the good gum must be deteriorated by the inferior gums and resinous matter mixed with it: a little care in the collection, only the better sorts being chosen, would be amply repaid by the increased value of the article.

The very remarkable wood-oils and native varnishes of India, obtained from various species of *Dipterocarpus*, belong properly to the "resin" series, and may therefore be mentioned here in connexion with the balsams and oleo-resins. These curious substances, though fluid when first obtained, soon harden and solidify (p. 876); they constitute the basis of the best Burmese and other eastern varnishes and lacquers. Specimens of the Thetsee, *Melanorrhœa usitatissima*, employed as a lacquer, from Arracan; of the Thenakthu, also used in Arracan, in the manufacture of *papier-maché* work, and in rendering umbrellas water-proof; and of the Gurjun, or wood-oil, from various *Dipterocarpi*, from Madura, Tinnevelly, Chittagong, Pegu, and Mahurmanee, are shown. The "Theet-see," or varnish-tree of the Burmese, is spread over a wide range of country extending from Munipur (lat. 25° N., long. 94° E.) to Tavoy (lat. 14° N., long. 97° E). It attains its greatest size in the valley of Kubbu, distant about 200 miles from the sea-shore. The trees average from 30 to 40 feet high, and have a circumference of from 5 to 11 feet, 4 feet above the ground. A good tree yields about 10 or 12 lbs. of varnish, annually, and its value at Prome, on the Irawaddi, is about 10*d.* the pound: it is used in enormous quantities by the natives. Dr. Wallich states that the natives never experience those deleterious effects from handling the varnish in its liquid state which Europeans generally suffer: in its fresh state it has very little pungency of taste, and is altogether devoid of smell. The natives are very apt to adulterate that brought to market with sesamum oil. The "Gurjun-tree," which flourishes in the same districts, and especially in the valley of Kubbu, attains very large dimensions: Captain Grant describes it as having a straight stem of more than 40 feet to the first branch, and a circumference of 13 feet and upwards.

Samples of the empyreumatic oil of teak-wood are contributed by W. P. Horsley, from Palamcottah. Two remarkable oils, apparently analogous to the wood-oils, are contributed from Coorg, but without any information; one of these, a thick blood-red oil, is stated to be obtained from the *Rottlera tinctoria*.

Interesting specimens of the "Calambak" or eagle-wood, the true lignum aloes or *Lignum paradisi*, so highly esteemed in the East as a perfume or incense, are shown in the East Indian collection. This remarkable wood, which contains a large quantity of an odoriferous oleo-resin, is called "Kayu Garu" in the Indian Archipelago, and is produced by the *Aloexylum agallochum*, Lour.: when heated it undergoes a sort of imperfect fusion, and exhales a fragrant and very agreeable odour. Its price in Sumatra is about 30*l.* per cwt.: inferior specimens are likewise contributed from Malacca. Eagle-wood is also obtained from several other trees, as from the *Aquilaria agallocha* in Silhet. The true eagle-wood is, however, very scarce.

The specimens of African gums and resins from Aden, sent by the Bombay Committee, and exhibited in the East Indian collection, are remarkably fine. The samples shown are varieties of myrrh, olibanum, dragon's-blood, and gum-arabic.

The collection of gums and resins exhibited by T. A. Pieris, of Kandy (p. 938), is interesting; unfortunately, it is not accompanied by any botanical or statistical information, which considerably diminishes its practical value. The specimens shown are labelled—

1. Diwol gum.
2. Devul gum.
3. Gokhuto gum.
4. Kekuna gum.
5. Dammar.
6. Kobombe gum.
7. Othium gum.
8. Kos gum.
9. Hick.
10. Gamboge.
11. Hildummele gum.
12 Cadjic gum.

Of these specimens it may be observed that No. 2 seems to be excellent gum "arabic;" No. 7 resembles inferior gum-arabic; and No. 1 appears to be a variety of "Cherry-tree gum;" Nos. 4, 8, 9, and 11 are resins, and apparently not of any great value; No. 3 seems to be a kind of gamboge; No. 10 is gamboge, probably obtained from the *Hebradendron cambogoides*, and No. 12, though it seems to be a difficultly-soluble kind of gum, like Nos. 1 and 7, is remarkably pure and of good colour. The Jury deemed this series worthy of a Prize Medal, in conjunction with the collection of oils from Ceylon, also shown by the same exhibitor (see p. 82).

Very few specimens of African gums or resins are shown. A tolerable sample of the gum of *Acacia horrida*, and a fair specimen of mixed gum arabic from the Cape of Good Hope, is exhibited (p. 952). Mr. Warwick Weston exhibits a fair sample of "copal" from the western coast. There are also shown a fine sample of gum-arabic from Ayer and Touat; a light-coloured resinous substance resembling copal, from Abbeakuta; a black, pitch-like matter from Timbuctoo, called Bekhouri or incense; and a resin used by the natives of Bornou as incense, and called Omm-el-barker, or "the mother of blessing."

T. B. Duggin (49, p. 980) exhibits a fine sample of anime, said to be abundantly produced by the simiri, or locust-tree, on the river Berbice: this was deemed worthy of Honourable Mention.

A specimen of Hawai gum, a variety of frankincense, from the river Demerara, is shown by J. Outridge (51, p. 980), who also shows a sample of indifferent caoutchouc, from the Demerara river (47, p. 980). G. R. Bonyun (50, p. 980) exhibits some Karman, a black resinous substance, said to be the inspissated exudation of the mannee-tree, and used by the fishermen on the river Essequibo to preserve their nets: it has, however, the appearance of being an artificial compound, containing wax. A good sample of balsam of copaiba, from the Pomeroon river, Essequibo, is exhibited by J. S. Stutchbury (46, pp. 979, 980).

Fine specimens of anime from the locust-tree (*Hymenæa courbaril*), from Arima (p. 973), and also of incense (*Trichilia trinitenis*), are shown in the collection of raw produce of Trinidad, sent by his Excellency Lord Harris, the Governor (see p. 71).

Several good specimens of resin and gums are shown in the Australian and Van Diemen's Land collections, including the gums of the black and silver wattle, *Acacia mollissima* and *dealbata* (No. 296, p. 998), shown by Lieutenant Smith, R.N., deemed worthy of Honourable Mention; and other varieties of gum-arabic; and some fine samples of the Grass-tree gum, or "Black-boy gum," the resin of the *Xanthorhœa Australis*. The specimens of Australian gums and resins exhibited by the Colonization Assurance Corporation are particularly fine; including several varieties of arabic, or acacia gums, and the Xanthorhœa resins, they form part of the collection for which the Jury have awarded a Prize Medal (see p. 71).

The resins shown by J. Milligan, of Flinders' Island, Bass's Straits, including specimens of the "Black-boy gum" (Xanthorhœa resin, 81, p. 994); the fine pale resin of the Oyster-bay pine (*Callitris Australis*), from the eastern coast of Van Diemen's Land, and the *Acacia mucronata* gum, also from Flinders' Island (254, p. 997), were likewise deemed worthy of Honourable Mention.

A fine sample of Kauri, or cowree copal, the produce of *Dammara Australis*, a very beautiful resin from New Zealand, exhibited by W. Brown (16, p. 1001), was deemed worthy, by the Jury, of a Prize Medal. It is stated that this resin may be obtained, in any quantity, in the northern parts of New Zealand, ranging from 20 miles south of Auckland to the North Cape. A small sample of this resin, exhibited by G. M. Mitford, was deemed worthy of Honourable Mention.

Some excellent specimens of lac, benjamin, dammer, gutta percha, and caoutchouc, &c., from the Eastern Archipelago, are exhibited by Messrs. W. P. Hammond and Co. (p. 988), in the collection of raw produce, for which a Prize Medal has been awarded by the Jury (see p. 71).

Dr. Feuchtwanger, of New York (469, pp. 1464, 1465), has shown a very excellent specimen of bleached shell lac. This was deemed deserving of Honourable Mention.

In the Mexican collection is a sample of a remarkable orange-coloured resin, called Pipitzahuac, but of which no particulars are given.

The Egyptian collection of raw produce, for which, as a whole, a Prize Medal has been awarded by the Jury (see p. 71), contains some good specimens of gum (120, 121, p. 1409). The selected gum of Sennaar is of excellent quality, and was deemed worthy of Honourable Mention.

The purified turpentine shown by J. F. Fleury, of Bordeaux (214, p. 1184), prepared by a patent process, was found to be excellent, and therefore deemed worthy of Honourable Mention.

A fine sample of copal, from Angola, shown in the Portuguese collection by F. R. Batalha (458, p. 1313), was also deemed worthy of Honourable Mention.

An excellent series of specimens of turpentine, and of the resins and volatile oil obtained from it by distillation, is shown by Flores, Calderon, & Co., of Burgos (241,

p. 1344). It was deemed deserving of Honourable Mention.

In the Turkish collection, very good samples of the ordinary gums and resins for commerce are shown, including the following:—

1.	Gum-arabic	Egypt.
2.	,, ,,	Tripoli.
3.	Gum-tragacanth	Damascus.
4.	,, ,,	Sparta.
5.	Gum cherry-tree	Damascus.
6.	Caramaniacum	Koniah.
7.	Pine resin	Asia Minor.
8.	,, ,,	Smyrna.
9.	,, ,,	Broosa.
10.	,, ,,	Koniah.
11.	,, ,,	Berkoftcha.
12.	,, ,,	Wallachia.
13.	,, ,,	Tripoli.
14.	Mastic	Scio.
15.	,,	Koniah.
16.	Sandarach	Kaissarich.
17.	Storax	Smyrna.
18.	,, liquid	Asia Minor.
19.	Balm of Mecca	Mecca.
20.	Labdanum	Rhetino.
21.	Libanum	Arabia.
22.	Resin (?)	Anatolia.

The samples of arabic and of mastic are excellent. It is stated that the resin from Anatolia is used for making the handles of knives, and for similar purposes.

STARCH SERIES.

In examining the starch series, or rather the starch and starch-gum or dextrine series, the Jury have only taken notice of those substances prepared especially for manufacturing purposes, or which they conceived might be advantageously employed by manufacturers. They have altogether passed over those forms of starch and farina intended, specifically, as articles of food, or which, from their cost or the mode in which they were prepared, would not be suitable for the former purposes.

The specimens of starch from rice, exhibited by Messrs. **ORLANDO JONES** & Co. (Class III., 128, p. 208), are remarkably good. Rice contains, on an average, about 84 per cent. of starch; but, till comparatively a few years ago, no starch was manufactured from it, notwithstanding its low price and the large quantity of starch which exists in it. The reason of this was, that the old process of fermentation, by means of which starch is procured from grain, was not found to be applicable to rice; and hence the latter only became available as a source of starch in 1840, when Mr. O. Jones introduced his new process, for which he obtained a patent. This process consisted in macerating the rice for about 20 hours in a dilute solution of caustic potash, containing about 200 grains of the alkali in every gallon; the liquor is then drawn off, the rice dried, reduced to powder by grinding, then a second time digested in a similar alkaline lye for 24 hours, repeatedly agitated: after this it is allowed to settle, and well washed with pure cold water. The Jury awarded a Prize Medal to Mr. O. Jones for his rice starch.

Mr. S. **BERGER** (Class III., 130, p. 208), of Bromley, also exhibits starch prepared from rice, which is of similar excellence, though said to be prepared in a different manner. In place of employing a dilute solution of caustic potash to dissolve the "gluten" and other insoluble matters of the grain, Mr. Berger uses a solution of carbonate of soda, containing half-a-pound to the gallon. The rice is steeped in cold water for 48 hours; levigated in a suitable mill; and the pulp thus formed is treated with the solution of carbonate of soda for 60 or 70 hours, being repeatedly stirred: it is then allowed to settle for some hours, the alkaline liquor is drawn off, and the starch is washed and purified. This process was patented by Mr. Berger in December 1841. The Jury awarded a Prize Medal to Mr. Berger for his rice starch.

A third series of samples of rice starch, also prepared by a different process, is exhibited by Messrs. J. and J. **COLMAN** (Class III., 117, p. 207), who also show good specimens of ordinary wheat starch, and dextrine or British gum. In February, 1842, Mr. Colman took out a patent for the manufacture of starch from rice, by the action of dilute muriatic acid, which was employed for the same purpose as the caustic potash and carbonate of soda in the patents of Messrs. O. Jones & Berger. The samples exhibited by Messrs. Colman are excellent, and the Jury consequently awarded to them a Prize Medal.

Some very good specimens of starch and starch-gum are exhibited by R. G. **TUCKER**, of Lenton, near Nottingham (Class III., 121, p. 207). The former in the state in which it is used by the Nottingham lace-dressers; the latter, as it is obtained by the action of a carefully-graduated temperature in starch; fit for the use of dyers, who use it to give body and thickness to the colours which they employ in dyeing cotton, woollen cloths, and silk. It is also used by paper-stainers, or printers; and as a cheap but strong gum in the manufacture of adhesive labels. The specimens shown by Mr. Tucker are excellent, and the Jury awarded to him a Prize Medal.

In the preceding cases, account has been taken not merely of the superior excellence of the samples of starch, but at the same time the Jury have also taken into consideration the novelty or ingenuity of the process, and other circumstances which appeared to them to demand peculiar notice. The specimens shown by Messrs. **BROWN & POLSON**, of Paisley (Class III., 123, p. 208), consisting of several varieties of starch and dextrine from wheat, potato, and sago, are good, and deserve Honourable Mention. The preparation of starch from sago, or rather the purification of sago meal, which consists chiefly of starch, is now carried on to a very considerable extent. Messrs. Brown & Polson appear to have been the first to employ chemical means in bleaching or improving the colour of sago-meal, and by the introduction of certain improvements in this process they succeeded in rendering the bleached starch more perfectly soluble in water than it is in its ordinary state. The samples exhibited by Messrs. **RECKITT & SON**, of Hull (Class III., 125, p. 208), of the same substances, are also deserving of Honourable Mention. The other samples of starch shown in the English Department are all good; and several of them, indeed, judged merely for quality alone, are excellent. Some very beautiful starch, prepared from sago, is shown by R. **WOTHERSPOON**, of Glenfield, near Paisley (Class III., 124, p. 208). The Jury deem these, and likewise the samples of potato-starch shown by E. **TUCKER**, of Belfast (Class III., 122, pp. 207, 208), each deserving of Honourable Mention.

The Jury also deem worthy of Honourable Mention, the specimens of starch shown by Messrs. **SHAND and MUCKART**, of Montrose (Class III., 126, p. 208); and that of A. **STENHOUSE**, of Perth (Class III., 154, p. 193*).

An excellent series of specimens of starch from various sources is exhibited by Messrs. D. and W. **MILLER**, of Musselburgh, near Edinburgh (Class III., 127, p. 193*). The Jury considered these, as well as the specimens of starch and dextrine shown by C. **COONEY**, of Dublin (Class II., 70, p. 200*), and those of H. C. **JENNINGS**, of London (Class II., 99, p. 197), severally deserving of Honourable Mention.

In the collections of the **HONOURABLE EAST INDIA COMPANY** (pp. 874, 875), there are several samples of starch suitable for manufacturing purposes; and there is little doubt that they might be prepared in any quantity, and sent over at a low price, as the Rajah of Vizianagram states that any quantity of excellent arrowroot may be had in the northern Circars for about 4*s.* 6*d.* per cwt.

The specimen of Maranta starch, or arrowroot, of Messrs. **COCKBURN**, of Moorshedabad (pp. 874, 875), is particularly fine, and the Jury accordingly awarded to it a Prize Medal.

The Cassava starch, or fecula of the *Jatropha*, exhibited by Messrs. **SPEEDE**, of Calcutta (pp. 874, 875), was also found to be remarkably good, and the Jury accordingly awarded to it a Prize Medal.

Good specimens of sago, and sago-meal or flour (pp. 874, 875), obtained from the sago-palm, *Arenga saccharifera* (*Saguerus Rumphii*), are contributed from Sumatra, Singapore, and Cuttack.

Besides these, good samples of similar kinds of starch are exhibited by T. Oxley, of Singapore (pp. 874, 875), from various parts of the Indian Archipelago, Borneo, Moluccas, Java, Singapore, &c., and by other individuals from Calcutta, from Assam, from Cuttack, Vizagapatam, Tenasserim provinces, Rhutnagherry, &c.

Some good specimens of starches are also shown in the Ceylon Department (p. 937), especially arrowroot, and the fecula of the *Jatropha*.

From Western Africa, a fair sample of arrowroot, together with the plant from which it is obtained, is shown by Warwick Weston (1, p. 952).

In the Canadian Collection, J. Prendergast (125, p. 966) exhibits two specimens of starch, apparently prepared from wheat, one being white, and the other coloured blue, for domestic use. These are both very good, and the Jury deemed them worthy of Honourable Mention.

A specimen of starch from potatoes is also shown by Brunsden & Shipton, of St. Hilaire (128, p. 966). This also was deemed worthy of Honourable Mention.

In the excellent collection of raw produce from British Guiana, sent over by the Royal Agricultural and Commercial Society of the Colony, and for which the Jury have awarded a Prize Medal (see p. 71), there are two specimens of starch which are peculiarly deserving of notice: these are, starch from the bitter cassava, and arrowroot, prepared by H. T. Garnett, of Herstellung River, Demerara (31, p. 979), for this the Jury awarded a Prize Medal; and for the starch from the sweet cassava, plantain and buck yam, from the eastern coast of Demerara, exhibited by D. Shier (33-35, p. 979), the Jury also awarded a Prize Medal.

Very fine samples of arrowroot and other starches are shown in the collection of Trinidad raw produce, transmitted by the Governor, Lord Harris. The samples of cassava or Jatropha starch, arrowroot, and Tulima or Tous-les-mois, are excellent (p. 974), and were considered especially to deserve Honourable Mention. It is stated that the cultivation of the cassava from which this starch is obtained is found to be very profitable, the yield being from one to two tons per acre.

Two good specimens of arrowroot from Bermuda are shown: the Jury deemed that of — Gray (1, p. 971) worthy of Honourable Mention.

Some fine arrowroot from Norfolk Island is exhibited by Sir W. T. Denison (25, p. 993), and a very good sample of starch, apparently from wheat, is shown by W. Murray, of Hobart Town (18, p. 993). The Jury deemed both of these specimens worthy of Honourable Mention.

The Oswego Starch Factory, of New York (104, p. 1440), shows some samples of starch manufactured from maize or Indian corn, of superior quality, for which the Jury awarded a Prize Medal.

Some very fine samples of pearl starch are also shown by W. Colegate & Co., of New York (301, p. 1453): to these, likewise, the Jury awarded a Prize Medal for excellence.

An interesting series of flour and starch prepared from maize is contributed by B. B. Kirtland, of Greenbush, New York (84, p. 1438). Among these samples of the various products obtained from maize are specimens of oil.

Good specimens of dextrine or starch-gum are shown by S. Engelmann, of Karalinenthal, near Prague (Austria 22, p. 1008). The Jury awarded a Prize Medal for these preparations.

Several samples of starch are shown in the Belgian collection. Especially deserving of notice is the starch prepared from maize by C. Van Geeteruyen, of Staume (East Flanders 489, p. 1166). The Jury awarded to this a Prize Medal.

Very good potato starch, prepared from diseased potatoes, is shown by Docquir & Parys, of St. Josse-ten-Noode, near Brussels (68, p. 1153). This was deemed deserving of Honourable Mention.

The samples of white and blue starch manufactured by H. Bocken & Co. (73, p. 1153); the potato-starch of C. Van Bunnen, of Bruges (74, p. 1153); and the potato-starch of G. Blyckaerts,* of Tirlemont (78, p. 1153), were also good, and the Jury deemed them severally deserving of Honourable Mention.

In the French Department there are several exhibitors of starch and starch-gum, derived from different sources. Amongst the specimens most deserving attention is the starch shown by L. Ruez, of Cambrai (363, p. 1194): to this the Jury awarded a Prize Medal.

An excellent series of starches and dextrines, manufactured for the use of calico-printers, is shown by J. J. Steinbach, of Rouen (382, p. 1195): the Jury considered these of superior quality, and accordingly awarded to them a Prize Medal.

A very superior sample of starch is likewise exhibited by Belleville Brothers, of Nancy (1078, p. 1229); for this also the Jury awarded a Prize Medal.

Good samples of well-prepared potato starch are shown by H. Lebleis, of Pont l'Abbé, Finistère (570, p. 1205), and by L. Le Paisant, also of Pont l'Abbé (590, p. 1206). A good specimen of wheat starch is exhibited by Vézon Brothers, of Ligugé, Poitiers (1520, p. 1249), and some well-manufactured starches from wheat and potatoes are shown by H. Bleuze, of Paris (1091, p. 1238), and some excellent dextrine by M. Augan, also of Paris (12, p. 1170). The Jury deemed these five severally worthy of Honourable Mention.

Starch obtained from a species of *Canna* (*C. discolor*) is shown by M. Chapel,* of Kouba in Algeria (16, p. 1260). This, though exhibited really as an article of food, the Jury deemed worthy of Honourable Mention in connexion with the other forms of starch suitable for manufacturing purposes.

A considerable number of specimens of starch, &c., are shown in the collection of the Zollverein States, and several of them are of excellent quality. In particular, the wheat starch manufactured by J. C. Haller, of Halle (690, p. 1088), is deserving of special commendation, and the Jury accordingly awarded to it a Prize Medal.

The "improved" potato starch manufactured by A. C. Welcker, of Wallersheim, near Coblentz (331, p. 1069), and said to be extensively used for stiffening muslins, is likewise highly deserving of praise, and the Jury, therefore, awarded a Prize Medal to it.

The Jury also award a Prize Medal to A. Werth and Co., of Bonn (333, p. 1070), for their superior potato starch.

Samples of wheat starch, manufactured by A. T. Kruse, of Stralsund (19, p. 1049), C. G. Kramsta and Sons (128, p. 1055), and by Burre and Küster, of Lübeck (827, p. 1095), were severally deemed worthy of Honourable Mention.

Starches prepared from potatoes by L. von Uechtritz, of Mühlrädtlitz, in Silesia (21, p. 1069), by L. Eipenschleid, of Neuwied (330, p. 1069); and the sago and potato starch of F. Wahl,* of Neuwied (332, p. 1070), were also deemed, each of them, deserving Honourable Mention. Some good samples of potato starch, and starch gum, are also shown by the Loburg Factory at Magdeburg (694, p. 1088).

In the collection from the Netherlands, three exhibitors of starch appear especially deserving of notice. The samples of starch manufactured by C. C. Prins, of Wormerveer (12, p. 1143), are excellent, and the Jury accordingly awarded to them a Prize Medal.

The specimens of potato starch, and dextrine prepared from it, exhibited by Schöneveld and Westerbaan, of Gouda (13, p. 1143), were also judged superior, and a Prize Medal was accordingly awarded for them.

A capital sample of potato starch is likewise shown by Visser, Nolet, and Co., of Scheidam (15, p. 1143). This the Jury deemed worthy of Honourable Mention.

Amongst the small series of the natural productions of the Island of St. Domingo, exhibited by Sir R. Schomburgk (see p. 71), is a sample of starch prepared there from a plant called "guayiga" (p. 1429), a species of *Zamia*, and which is stated to be abundant. This specimen the Jury deemed worthy of Honourable Mention.

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* Awarded also by Jury of Class III.

Some good samples of starch are shown by D. G. **Mirat**, of Salamanca (128, p. 1337).

Two specimens of starch in the Portuguese Department are found to merit notice, namely, the starch from Estremadura, exhibited by MM. **Holbeche** (454, p. 1313), and the starch from Alemtejo, Evora (453, p. 1313): the Jury deemed both these deserving of Honourable Mention.

In the Russian collections, there is a good sample of potato starch exhibited by **Yurghenson**, of Marieno, in the government and district of Novgorod (72, p. 1368); also a specimen of dextrine prepared from potato starch, in the district of Shatzk, government of Tamboff, exhibited by the Prince V. **Volkonsky** (70, p. 1363); some samples of starch and dextrine, manufactured by **Verdan** and Co., of Moscow (30, p. 1367); and some excellent wheat starch exhibited by C. **Roterman**, of Reval (71, p. 1368). The Jury deemed these, severally, deserving of Honourable Mention.

Section 2.—Oil Series.

Notwithstanding the great importance of oil, and the number of purposes to which it is applied in the arts and manufactures, comparatively few English exhibitors have contributed specimens, independent of those sent in illustration of the manufacture of candles, all of which, as already stated, have been referred to Class XXIX. This is certainly remarkable, when we remember the large quantities of oil annually imported, and the extensive use of it in the arts of candle and soap making, for burning in lamps, for diminishing friction in machinery of all kinds,—and especially for locomotives;—in wool dressing, in the manufacture of paints and varnishes, as an article of food, for medical purposes, &c. Oils are generally divided into the fat or fixed oils, and the essential or volatile oils; the former class being again subdivided, into fixed greasy oils and drying oils; and, lastly, the fixed greasy oils are separated into those which are usually fluid at all ordinary temperatures, and those which are generally solid, the latter being called tallows, butters, or solid oils. The quality of any oil depends, in part, on the nature and goodness of the seed or nut from which it is expressed; but it is influenced far more by the process employed in its extraction; the value of the oil for many purposes depending on its purity, or the absence of foreign matter derived from the seed, and consequently being greatly affected by the conditions under which it is expressed, the mode in which the seed is crushed, the kind of press employed, and, above all, the temperature at which it is pressed.

Among the oils (of which there is a very great number), there are several which are admirably suited for various purposes, but which, nevertheless, on account of their price, depending, generally, on local circumstances, such as cost of freight, &c., are very little or not at all used by our manufacturers. The knowledge, however, that such oils may, at any time, be procured in large quantities, is of great practical value; because, not only is it possible that, by the introduction of improved machinery, or by increased facilities of conveyance, their price may be reduced; but the very existence of such substances tends to equalize the market value of those oils now generally employed—and should, at any time, accidental circumstances cause the price of the latter to advance, these substances would then be most advantageously introduced, and would probably, ere long, altogether supersede the oils in the place of which they had been originally imported. Thus the price of tallow is, to some extent, regulated and kept in check by that of palm and cocoanut oil; and should the value of the latter oils at any time rise, there are a number of other solid vegetable oils, equally good for all practical purposes, which with a very little trouble might be had in almost any quantity. There are, however, some special purposes in which oils are used, for which it would not be so easy to find good substitutes; such, for example, as the lubrication of fine machinery, and the operations of the wool-spinner. It is probable that, among the numerous little-known oils of tropical countries, there may be many as well suited for both of these purposes as those now generally employed; good specimens of new oils are, therefore, always of considerable practical interest. Whilst, on the one hand, it is desirable to draw the attention of manufacturers and consumers to the numerous foreign and colonial oils not at present imported into this country,—it is at the same time also useful to point out how greatly the value of such oils depends on the care bestowed on their preparation, especially as regards cleanliness of the seed, and the exclusion of impurity of all sorts in the process of extracting the oil.

Of the six principal vegetable oils, namely, palm, cocoanut, castor, olive, linseed, and rape, the first four are imported in the state of oil, only; the two last chiefly as seed: the proportion in which they were imported in the year 1850, is shown in the following Table; and if to these quantities are added about a million and a half cwts. of tallow, and about 20,000 tons of whale oil and spermaceti, they will nearly represent the total quantity of oil imported into Great Britain.

	Linseed.	Rape-seed.
	Qrs.	Qrs.
From Russia - - - -	482,813	3,235
Sweden - - - -	870	-
Norway - - - -	268	-
Denmark - - - -	37	3,092
Prussia - - - -	87,273	645
Hanse Towns - - -	1,153	2,872
Holland - - - -	7,734	201
Naples - - - -	1,476	-
Austrian Territories -	40	2,480
Greece - - - -	-	1,637
Wallachia and Moldavia	910	1,280
Egypt - - - -	17,517	-
East Indian Empire -	26,142	13,126
Miscellaneous - - -	262	922
Total - - -	626,495	29,490

The quantity of the four principal vegetable oils annually imported into Great Britain is shown by the following Table:—

	1848	1849	1850
Palm Oil - -	510,218 cwts.	493,331 cwts.	448,589 cwts.
Cocoa-nut Oil	85,463 "	64,452 "	98,040 "
Castor Oil -	4,588 "	9,681 "	-
Olive Oil - -	10,086 tuns.	16,964 tuns.	20,783 tuns.

The proportion in which these oils were furnished by various countries in 1849 was:—

	Palm Oil.	Olive Oil.	Castor Oil.
	Cwts.	Tuns.	Cwts.
From Western Africa -	475,364	1	-
United States -	13,349	-	290
Naples and Sicily	14	9,661	-
East Indies - -	-	-	9,315
Canary Islands -	3,719	-	-
Malta - - -	-	2,237	-
Turkish Empire -	-	1,712	-
Tuscany - -	-	832	-
Spain - - -	-	753	-
Brazil - - -	525	-	-
Ionian Islands -	-	506	-
Morocco - -	-	368	-
Madeira - -	353	-	-
Sardinia - -	-	333	11
Miscellaneous -	7	461	65
Total - -	493,331	16,864	9,681

An interesting and valuable series of specimens of cotton seed, and of the oil and cake obtained from it, after the expression of the oil, is shown by R. **Burn**, of Edinburgh (Class III., 68, p. 204). The oil of cotton seed has been made in small quantities for a considerable number of years. In 1785, the Society for the Encouragement of Arts and Commerce offered a prize for its manufacture on a large scale; but it does not seem to have been then taken up extensively, probably in consequence of the difficulty of purifying it. It has, however, been extracted, for some time, in Egypt, America, and India. Of late years this oil has attracted a good deal of attention; and means have been devised of purifying it, and removing the dark colour which it possesses in the raw state. Very large quantities of cotton seed are destroyed every year; as far more seed is produced than is required for the next year's crop: this, for the most part, has hitherto been thrown away as useless, or used as manure; its value is now, however, so far acknowledged, that in some places it is collected and exported for the manufacture of oil and oil-cake. The oil seems to be well worthy of attention. The Jury consider the specimens shown by Mr. **Burn**, valuable and instructive, especially as they are accompanied by much useful information, and they therefore awarded to him a Prize Medal.

Some very good samples of rape, olive, and almond oil, are exhibited by Messrs. W. **Brotherton** and Co. (23, p. 196*), including specimens of rape-seed, both of English and foreign growth, in its natural state, and as prepared for pressing. The exhibitor has found good rape oil to be better suited than any other oil, for the lubrication of machinery, when properly purified from the mucilage, &c., which it contains in the raw state. Rape oil is now used, extensively, for locomotives, for marine engines, and also for burning in lamps. It is stated that a locomotive consumes between 90 and 100 gallons of oil yearly; and the annual consumption of oil by the London and North Western Railway for this purpose alone is more than 40,000 gallons. Mr. Brotherton finds, that good English-grown rape yields oil of superior quality to any foreign seed which he has tried; and he consequently recommends its cultivation to agriculturists: he states that an acre of land yields nearly five quarters of seed, worth at present 50*s*. per quarter. The inferiority of the oil obtained from Indian or colonial seed, probably depends on the want of sufficient care being paid to the purity and cleanliness of the seed itself, and not on any real deficiency in the oil. The Jury deemed these samples worthy of Honourable Mention.

Specimens of purified oil, employed for lubricating machinery, and in perfumery, are shown by F. **Hillas** (28, p. 197*). The oils are remarkably well purified, nearly colourless, and apparently devoid of all impurity; the Jury, therefore, awarded a Prize Medal.

Specimens of essential oils, including sweet oil of turpentine, are exhibited by **Barker** and Co. (62, p. 199*).

Refined oil, prepared for the use of watch and clock makers; and suitable for lubricating delicate machinery, is shown by W. A. **Breakey** (Class II., 80, p. 196).

Good samples of linseed and rape oils are contributed by **M'Garry and Sons** (Class III., 132, p. 208).

Fine specimens of various volatile oils, especially the oil of cinnamon leaf, are included in the collection of the **London Drug Trade** (Class II., 117); and a good sample of English attar of roses is exhibited by J. **Bell** (Class II., 116, p. 199).

Specimens of clarified oil for machinery, and for burning in lamps, are contributed by W. A. **Rose** (Class IV., 27, p. 197*).

Samples of vegetable oils are shown by T. **Peterson** (Class III., 66, p. 204).

A good specimen of bleached linseed oil, for the manufacture of varnish, is exhibited by H. **Penney** (Class IV., 64, p. 199*).

In the collection of **English's Patent Camphine Company** (Class IV., 61, p. 199*), already alluded to, there is a number of samples of new and refined oils: these are valuable because they are accompanied by samples of the seeds from which they are extracted. The Jury deemed these specimens worthy of Honourable Mention.

In the extensive collection of **Liverpool Imports**, there is a valuable series of oils, including among the volatile oils,—

1. Aniseed.
2. Bergamotte.
3. Cassia.
4. Carraway.
5. Cloves.
6. Cinnamon.
7. Citronella.
8. Juniper.
9. Lavender.
10. Lemons.
11. Lemon-grass.
12. Neroli.
13. Nutmegs.
14. Orange.
15. Peppermint.
16. Rosemary.
17. Rose.
18. Thyme.

The collection of fixed oils consists of—

			1849	1850
			Tons.	Tons.
Poppy-seed –	Papaver somniferum –	– –	–	3
Ground-nut –	Arachis hypogæa –	– –	80	90
Castor – – –	Ricinus communis –	East and West Indies	5	45
Seed – – –	,, ,, –	Lisbon – – – –	–	700
Rape – – –	Brassica napus – –	Antwerp – – –	6	15
,, – – –	,, ,, – –	Antwerp – – –	3	5
Olive – – –	Olea europæa – –	Manilla – – – –	56	8
,, – – –	,, ,, – –	Barbary – – –	2,785	2,330
,, – – –	,, ,, – –	Malaga – – – –	246	–
,, – – –	,, ,, – –	Levant – – – –	1,243	2,100
,, – – –	,, ,, – –	Corfu – – – –	280	762
,, – – –	,, ,, – –	Leghorn – – –	–	15
,, – – –	,, ,, – –	Palermo – – –	2,785	[illegible]
,, – – –	,, ,, – –	Gallipoli – – –	2,420	4,815

The collection of oils exhibited by the **Honourable East India Company** is very extensive, and contains a large number of highly interesting specimens; it constitutes, in fact, one of the most important divisions of the very valuable series of Indian raw produce which they exhibit.

Among the volatile oils must be particularly specified the attar of roses contributed by H. H. the **Rajah of Jeypore**, H. H. the **Rajah of Kotah**, and H. H. the **Rajah of Kishingurh** in the Rajpootana states; for these the Jury severally awarded Prize Medals. Very superior attar of roses and rose-water are contributed by Messrs. **Godfrey**, of Ghazeepore (p. 878); for these, also, the Jury awarded a Prize Medal.

Besides these species of attar, or oil of roses, a number of other volatile oils are exhibited, many of which are very good; and also a series of artificial attars, or mixtures of various highly-scented volatile oils, with fixed oils, obtained in the manner sometimes adopted in preparing spurious attar of roses. Oil of aloes wood is contributed from Nepal, Rajpootana, and Ghazeepore; and oil of saffron by H. H. the **Rajah of Kotah** (p. 878), from the Rajpootana states.

Several good specimens of the attar of keora, the odorous principle of the fragrant yellow flowers of the screw pine, or *Pandanus odoratissimus*, are contributed by H. H. the **Rajah of Kotah** and others (p. 878). Some excellent attars prepared from various flowers are also sent by a native perfumer at Benares; the samples of Jasmine attar, *Jasminum grandiflorum* and *J. sambac;* the khus-khus attar, obtained from the *Andropogon muricatum*, and the attars of Chumeylee, Beyla, Begla, and Moteya, are especially good; and were deemed worthy of Honourable Mention.

Grass-seed oil, obtained from the *Andropogon schœnanthus* (or *Calamus aromaticus*), accompanied by a portion of the seed, and some of the dried plant itself, are contributed from Malwa by R. N. **Hamilton**, resident at

Indore (p. 878): these were deemed worthy of Honourable Mention.

Specimens of Sirri, or lemon-grass oil, *Andropogon schœnanthus?* are likewise forwarded from Sumatra. The fragrant volatile oil obtained from various species of andropogon is now extensively imported into England for the use of perfumers; it is brought from Travancore under the name of oil of geranium.

A series of attars from different plants is sent from Moluccas; but unaccompanied by any information: they are labelled:—

1. Kodjamas.
2. Ananas.
3. Yailang.
4. Pulasare.
5. Guelang.
6. Tjoelang.
7. Tjindor.
8. Abier.
9. Rampsing.

A good sample of oil of cloves is exhibited by T. Key of Madras (p. 878); some excellent oils of kayu-pateh, or cajeputi, and macassar, from the Celebes, are shown by Syed Omar (p. 878); and a fine sample of sandal-wood oil, obtained from *Santalum album*, is contributed from Canara.

Good specimens of sandal-wood oil are also contributed from Mangalore and from Coorg.

In connexion with the volatile oils, an interesting specimen of the Barus (Borneo) camphor may be mentioned. It is obtained from the *Dryobalanops camphora*, in Sumatra, and is chiefly exported to China, where it is very highly valued, selling at nearly one hundred times the price of common camphor. It is said that the Chinese employ it to mix with, and improve the flavour of the ordinary camphor of commerce: this, however, is highly improbable; it is most likely valued for its supposed medicinal qualities. Specimens are contributed by the Singapore Committee (p. 878), and were deemed worthy of Honourable Mention.

The collection of fixed fat oils is even still more numerous, and includes contributions from various exhibitors, some of whom send specimens of similar oils, but obtained from different localities. The Jury awarded a Prize Medal to Messrs. Sainte and Co., of Cossipore, near Calcutta (pp. 878, 879), for their samples of refined cocoa-nut oil. They also awarded Prize Medals to H. H. the Maharajah Rao Scindia, of Gwalior, H. H. the Rajah of Vizianagram, Lieut.-Colonel Tulloch, the Commissary-General of Madras, Mr. T. Bishop, of Tanjore, and Professor J. Key, of Madras, for specimens of the fat oils of India. The following are the most important of the oils included in these collections, and in the general series of the Honourable East India Company:—

1. Sesamum oil. Three varieties of til, or *Sesamum orientale*, are extensively cultivated throughout India for the sake of the fine oil expressed from their seeds; these are "suffed-til," the white-seeded variety; "kala-til," the parti-coloured variety; and "tillee," or black til; it is from the latter that the sesamum, or "gingelly" oil of commerce, is obtained. Sesamum seed contains about 45 per cent. of oil; good samples of this oil are contributed from Vizianagram, Ganjam, Hydrabad, Tanjore, the district of Moorshedabad, and Gwalior. The samples exhibited by H. H. the Rajah of Vizianagram (p. 879) are particularly fine; the value of the Novvooloo Pyaroo, or gingelly seed, is stated to be about 4*l.* per ton in the N. Circars. The samples shown by the Commissary-General of Madras, and by Professor Key, are also excellent.

2. Ram-til oil. An oil resembling that of the sesamum, obtained from the seed of the *Guizotia oleifera*, a plant introduced from Abyssinia, and common in Bengal. Specimens of this oil from Bombay, Vizagapatam, and Ganjam, are shown. From the latter place there is a sample of the oil obtained from another variety of *Guizotia*, the Valusa mum, or *Guizotia abyssinica*, which is very similar to, if not identical with, the *G. oleifera*. The ram-til, or valisaloo seeds, yield about 34 per cent. of oil; in Vizianagram the oil is used exclusively for burning; its value there is stated to be about 10*d.* a gallon. The samples shown are of a dark-brown colour, and evidently impure.

3. Ground-nut oil, obtained from the seed of the Bhoe moong (Moong phullee), or *Arachis hypogæa*, a plant pretty extensively cultivated in various parts of India; the seeds contain about 44 per cent. of a clear pale-yellow oil, which is largely used as food, and for lamps. Samples of this oil are sent from Bombay by T. Key; from Malwa, and from Malacca. Two varieties of the ground-nut, or Katjang tanah, are cultivated in Malacca, the white seed, and the brown seed; specimens of these, as well as of the Katchary, or Katjang oil from Malacca, and also Java, are exhibited. This plant is much cultivated in Java, in the vicinity of sugar plantations, and the oil-cake is used as manure.

4. Oil of Kossumba, or Koosm-oil, a pale brownish-yellow oil, obtained from the seeds of *Carthamus tinctorius*, which contain about 28 per cent. A good sample of this oil, as well as of the carthamus seeds, is sent from Bombay.

5. Shersha, or oil of mustard. Excellent oil is expressed in various parts of India from the seeds of different species of *Sinapis*, especially from the *Sinapis* commonly called black mustard, &c. Specimens of mustard oil from *Sinapis toria*, from Meerut; from black mustard, from Tanjore; from *Sinapis glauca*, from the Chota Nagpore division; and mustard seed from Ghazeepore, and various localities, are shown.

6. Castor oil, obtained from the seeds of *Ricinus communis*. Good specimens of this are exhibited from Tanjore, contributed by Mr. Bishop, from Beerbhoom, Bellary, Madura, Tinnevelly, and Java (p. 879). The common jungle lamp oil, of which a sample is also shown from Tanjore by T. Bishop, is a variety of castor oil.

7. Poppy oil, obtained from the seeds of *Papaver somniferum*. Good specimens are sent from Tanjore, by Mr. Bishop, from Calcutta, and from Bombay (p. 879). The sample from Tanjore is almost colourless, and deserves special commendation.

8. Croton oil. Expressed from the seeds of the Narpaula, or *Croton sp.* nearly allied to *C. tiglium;* samples of this are shown from Vizianagram and Ganjam; a very good specimen is exhibited by J. Key (p. 879).

9. Poon-seed oil. Hoenda, oondee, or Pinnacottay oil. The seeds of the Poonay tree, the *Calophyllum inophyllum*, or Alexandrian laurel, contain a large quantity of oil, which constitutes nearly 60 per cent. of their weight. As commonly prepared, it has a dark-greenish colour, derived from the colouring matter of the seed. It is perfectly fluid at common temperatures; but begins to gelatinize when cooled below 50°. Specimens of this oil are exhibited from Palamcottah, from Bombay, from Madura, and Tinnevelly, Malwa, and by T. Bishop, from Tanjore (p. 879).

10. Limbolee oil, obtained from the seeds of *Bergera koenigii;* it is of a rich-yellow colour, perfectly clear and transparent; from Bombay.

11. Napala oil, procured from the seeds of the Caatâmunâka, Bhoga cherinda, or *Jatropha curcas;* the angular-leaved physic nut. A beautiful pale-yellow oil, used by the natives in medicine, and as a lamp-oil. Good specimens are contributed by the Commissary-General of Madras; from Vizianagram and Ganjam; an inferior sample, called Bhoga bhirinda, is sent from Beerbhoom.

12. Linseed oil—tissee til. Contributed, together with samples of linseed, from Moorshedabad, Bombay, Patna.

13. Mulu unnay oil, expressed from the Brumadundoo unnay, the seed of the *Argemone mexicana*, an oil used in various parts of India for lamps, and in medicine.

14. Cheeroojee oil, obtained from the Tumbi pullum, the fruit of the *Chirongia sapida*, or *Buchanania latifolia.*

15. Kanagu nune, or Kurrunj oil, procured from the seeds of the *Pongamia glabra*, or *Galedupa arborea;* a honey-brown and almost tasteless oil, fluid at common temperatures, but gelatinizing at 55°. Specimens of the oil are contributed from Vizagapatam and Tannah.

16. Mooneela oil; Varoo samgaloo Nonæ, obtained from the seed of *Dolichos biflorus?* exhibited by T. Bishop (p. 879), from Tanjore; a pale-yellow clear oil.

17. Caju apple oil; Moontha maunnerley noonæ; expressed from the seeds of the Kâpû mâvâ, or *Anacardium occidentale;* contributed by T. Bishop (p. 879), from Tanjore.

18. Poonga or Poon (?) oil, from the seeds of *Sapindus*

emarginatus? contributed from Tanjore by T. Bishop and W. B. Horsley (p. 879), from Palamcottah. Mr. Horsley is Honourably Mentioned.

19. Badum noonæ, almond oil; *Terminalia sp.* from Tanjore.

20. Coodivetty Poondoo oil.—*Allium sp.* from Tanjore.

21. Malkamnee oil, *Celastrus paniculatus?* from Madras.

22. Nahor nut oil; contributed by Major Hannay (pp. 879, 880).

23. Moringa oil; *Moringa pterygosperma.*

24. Shammanatie oil; contributed by W. B. Horsley, from Palamcottah (pp. 879, 880).

25. Hingun or Hingota.—*Balanites Egyptiaca*, from Bombay.

26. Dessy akhroot, obtained from *Aleurites triloba*, the country walnut, from Bombay.

27. Saul tree seed oil.—*Shorea robusta.*

28. Chendoorookoo oil, from Madura and Tinnevelly.

29. Coorookoo oil, contributed by the Commissary-General of Madras, from Madura and Tinnevelly, (pp. 879, 880).

30. Koodree oil.

31. The collection of oils also includes some very interesting vegetable butters and tallows, some of which are almost entirely unknown in Europe. The samples of cocoa-nut oil from Messrs. Sainte (p. 880), of Cossipore, have been already alluded to; besides these, very good samples are contributed by the Commissary-General of Madras, T. Bishop (p. 880), from Tanjore; and by other exhibitors from Malabar, Madura, Tinnevelly, and Sarawak in Borneo.

Three species of *Bassia*, indigenous to India, yield solid oils; and are remarkable for the fact, that they supply at the same time, saccharine matter, spirit, and oil, fit for both food and burning in lamps.

32. Ilpa oil, Eloopei unnay, expressed from the seed of the illupie tree, or *Bassia longifolia*, a tree abundant in the Madras Presidency, and the southern parts of Hindostan generally. The oil is white and solid at common temperatures, fusing at from 70° to 80°. It may be advantageously employed in the manufacture of both candles and soap. Specimens of this oil are contributed by the Commissary-General of Madras, (p. 880), and J. Key (p. 880), and from Madura and Tinnevelly.

33. Epie oil, or mahowa seed oil; Ippa noonæ, obtained from the seeds of the mahower, or *Bassia latifolia*, which is common in most parts of the Bengal Presidency. The oil a good deal resembles that of the illupie tree, and may be used for similar purposes. It is solid at common temperatures, and begins to melt at about 70°. The specimens of this oil shown by T. Coplestone (p. 880), from Mangalore, were deemed worthy of Honourable Mention; it is also sent from Canara.

34. Phoolwa, or vegetable butter, expressed from the seed of the choorie, or *Bassia butyracea*, a tree, which though far less generally abundant than the *B. longifolia* and *B. latifolia*, is common in certain of the hill districts, especially in the eastern parts of Kemaon: in the province of Dotee, it is so abundant, that the oil is cheaper than ghee, or butter, and is used to adulterate it; it is likewise commonly burnt in lamps, for which purpose it is preferred to cocoa-nut oil. It is a white solid fat, fusible at about 120°, and exhibits very little tendency to become rancid when kept. Specimens of this oil, as prepared for food, are shown from Kemaon.

35. Miniak Tenkawung, a solid oil of a pale-greenish colour, a good deal resembling the oils of the Bassia in character, though rather more hard, and approaching more in properties to myrtle wax. This is probably the produce of the tallow tree of Java, described by Sir S. Raffles under the name of minyak kawon; and by Crawford, as being very common in the western countries of the Archipelago, where it is called "kawan." Mr. Crawford supposes it to be produced by a species of Bassia. According to Mr. Low, there are several varieties of solid oil commonly used in the islands of the Archipelago, and obtained from the seeds of different species of "Dipterocarpus." It is a hard yellowish-green coloured substance, brittle, and fusible at about 93°, and when fused, solidifies at about 86°. Specimens are contributed by the Singapore Local Committee. It is very easily bleached; indeed, by mere exposure to air and light, it becomes perfectly white; if not too costly, it promises to be a valuable oil.

36. Piney tallow, obtained from the fruit of the peynie marum, paenoe, dammar, or doop tree, *Vateria indica*, a large and quick-growing tree, abundant in Malabar and Canara. A white, solid oil, fusible at a temperature of 97°. This oil makes excellent candles, especially when saponified and distilled in the manner now adopted with palm oil, &c.: it has one great advantage over cocoa-nut oil, that the candles made of it do not give out any suffocating acrid vapours when extinguished, as those made with the latter oil do. Samples are shown by T. Coplestone, from Mangalore (p. 879), and from Malabar and Canara.

37. Cocum oil, or kokum butter, obtained from the seeds of a kind of mangosteen, *Garcinia purpurea*, used in various parts of the peninsula to adulterate ghee or butter, and said to be exported to England for the purpose of mixing with bears' grease in the manufacture of pomatum. It is a white, or pale-greenish yellow, solid oil, brittle, or rather friable, having a faint, but not unpleasant smell, melting at about 95°, and when cooled after fusion, remaining liquid to 75°. Samples of this oil are contributed from Bombay.

38. Kali ziri, or khatzum, obtained from the seed of the caat siragum, or buckchie, *Vernonia anthelmintica*, a plant common in Guzerat and the Concan Ghats; there is, however, some uncertainty as to the plant from which this excellent oil is obtained, the label on one of the specimens describing it as the produce of the *Salvadora persica*. It is a bright green, solid oil, having a consistence intermediate between that of tallow and wax, fusible at about 95°, and easily bleached; it has a peculiar and somewhat aromatic odour. Samples of this oil are sent from Bombay.

39. Neem oil, Vaypum unnay, obtained from the ripe fruit of the Nim, Arishto, Vaypum, or Margosa tree, *Melia azadirachta*; a large and beautiful tree, by no means uncommon. The oil is pale yellow, and is solid at ordinary temperatures. Specimens are contributed by the Commissary-General of Madras (pp. 879, 880); from Bellary; by T. Bishop (pp. 878, 880), from Tanjore; and by J. Key (pp. 879, 880).

40. Gutta podah; from Biliton; a sort of wax, of a bright-green colour, which might probably be advantageously used like the other kinds of vegetable wax, in the manufacture of candles, associated with the more easily fusible fatty substances.

Good specimens of lemon-grass oil from Galle, are shown by G. Winter, (pp. 879, 880); and samples of cinnamon and citron oils, and the oil of the Bengal quince, or *Ægle marmelos*, from Ceylon, are also exhibited; the cinnamon oil from Messrs. Parlett, O'Halloran, and Co. (pp. 879, 880), of Colombo, is very good. There are likewise some excellent specimens of cocoa-nut oil, intended to illustrate the process of its manufacture, consisting of the copperah, or dried nut, the expressed oil, and the stearine and elaine purified, and obtained separately; for this valuable series a Prize Medal was awarded.

A valuable series of eighteen samples of Ceylon oils is contributed by T. A. Pieris (p. 938)—*see* also East India Collection (pp. 878, 879)—of Kandy, the names of these are—

1. Castor.
2. Rape-seed.
3. Gingelly.
4. Branjematy.
5. Siddharte.
6. Kolestesma.
7. Kekuna.
8. Makula.
9. Kadjie.
10. Kellooraje.
11. Rattee.
12. Doreno.
13. Koola.
14. Balegorunde.
15. Naarawyene.
16. Mahakoomare.
17. Dummele.
18. Chandenade.

The oils, Nos. 5 and 7, are nearly colourless. The value of this collection would have been considerably increased, had the specimens been accompanied by any practical information. The Jury awarded a Prize Medal for these oils, together with the series of gums and resins shown by the same exhibitor.

Some fine specimens of myrtle or berry wax, from the

Cape of Good Hope, are exhibited by J. Lindenberg, of Worcester district (45, p. 950). This is an excellent material for the manufacture of candles, when employed in conjunction with other solid fats. The Jury awarded a Prize Medal for these specimens.

From Western Africa an interesting collection of oils and oil seeds is contributed by Warwick Weston (1, p. 952), consisting of Shea butter, or galam butter, obtained from the fruit of the Micadenia, or *Bassia Parkii*, a tree closely resembling the *Bassia latifolia*, and other species indigenous to Hindostan. According to Park, the tree is abundant in Bambara; the oil is solid, of a greyish-white colour, and fuses at 97°. Specimens are also shown of Beynie seed and Ground-nut (*Arachis hypogæa*), and of the oil expressed from them; and likewise of palm oil, and palm kernel oil, the former excellent. The Jury awarded a Prize Medal for these specimens.

A specimen of the Shea butter is also exhibited by Dr. McWilliam, from Egga, on the river Niger (5a, p. 953, 954), which was deemed worthy of Honourable Mention.

A good specimen of myrtle or candle berry wax, accompanied by candles made from it in the crude unbleached state, and a dried branch of the plant itself, bearing leaves and fruit from New Brunswick (29, p. 970), are exhibited by J. Chalmers; these were deemed worthy of Honourable Mention.

Good samples of cocoa-nut oil are contributed by the Royal Society of Natural History of the Mauritius, (4, p. 970), and by Mr. Mellon, likewise from the Mauritius (6, p. 956).

Specimens of laurel oil, from the River Poomeroon, Essequibo, and crab or carapa oil, from the Essequibo river, in British Guiana, are exhibited by J. S. Stutchbury (52, 53, p. 980). The latter is a sort of vegetable butter, being sometimes solid, and sometimes half fluid, which is obtained from the seed of the carapa or y andiroba, *Carapa guianensis*, or *Xylocarpus carapa*, a large tree, abundant in the forests of Guiana and Acagie. It is said to turn rancid very soon when exposed to the air, but this is probably caused by the presence of impurities arising from the crude and imperfect mode in which it is prepared by the natives, who boil the kernels, leave them in a heap for a few days, then skin them, and lastly reduce them into a paste in a wooden mortar, which is then spread on an inclined board, and exposed to the heat of the sun, so that the oil may melt and gradually trickle down into a vessel placed below to receive it. The Jury awarded a Prize Medal for this specimen.

Another sample of crab or carapa oil is also shown in the collection of Trinidad, raw produce, exhibited by Lord Harris (see p. 71; p. 973), as well as a portion of cocoa-nut oil, of which a considerable quantity is obtained in that island, chiefly on the eastern coast; and a specimen of cacao butter, obtained from the seeds of the *Theobroma cacao*, a well-known white solid fat, fusible at about 120°.

Some excellent olive oil, the produce of New South Wales, is exhibited by R. Hallet and Sons (5, p. 991). Independent of its interest as coming from a colony, this oil deserves notice for its clearness, colour, and flavour; it was deemed worthy of Honourable Mention.

A good sample of olive oil, from South Australia, is also exhibited by the Colonization Assurance Corporation, in their series of Western Australian raw produce (see p. 71). They also show some sandal-wood nut oil and tar from Guildford; some distilled oil of the *Leptospermum*, which it is stated may be obtained in any quantity; and a similar oil produced by distillation from the *Eucalyptus piperita*, a powerful solvent of caoutchouc, evidently very similar, if not altogether identical, with the oil of Cajeput. The characters of these two oils are very similar, and without some care, it is difficult to distinguish them from one another by the odour; the leptospermum oil has a slight tinge of yellow, its specific gravity is 0·9035; the eucalyptus oil is colourless, and has a density of 0·9145. It is probable that these oils might be used with great advantage in the manufacture of varnish, they readily dissolve copal, and when its solution is spread over any surface, the oil soon evaporates, and leaves a hard brilliant and uniform coating of the resin; these oils are specially worthy of attention.

A remarkably good sample of oil of peppermint is shown by H. G. and L. B. Hotchkiss, of Lyons, New York (156, pp. 1446, 1447); for this the Jury awarded a Prize Medal.

An interesting specimen of maize, or Indian corn oil, is contributed by B. B. Kirtland, of Greenbush, New York (84, p. 1432).

An excellent series of samples of Austrian linseed and linseed oil is exhibited by A. Steinbock, of St. Georgia, near Mauthausen (103, p. 1013), consisting of Upper Austrian and Moravian seed, together with oil of first and second quality, both raw and prepared for drying, extracted from both sorts of seed. For the superior quality of these oils the Jury awarded a Prize Medal.

Some good Hungarian rape oil, in its crude state, and likewise refined, is shown by C. T. Malvieux, of Pesth (102, p. 1013); this was deemed worthy of Honourable Mention.

The chief oils shown in the Belgian collection are of animal origin, but there are also several good vegetable oils. L. E. Bissé, of Anderlecht, near Brussels (87, p. 1154), exhibits remarkably fine clear samples of refined vegetable oil: for these the Jury awarded a Prize Medal. Good linseed oil, prepared for the use of painters, and purified colza oil, are contributed by F. Vanderstraeten, of Brussels (84, p. 1154). L. Claude, of Brussels (85, p. 1154), shows extra-refined pale rape, purified for burning in lamps, as a substitute for sperm; and Debbaudt-Delacroix, of Courtrai (92, p. 1154), exhibits some good colza oil, both raw and purified. These three the Jury severally deemed deserving of Honourable Mention.

Some vegetable wax from China, is contributed by Her Majesty's Consul, at Shanghae (p. 1418): this substance, from its high melting point, and other physical characters, has of late attracted a good deal of attention; it is admirably adapted as a material for the manufacture of candles. The Jury, therefore, deemed it worthy of Honourable Mention. A remarkable vegetable wax from Japan is also shown.

Samples of castor oil, lettuce oil, safflower oil, turnip-seed oil, oil of nielle or nigella, linseed oil, and oil of cotton seed, are shown in the Egyptian collection; the latter is the most remarkable: the series of Egyptian oils was deemed worthy of Special Mention.

Cotton-seed oil in the raw state, and the same refined and bleached by a patent process, are exhibited by De Géminy, of Marseilles, where the manufacture of this oil from Egyptian seed, and its purification, are now carried on to a considerable extent (1613, p. 1254). For this specimen the Jury awarded a Prize Medal.

Specimens of various volatile oils are shown by Hugues, junior, of Grasse, Var (881, p. 1222). These oils are prepared by a direct process of distillation, discovered by the exhibitor about a year since, and by means of which the oil is at once obtained in a state of purity, so that no subsequent rectification is required. By this process, volatile oils are manufactured for the use of perfumers, in a highly-economical manner, and a superior product is obtained both in regard to colour, and likewise in respect to delicacy of odour. The Jury awarded a Prize Medal for these oils.

Specimens of volatile oils prepared for the use of perfumers, are also exhibited by C. D. Méro, of Grasse, Var (1356, p. 1241). For these likewise the Jury awarded a Prize Medal.

Samples of very superior bleached oil, for the use of painters and varnish-makers, are contributed by E. F. Haro, of Paris (866, p. 1221). The Jury awarded a Prize Medal for these specimens.

Some very interesting specimens of artificial volatile oils, and perfumed essences, are shown by M. A. C. Collas, of Paris (801, p. 1219). The Jury awarded a Prize Medal for these.

Some very good bleached oil, prepared for the use of painters, is shown by De Ruolz, of Paris, (1466, p. 1246); this was deemed worthy of Honourable Mention.

A very fine cake of purified camphor is exhibited by W. Conrad, of Paris (1156, p. 1233); this was deemed worthy of Honourable Mention.

Purified oil, prepared for the use of watchmakers, for diminishing friction in machinery, and for fire-arms, &c., is shown by F. Jolly, of Mer, Loire-et-Cher (276, p. 1192).

Oil for lamps and machinery of various sorts is also exhibited by M. Moreau (325, p. 1192).

Purified linseed oil, and oil boiled with oxide of lead, are shown by Renault, of Bordeaux.

A number of good samples of oils are shown by various exhibitors, in the very interesting collection of the raw produce of Algeria, contributed by the Minister of War (see p. 69). In particular, the series shown by Curtet, junior, of Bab-el-Oued (22, p. 1261), deserves notice; it consists of good specimens of the oils of linseed, sunflower, cameline, sesamum, mardia, castor, olive, colza, mustard, and cotton seed, together with the seeds from which they are expressed. The Jury awarded a Prize Medal for this series.

A good collection of oils is also shown by H. J. Mercurin, of Cheragas (37, p. 1261), including olive oil of 1850, and a series of essential oils, for the use of perfumers, namely—

1. Bigararde.
2. Citrine.
3. Melarose.
4. Absinthe.
5. Myrthe.
6. Rose.
7. Geranium.
8. Jasmin.
9. Citron.
10. Portugal.
11. Petit grain.
12. Neroli.
13. Cedrat.
14. Bergamotte.

For this also the Jury awarded a Prize Medal.

Fine samples of olive oil, prepared in 1850, are likewise exhibited by J. Borde, of Philipville, Constantine (9, p. 1259), and E. F. Maffre, of Bougie, Constantine (35, p. 1261); these were each deemed worthy of Honourable Mention.

A series of volatile oils, or essences, are also contributed by P. Simounet (51, p. 1262), consisting of—

1. Sauge.
2. Absinthe.
3. Verveine.
4. Citronine.
5. Citron zeste.
6. Melarose.
7. Portugal zeste.
8. Bigarrarde.
9. Neseri.
10. Neroli.

Pine-needle oil, a volatile liquid obtained during the desiccation of pine leaves, or needles, in preparing a fibrous material for the use of upholsterers (see p. 82; p. 1054), is exhibited by C. G. Fabian, of Humboldsaw, near Breslaw (95); this was deemed worthy of Honourable Mention.

Purified oil, intended for the use of watchmakers, is exhibited by J. L. F. Schramm, of Dessau (806, p. 1094).

Fair samples of rape-seed, and rape oil, from Holland, are shown by A. de Haan, of Rotterdam (9, p. 1143); these were considered deserving of Honourable Mention.

A large number of exhibitors of olive and other oils is found in the Portuguese collections. Among these may be specified fine samples of olive oil from J. L. de Catheiros Menezes (460-1, p. 1313); from Almeida Praenca (462-3-4, p. 1313); from De Maudo (465-6, p. 1313); from J. Larcher (467-8, p. 1313); from the Count de Farrobo (469-70, p. 1313); from J. B. Pinto (471-2, p. 1313); from Almedia Silva, and Co. (473-4-5-6-7, and 480, p. 1313); from J. d'Albuquerque Mello (478-9, p. 1313); from the Marquis de Ficalho (481-2, p. 1313); and from the Count de Linhares (483-4, p. 1313); each of these was deemed worthy of Honourable Mention.

Excellent specimens of several volatile oils, including those of lavender, juniper, rosemary, and lemon, are sent by F. M. C. Leal, (497-500, p. 1313); for these the Jury awarded a Prize Medal.

Very good samples of palm and ground-nut (*arachis*) oils, from Angola, are exhibited by F. R. Batalha; (495a, p. 1313); these were deemed deserving of Honourable Mention. Fair samples also of castor, linseed, and almond oils are likewise shown by V. Burnay (493, p. 1313), from Estremadura.

From the Linsinsk Forest Institute, in the government of St. Petersburg, district of Czarskoe Sielo (83, p. 1369), are samples of the empyreumatic volatile oil, obtained by the destructive distillation of birch bark; this substance is employed in the preparation of Russia leather, and gives it that peculiar and agreeable odour, which helps to preserve it from the attacks of insects. This oil has a dark-brown or almost black colour, is somewhat thick, and has a specific gravity of 0·939. Its odour is strong, disagreeable, and empyreumatic; when poured upon paper, it forms a brown greasy stain, which, however, soon dries, and after a short time, when the empyreumatic odour is dissipated, there remains only the peculiar and agreeable scent which belongs to Russia leather. The Jury awarded a Prize Medal for these specimens.

Fine samples of walnut, linseed, coleseed, and castor oils, are exhibited by Girardi Brothers, of Turin, (5, p. 1302). Good olive oil is also shown by the Chevalier Mancu Simone, of Sassari (15, p. 1303); and by S. Mesina, of Nuoro (31, p. 1303); and some good linseed oil is contributed by J. Calvi, of Genoa (22, p. 1303). These were severally deemed deserving of Honourable Mention.

In the Spanish collections, an excellent sample of the essential oil of lemons is shown by J. Canales, of Malaga, (242a, p. 1344). For this the Jury awarded a Prize Medal. The manufacture of olive oil in Spain has undergone very considerable improvement during the last few years; in particular, the process for expressing the oil has been rendered more rapid and effectual by the introduction of the hydraulic press, and thus the injurious consequences which resulted from the partial fermentation of the fruit are avoided.

Fine samples are contributed by the Province of Almeria (164, p. 1339); from Alburquerque, by C. S. Montesinos, of Badajoz (167, p. 1339); from Almadovar del Rio, by the Province of Cordova (165, p. 1339), being the produce of the wild olive; from the village of Niguelas, by J. Zayas, of Granada (168, p. 1339); from Santa Fé, by A. Diez de Ribera, of Granada (172, p. 1339); by M. Fernandez, of Malaga (169, p. 1339); and by the Province of Seville (171, p. 1339). These were severally deemed worthy of Honourable Mention.

Samples of olive oil are likewise exhibited by the Agricultural Board of Valencia, from D. V. Tortosa, and D. J. Cairascosa (173, p. 1339); by the Agricultural Board of Cordova; and by the Count of Sobradiel of Saragossa (174, p. 1339). A specimen of linseed oil, from Lorca, is contributed by D. ——, of Murcia (170, p. 1339); and nut oil from Oviedo, by D. S. Alvarez Calleja (166, p. 1339).

A cake of hard vegetable wax, obtained from a plant indigenous to the northern parts of St. Domingo, is contributed by Sir R. Schomburgk amongst the other raw produce of that island. It is not suited for the manufacture of candles alone, but, like the berry wax of the Cape of Good Hope, serves very well to mix with other fatty substances (see p. 83; p. 1429).

A few samples of oils are contributed from Tunis, including, besides some of the common fixed oils, samples of several of the volatile oils used in perfumery, especially the oil or attar of roses, and of jasmine, together with a few mixed essences, such as those of quince, orange, benzoin, aloes, &c.

Some good specimens of linseed oil, and of rape oil, both refined and unrefined, are shown by Joseph Owen, of Copenhagen (44, p. 1359); these were deemed worthy of Honourable Mention.

The Turkish collection of raw produce includes a numerous and interesting series of oils, both fixed and volatile, from various localities, the former include the following (see p. 69):—

1. Almond – – – Damascus.
2. Castor – – – – Asia Minor.
3. Laurel – – – – Djendgiva.
4. Linseed – – – Constantinople.
5. Olive – – – – Damascus.
6. ,, – – – – Broosa.
7. ,, – – – – Candia.
8. ,, – – – – Adramati.
9. ,, – – – – Mentesche.
10. ,, – – – – Tripoli.
11. ,, – – – – Erzeroum.
12. Sesamum – – – Constantinople.
13. ,, – – – Beyrout.
14. Sunflower – – – Moldavia.

Among the volatile oils from Turkey, the oil or attar of roses, and the oil of geranium or andropogon used to mix with and adulterate oil of roses, are specially worthy of mention. The oil of orange flowers is also deserving of notice. The series of Turkish oils shown, includes the following:—

1.	Almonds, bitter	Sara.
2.	Fennel	Broosa.
3.	Geranium	Mecca.
4.	Laurel	Salonica.
5.	Lavender	Broosa.
6.	Lemon	Salonica.
7.	,,	Scio.
8.	Orange flowers	Constantinople.
9.	Origanum	Salonica.
10.	,,	Carlova.
11.	,,	Kezar.
12.	Peppermint	Janina.
13.	,,	Kezar.
14.	,,	Carlova.
15.	,,	Saida.
16.	Rosemary	Smyrna.
17.	Rose	Kazemlik.
18.	Sago	Elliferm.
19.	,,	Constantinople.
20.	Sabine	Broosa.
21.	Spike	,,
22.	Turpentine	Constantinople.
23.	,,	Broosa.
24.	,,	Nicomedia.

Good samples of olive oil are exhibited in the Tuscan collection, by C. T. ORSETTI, of Lucca, from the hilly districts near that place (31, p. 1293); by RUSCHI BROTHERS, from Calici, near Pisa (32, p. 1293); by D. PACINI, from Buti, near Pisa (33, p. 1294); and by the CHEVALIER C. A. SARACINI, of Sienna, from Castel-nuovo, Berardenga, near Sienna (34, p. 1294). These, also, were severally deemed worthy of Honourable Mention.

SECTION III.—DYES AND COLOURS.

The arts of dyeing and printing in colours have undergone very considerable modifications during the last half-century, and perhaps no manufacturing processes have received more important assistance from the labours of chemists. Dyeing is purely a chemical operation; and consequently it has improved in exact proportion to the advance made in the investigation of those chemical laws which regulate the formation of colour, and the union of colouring matter with the various vegetable and animal substances which come under the operation of the dyer. A vast number of new colouring materials have been discovered or made available, and improved modes have been devised of economically applying those already in use; so that the dyer of the present time employs many substances of the very existence of which his practical predecessors were wholly ignorant. From the increased use of many of the vegetable colours, and from the improved modes of applying the colouring matters, a demand has naturally sprung up for various dye-stuffs; and at the present time, many of the dyeing materials of distant countries are beginning to excite the attention of practical men; for though they have long been acquainted with many of these substances, it is only recently that the progress of the art has rendered their use desirable, or even practicable.

At the present time, by far the greater number of the vegetable dye-stuffs used in Great Britain are derived from foreign countries. The following Table shows the quantity of some of the chief of those substances imported in the years 1848, 1849, and 1850; but it must be remarked, that it includes the quantities imported for re-exportation, as well as those retained for home consumption by our manufacturers:—

	1848	1849	1850
	Cwts.	Cwts.	Cwts.
Cochineal	18,380	18,254	22,451
Fustic	154,320	175,840	–
Indigo	59,127	81,332	70,482
Lac dye	4,449	13,585	18,124
Logwood	463,840	479,840	603,800
Madder	220,724	254,722	261,861
Nicaragua wood	47,220	54,020	–
Safflower	8,144	10,452	–
Yellow-berries	5,421	7,761	–

The proportion in which some of the principal dye-stuffs are supplied by different countries is shown in the following table, which represents the imports for 1849:—

	Logwood.	Madder.	Fustic.	Indigo.	Lac Dye.	Safflower.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
East Indian Empire	–	424	–	77,793	13,546	10,308
British Guiana and West Indies	84,120	–	25,140	73	–	–
British North America	4,460	–	420	–	–	–
Malta	–	2,246	–	–	–	–
France	–	80,568	–	–	–	53
Holland	–	31,570	–	–	–	–
Spain	–	4,091	–	–	–	–
Naples	–	34,632	–	–	–	–
Turkey	–	99,701	–	–	–	–
United States	44,340	169	15,920	45	39	–
Central America	2,520	–	–	2,494	–	–
Mexico	144,860	–	13,080	–	–	–
Cuba	2,580	–	42,340	14	–	–
New Granada	–	–	56,640	317	–	–
Hayti	122,320	–	2,560	–	–	–
Honduras	72,960	–	14	214	–	–
Brazil	–	–	11,800	–	–	–
Chili	420	–	–	216	–	–
Venezuela	–	–	6,860	3	–	–
Miscellaneous	1,260	1,321	1,066	163	–	91
Total	479,840	254,722	175,840	81,332	13,585	10,452

The series of dye-stuffs, included in the collection of LIVERPOOL IMPORTS, consists of the following:—

			1849	1850
			Tons.	Tons.
Alkanet	Anchusa tinctoria	Smyrna	–	–
,,	,, ,,	Hamburg	–	–
Barwood	Baphia nitida	Sierra Leone	400	350
Brazil wood	Cæsalpinia braziliensis	Rio de Janeiro	1,800	3,120
Brazilletto	,, bahamensis	New Providence	180	96
Camwood	Baphia nitida	Sierra Leone	180	210
Flavine	(Yellow dye)	New York	–	70
Fustic	Maclura tinctoria	St. Domingo	100	420
,,	,, ,,	Savanilla	400	1,450
,,	,, ,,	Cuba	300	1,220
Garancine	(Madder red)	France	2,340	2,985
Green ebony	Sacandra ovalifolia	Brazil	36	30
Indigo	Indigofera tinctoria	Calcutta	10	7
,,	,, ,,	Bombay	3	2
,,	,, anil	Brazil	–	–
Logwood	Hæmatoxylon campechianum	Honduras	1,330	1,300
,,	,, ,,	Tobasco	420	390
,,	,, ,,	Campeachy	1,700	1,860
Madder	Rubia tinctoria	Naples	2,340	2,985
,,	,, ,,	Seville		
,,	,, ,,	Marseilles		
,,	,, ,,	Rotterdam		
Munjeet	Rubia cordifolia	Bombay and Calcutta	405	525
Nicaragua wood	Cæsalpinia echinata	Lima	400	1,570
Orchilla weed	Roccella	Valparaiso	–	2
,, ,,	,,	Cape de Verd	–	8
Quercitron bark	Quercus tinctoria	Philadelphia	296	514
Red Sanders	Pterocarpus santalinus	Calcutta	120	246
Safflower	Carthamus tinctorius	,,	11	4
,,	,, ,,	Bombay	18	12
Sappan	Cæsalpinia sappan	Calcutta	75	120
Turmeric	Curcuma longa	Bombay and Calcutta	140	414
Yellow berries	Rhamnus infectorius	Levant	113	115
,, ,,	,, ,,	Smyrna		
Young fustic	Rhus cotinus	Zante	276	356

The series of HULL IMPORTS includes samples of alkanet root and madder; the yearly average imports being about 60 cwts. of the former, and 18,500 cwts. of the latter.

A numerous and highly-instructive collection of dye-stuffs is exhibited by Mr. W. BURCH, of Sewardstone (77, pp. 200*, 201*), consisting of the different substances employed as dyes, mordants, &c., in dyeing; forming altogether a complete illustration of the operations of the dyer and calico-printer, and accompanied by specimens exhibiting the various stages through which silk, wool, and cotton fabrics have to pass in the processes of the dyer.

The arts of dyeing and printing, although involving very different processes of manipulation, are, as regards the chemical basis of their operations, essentially the same. Dyeing consists in staining the whole surface of a fabric with the same colour, which is effected, generally, by immersing it in a bath, or a series of baths, more or less heated, by which means the fibre becomes penetrated with the colouring matters thus brought in contact with it.

Printing, on the other hand, consists in staining the surface of a piece of cloth in parts, with one or more colours, or, if entirely covered, in staining it with a variety of colours arranged in patterns. In order to effect this partial staining, and to obtain due clearness of outline in the figure, a decoction or solution of the colouring matter,—or of a proper metallic solution or mordant, by means of which the colouring matter is to be subsequently fixed,—is thickened by mucilage of some kind, usually either gum or starch, in order to prevent its running or spreading beyond the parts intended to be dyed. This mucilage is taken on the surface of the printing blocks, and impressed in proper order on the cloth. It is then allowed to dry, and is afterwards, according to the nature of the colour, either subjected to the action of steam (which merely softens the mucilage and fixes the colouring matter in the cloth without wetting it), or, if a mordant, it is placed in a warm bath with colouring matter that becomes fixed only on those parts on which the mordant has been printed, and after this the mucilage is readily washed away.

But although the operations of dyeing and printing are thus, to some extent, different, yet the dye-stuffs or colouring matters used are entirely the same, and are applied to produce the same results; so that, in fact, the art of colour-printing, setting apart pattern designing, may be regarded as a mere modification of the art of dyeing.

In the processes of fixing colouring matters, it is found that there are many substances capable of affording very beautiful, useful, and lasting colours, which have not, of themselves alone, a sufficient affinity for the fibre; but which, nevertheless, may be easily combined with it through the agency of certain other substances not in themselves colouring matters, but having an affinity both for the substance of the fabric and also for the colouring matters, by which means the colouring matters are effectually united with the fibre. These substances (for the most part metallic solutions), are termed "mordants," and besides their peculiar action in changing the hues of the colouring matters are the means by which some of the most lasting, and therefore most useful, dyes are attained. The bases of the mordants chiefly used are the oxides of iron, tin, copper, and alumina, in combination with sulphuric, muriatic, nitric, acetic, and other acids. From the great diversity of substances used in the art of dyeing, including metals and metallic compounds, woods, flowers, roots, barks, leaves, fruits, insects, &c., all of which respectively require essentially different treatment, there is necessarily considerable variety in the methods and processes employed; and this variety is still further increased by the different nature of the substances dyed—such as wool, silk, leather, cotton, flax, and wood.

In the substances of the greatest importance—wool, silk, and cotton—experience shows that the colouring matter which suits the nature of one does not, necessarily, suit that of another; and indeed, for the most part, the process of dyeing those three substances is so distinct as to have caused the dyers to be generally divided into woollen, silk, and cotton dyers. It is found that, as regards the use of the strong mineral acids, which are employed both to brighten, and—assisted by heat—to fix some colouring matters, an important difference exists between wool, or silk, and cotton. Animal substances will bear, uninjured, a much greater proportion of acid, and of the two, wool being the coarser fibre, is less easily injured than silk; but both will bear, with advantage, a proportion of acid which would corrode and destroy the fibre of cotton. It is necessary, therefore, to be very cautious in the use of acids on cotton goods; and the dyeing of a mixed fabric constitutes one of the nicest parts of the art, where a mixture of animal and vegetable fibres has to be printed with perhaps six or eight brilliant colours at the same time.

In illustration of these processes, Mr. Burch shows a complete collection, *ut suprà*, of the various chemical agents employed by the dyer, including acids, alkaline, and alkaline salts; metallic salts, used both as mordants and in the formation of metallic colours, and a very numerous series of vegetable and animal dye-stuffs. The mode of block-printing, and the manner in which several colours are successfully applied, are also well illustrated. The more important of these substances may be briefly enumerated as follows:—

1. Sulphuric acid, or oil of vitriol.
2. Muriatic or hydrochloric acid.
3. Nitric acid, or aquafortis.
4. Nitro-muriatic acid.
5. Acetic or pyroligneous acid.
6. Citric acid.
7. Tartaric acid.
8. Oxalic acid.
9. Iron sulphate, or green vitriol.
10. ,, acetate, or iron liquor.
11. ,, nitrate.
12. ,, chloride, or muriate.
13. Tin chloride, or muriate.
14. ,, ferroprussiate.
15. Alumina.
16. Alum.
17. Alumina, acetate.
18. Copper sulphate, or blue vitriol.
19. ,, chloride, or muriate.
20. ,, nitrate.
21. ,, acetate.
22. Lead, nitrate.
23. ,, acetate, or sugar of lead.
24. Zinc sulphate, or white vitriol.
25. Potassa carbonate, or pearlash.
26. ,, bitartrate, or cream of tartar.
27. Potash binoxalate, or salt of sorrel.
28. ,, ferroprussiate.
29. ,, chromate.
30. ,, bichromate.
31. Soda, carbonate.
32. Ammonia muriate, or sal ammoniac.
33. Lime, quick.
34. ,, chloride, or bleaching powder.

All these substances are used by the dyer, either in preparing the fibre to receive colouring matter, or as mordants to enable it to combine with the colour, in the direct formation of coloured compounds; to heighten animal or vegetable colours; or as "resists," or "discharges," either serving to prevent certain parts of the fabric, to which they have been applied, from receiving any colour in the vat, or to discharge or remove it in places when the whole has been dyed one uniform colour. For this important series a Prize Medal was awarded.

The dye-stuffs exhibited are as follows:—

Colouring Matters or Dye-Stuffs.

1. Logwood;—obtained from Campeachy in South America, the wood of the *Hæmatoxylon campechianum*: it is exhibited, 1st, in the block; 2nd, in the chips as cut up for the dyer's use; 3rd, an aqueous extract of the hematin, or colouring principle; 4th, the extract or hematin in the dry state; 5th, the colouring matter precipitated with iron, with which it forms a black dye; 6th, precipitated with tin, with which it forms a purple dye; 7th, with alum, a purple dye: 8th, with copper, a brown. Specimens are shown of these various colours dyed on cotton, silk, and wool.

2. Peachwood, or Nicaragua wood:—from Lima, South America; the wood of a *Cæsalpinia*, exhibited in the block, chips, aqueous extract, and the colouring matter precipitated black with iron, red with tin, red with alum, and brown with copper. Specimens of dyeing on silk, wool, and cotton.

3. Sappanwood, from Siam;—the wood of the *Cæsalpinia sappan*, exhibited in the block, chips, aqueous extract, and precipitated dark brown with iron, red with tin and with alum, brown with copper; with dyed samples.

4. Fustic, from Cuba;—the wood of the *Rhus cotinus*, exhibited in the block, chips, aqueous extract, and the colouring matter precipitated olive-brown with iron, yellow with tin, and yellow with alum; with dyed samples.

5. Ebony, the wood of the *Diospyros ebenum*;—exhibited in the block, chips, aqueous extract, and the colouring matter precipitated—olive-brown with iron, yellow with tin and with alum;—with dyed samples.

6. Barwood, from the west coast of Africa;—the wood of the *Baphia nitida* (?); exhibited in the block, chips, aqueous extract, and the colouring matter precipitated,—dark brown with iron, red with zinc; red with alum; brown with copper;—with dyed samples.

7. Camwood, from Sierra Leone;—the wood of the *Baphia nitida*, shown in the block, chips, aqueous extract, and the colouring matter precipitated,—black with iron, red with tin, red with alum;—with dyed samples.

8. Indigo, from the East Indies;—a well-known blue colouring matter obtained from the leaves of the *Indigofera tinctoria*. The process of dyeing with indigo consists in deoxidizing it, or depriving it of a portion of its oxygen, when it assumes a green hue, becomes soluble in water, and then readily enters the pores of the cloth immersed in the indigo vat. When the cloth is properly saturated, it is exposed to the action of the air, and the indigo speedily reabsorbs oxygen, and again assumes its original colour and its stability; or, if united with a yellow colouring matter, the result is—a green. It is exhibited in the lump, in powder, in its green deoxidized state dissolved in water; and also in a state of pulp, or minute subdivision, effected by treating it with strong sulphuric acid. In the last case it is not a "fast" dye, but by the first mode of treatment, it is one of the most permanent colours. Samples of indigo dyes are shown.

9. Woad;—from France and the north of Europe, a colouring matter analogous to indigo, but of a duller hue, obtained from the leaves of the *Isatis tinctoria*; it is now but little used. Exhibited in the lump.

10. Quercitron Bark, from South America;—the bark of the *Quercus tinctoria*; it is exhibited in the crusted or ground state, in the aqueous extract, and the colouring matter precipitated—olive-brown with iron, and yellow with alum;—dyed samples are shown.

11. Alder bark;—the bark of the common alder of Great Britain. *Alnus glutinosa*, shown as chips, as aqueous extract, and the colouring matter precipitated,—grey with iron, and pale amber with alum.

12. Catechu, from the East Indies;—an extract of the wood of the *Acacia catechu*, containing much tannin; it is shown in lump, and its colouring or tannin matter precipitated,—black with iron, brown with copper.

13. Valonia, from Turkey and Asia Minor;—the cup or shell of the acorn of the *Quercus ægilops*; it is exhibited as gathered. Also the aqueous extract and the colouring matter as precipitated,—black with iron.

14. Nut-galls, from Turkey;—an excrescence growing on the *Quercus infectoria*, which contains a very large quantity of tannin. It is exhibited as gathered. Also the colouring matter precipitated,—black with iron.

15. Madder;—from France and the north of Europe, the root of the *Rubia tinctoria*. This substance is of great importance in the art of dyeing, furnishing some of the most permanent dyes. It is shown in the root, and ground. Also "garancine," or the colouring principle, separated by the action of strong sulphuric acid; the black precipitate formed with iron, and the red precipitate

obtained with alum. Madder is the colouring matter used in the Turkey red dye, so celebrated for brilliancy and permanency.

16. Sumach, from Sicily;—is a small plant, the *Rhus coriaria*. The sumach is exhibited as ground for the dyer's use; also its black precipitate with iron,—yellow with tin,—yellow with alum.

17. Weld;—grown in Great Britain and the north of Europe; is a small plant, the *Reseda luteola*, a specimen of which is exhibited. It is used as a yellow dye, or as a component of green. Its aqueous extract and yellow precipitate with alum are shown.

18. Persian berries, from the Levant;—the berries of the *Rhamnus infectorius*, which afford a yellow dye. They are exhibited as gathered. Also the aqueous extract and the colouring matter precipitated,—yellow with alum and with tin.

19. Turmeric, from the East Indies;—the root of the *Curcuma longa*. It is exhibited as a root, and in the ground state as used by dyers. It affords of itself, without a mordant, a yellow dye, which is brilliant, but unfortunately not very permanent, samples of which are shown.

21. Orchil;—(*Roccella tinctoria*), from the Canary Islands, is a lichen, which grows on the rocks by the sea-shore. The plant is of a pale-stone colour, but yields a magnificent purple matter, which fixes in wool and silk without a mordant. It is reddened by acids, and rendered blue by alkalies, thus affording a great variety of tints. Its aqueous purple solution is shown, with samples of dye on silks and wool.

22. Annatto, from South America;—an orange colouring matter obtained from the seed of the *Bixa orellana*. The colouring matter is brought to this country in masses enveloped in rushes. It is soluble in alkalies, by which means it is fixed in the cloth. The annatto is exhibited as a mass, with samples of its dyes.

23. Safflower;—from Egypt, the Levant, Southern Asia, &c.,; the dried petals of the *Carthamus tinctoria*, from which is obtained a very beautiful colouring matter, that attaches itself without a mordant, and is extensively used in silk and cotton for a variety of shades of pink, rose, crimson, scarlet, &c., but which, unfortunately, does not possess the power of resisting the action of soap. The safflower as imported is exhibited; also the alkaline extract precipitated a fine rose-colour by an acid, with dyed samples on cotton and silk. This colouring matter is not suitable for wool.

24. Cochineal, from Mexico;—is a small insect, a variety of *Coccus*, which lives upon different species of the *Cactus opuntia* or nopal. It affords a fine red colouring matter, which is extensively used on silk and wool, particularly the latter, the whole range of the best red dyes on wool being due to the colouring matter of this insect. The two varieties exhibited are known in commerce as the "black grain" and "silver grain;" terms which arose from the fact that, when first imported, this insect was considered to be a seed or grain, and its dyes were spoken of as "grain" colours. The aqueous and ammoniacal extracts of the colouring matter are shown, also the colouring matter precipitated with tin and with alum. It forms very fine and permanent dyes in reds, crimsons, scarlets, &c., samples of which are shown on wool and silk. It is not applicable as a dye for cotton.

25. Lac-dye, from India;—the colouring matter of "lac," a substance formed on the branches of various trees by the puncture of a small insect, similar to cochineal, the *Coccus lacca*. The resinous matter, being separated, forms the "shellac" of commerce, and the colouring matter, the lac dye, is thus obtained. It is used as a red dye on wool, but its colour is inferior to that from cochineal. The dye is exhibited, with dyed samples.

Having thus briefly enumerated the substances exhibited, it may be observed that the dye samples show merely those colours which result, entirely and directly, from the substances in connexion with which they are placed; and do not, in fact, truly represent the art of dyeing, which frequently depends on a nice mixing of tints, and is effected by the combination of several,—perhaps many,—substances, in order to the attainment of artistic excellence. But in combination with these dyeing materials, and illustrating the subject as a whole, are exhibited samples of skein-dyeing by three London dyers—by Mr. CHABOT on wool, by Mr. REYNOLDS on silk, and Mr. BURCH on cotton: these may be taken as a fair sample of the uses to which the dyers of London put the variety of drugs and substances we have enumerated. In dyeing the skein previously to the threads being woven, Mr. Burch, who shows all his productions in this combination, exhibits also a series of dyes in "fast colours" on Lisle thread, which are used for the cotton glove manufacture, in which the ordinary dyes are sadly too fugitive; also a series of dyed lace cotton, dressed by a peculiar process to resemble the hard-thrown marabout silk, which is extensively used in the manufacture of velvet, gauze ribbons, and other fabrics in which a firmness of texture is desirable.

Some excellent illustrations of the native vegetable dyes of Scotland are shown in Messrs. LAWSON's valuable collection (Class III., 105, p. 206). These are now nearly all superseded by cheaper and more brilliant dyes of tropical countries.

A very good series of samples of superior orchil, cudbear, and other preparations of lichens, is exhibited by Messrs. SMITH & SON (68, p. 200*), accompanied by specimens showing the colours dyed with them. The Jury deemed these dyes of superior excellence, and accordingly awarded a Prize Medal for them.

A highly-complete and instructive series of lichen preparations is exhibited by WOOD & BEDFORD (Class II., 47, p. 192), including the chief varieties of lichens known in commerce, the colouring matters prepared from them, the different peculiar colouring and other principles contained in them, or obtained from them by chemical processes, and illustrations of the practical uses of lichen dyes to silk, feathers, wool, leather, marble, wood, &c. The chief lichens employed in the manufacture of orchil and cudbear are the following:—

Commercial Name.	Plant.	Whence Imported.
Angola weed	Ramalina furfuracea	Angola.
Mauritius weed	Rocella fuciformis	Mauritius and Madagascar.
Lima weed	,, ,,	Lima.
Valparaiso weed	,, ,,	Valparaiso.
Cape weed	Rocella tinctoria	Cape de Verde Islands.
Canary moss	Parmelia perlata	Canary Islands.
Tartareus moss	Parmelia tartarea	Sweden.
Pustulatus moss	Umbilicaria pustulata	,,
Velvet moss	Gyrophora murina	,,

Of these nine lichens, the first grows as a parasite upon trees; all the remainder upon rocks: the first is the richest in colouring matter. The samples of cudbear and orchil shown are numerous, and well illustrate the gradual development of the colour: the whole collection is highly creditable, and the Jury, therefore, awarded a Prize Medal for it.

Specimens of safflower, and good illustrations of its use in dyeing silk, are shown by LONG & REYNOLDS (75, p. 205*): these were deemed deserving of Honourable Mention.

Good specimens of several dye-stuffs are exhibited by J. MARSHALL, of Leeds (Class II., 68, pp. 194, 195), including cudbear and orchil, turmeric, and an interesting series of lac-dye: these also were deemed worthy of Honourable Mention.

A sample of chicory woad is exhibited by SAUNDERS and GATCHELL, of Dublin (71, p. 200*). It is stated that this substance, which can be used as a blue dye in the place of real woad, may be profitably grown and sold at about 8*l.* per ton, the price of real woad varying from 20*l.* to 30*l.* per ton.

A large and highly-valuable collection of dye-stuffs is exhibited by the Hon. EAST INDIA COMPANY, including specimens of the well-known dyes of India, and also of a large number of new and little-known substances employed by the natives in different parts of the East Indies (p. 880). This important series forms part of the collection of raw produce for which the Jury recommended the award of a Council Medal. In addition, they awarded a Prize Medal to their Highnesses the RAJAHS of KOTAH and of CUTCH (p. 880), for the various specimens of dye-stuffs which they have contributed to the East Indian collection.

1. Amongst the more important of the well-known Indian dyes, one of the principal is, of course, indigo, and of this a number of excellent specimens are contributed. The best are those shown by Messrs. MACNAIR, of Babookally, Messrs. ARBUTHNOT, of Cuddapah, and the proprietors of the JORADAH FACTORY (p. 880): for each of these the Jury awarded a Prize Medal. Very good samples of indigo are also contributed by the RAJAHS of KOTAH and CUTCH, from Kotah and Broach; and also from Sindh and Madras (p. 880). A complete and highly-interesting model of an indigo factory, showing all the different processes through which the dye passes in the process of manufacture, is likewise exhibited.

2. Specimens of the Pala or Palar indigo, prepared in some parts of India from the *Wrightia* (*Nerium*) *tinctoria*, a plant which flourishes in dry and barren lands, are contributed by Mr. G. T. FISCHER, of Salem (p. 880). It is said that this indigo is occasionally mixed with the ordinary indigo of commerce. The Jury awarded a Prize Medal for these specimens.

3. Fair samples of safflower or Kussoumba, *Carthamus tinctoria* (p. 880), are contributed by the RAJAH of KOTAH, from Kotah; by W. S. HUDSON, from Assam; from Dacca; from Rohilkund; from the Celebes; and from the neighbourhood of Calcutta. There is probably no dye more easily injured by careless collection than safflower: the great superiority of the Chinese over the ordinary East Indian safflower is chiefly due to the greater care with which the Chinese collect it.

4. Turmeric, *Curcuma longa* (p. 880), is sent from Nepal by his Highness the MAHARAJAH; from Assam; from the Rajpootana states; from Rohilkund; from Calcutta; from Beerbhoom; from Cuddapah; from Bombay; from Madras; and from Java.

5. Sappan-wood, *Cæsalpinia sappan* (p. 880), contributed from Bengal; from the Tenasserim provinces; and by TAN KIM SENG from Siam, and from the Philippine Islands.

6. Munjeet, Munjuth, or Indian madder, *Rubia munjistha* (p. 880). This is a valuable dye-stuff, and hitherto not so well appreciated as it deserves, for some of the colours dyed with it are quite as permanent as those dyed with madder, and even more brilliant; its use is, however, gradually increasing, and it is unquestionably well worthy the attention of dyers. Good samples are exhibited by Captain SMITH, from Assam (p. 880). For these the Jury awarded a Prize Medal.

Specimens of Munjeet are also contributed from Nepal by his Highness the MAHARAJAH; from Aden; and from Calcutta.

7. Chay-root, *Oldenlandia umbellata*, a red dye similar to Munjeet, and used to a great extent in the southern parts of Hindostan by the native dyers. This dye is not held in very good estimation in Europe; it seems, however, to deserve a better reputation than it at present possesses. Attention to this dye-stuff was drawn in 1798 by a special minute of the Board of Trade, recommending its importation; but Dr. Bancroft, who made some experiments with a sample of damaged chay-root, considered it inferior to madder, and hence discouraged its further importation. Specimens are contributed by Captain OGILVIE, from Masulipatam and from Palamcottah (p. 880). Samples of the Bulu or Mangkudu wood, and root, much used throughout the Indian Archipelago, are shown from Malacca, Java, and the Celebes.

8. Annotto. The seeds of the *Bixa orellana*, from which this colouring matter is prepared, are contributed from Assam, and from the vicinity of Calcutta.

9. Morinda bark. The bark and root of various species of Morinda are used in different parts of the East Indies, and are considered as a very valuable red dye. Specimens of the Muddi or Al, *Morinda citrifolia*, are exhibited by the Rajah of KOTAH from the Rajpootana states; and Ach, or *Morinda tinctoria*, are contributed from Patna. The colours dyed with the Morinda are, for the most part, not brilliant; but the colouring matter is far more permanent than many other red colours are, and with improved management would probably rival that of madder; it would, therefore, perhaps, be a useful dye-stuff; it appears well worthy the attention of dyers.

10. Lichens. A considerable number of different lichens are shown from various localities; some of these contain a good deal of colouring matter, and might, therefore, be advantageously employed in the manufacture of orchil, cudbear, and other preparations used by dyers. Among the specimens exhibited may be mentioned those from Rohilkund; from Moorshedabad; from Darjeeling; and other parts of the Himalayas; from the Tenasserim provinces; and from Sindh.

11. Mangrove bark. Kaboung, *Rhizophora mangle*;—used to dye a chocolate colour, from Arrakan. This was one of the colours introduced by Dr. Bancroft, and for the exclusive use of which he obtained an Act of Parliament.

12. Pulas, Tisso, or Madooga flowers;—*Butea frondosa*, used for dyeing red, from Tanna, from the district of Beerbhoom; from Cuttack; and by Captain OGILVIE from the Nizam's country (p. 881).

13. Hursinghar flowers;—*Nyctanthes arbor-tristis*, used as a yellow dye, from the RAJAH of KOTAH, in the states of Rajpootana; and from Cuttack (p. 879).

14. Ukulbere or usburgh;—*Datisca cannabina*, a bark used for dyeing yellow; it contains a bitter principle resembling that of quassia, from Lahore.

15. Marking nut;—*Semecarpus anacardium*, from Assam, from Calcutta, and from Rohilkund.

16. Capilla Ringhill, Rerso, Patany;—prepared from the dried fruit of the *Rottlera tinctoria*, and used by the natives to dye orange: the colouring matter is apparently of a resinous nature, or at least is accompanied by a large quantity of resin; it is a brilliant and tolerably permanent dye; contributed from Assam and from Cuttack.

17. Gaju gum;—used as a yellow dye, from the Celebes.

18. Gamboge, (*Hebradendron gambogoides*). Several excellent specimens are contributed from different localities. A good sample from Siam is exhibited by G. G. NICOL; and another is shown by Messrs. HAMMOND, in their collection of Archipelago produce (2, p. 998). Other specimens of gamboge (*Garcinia tinctoria*) are contributed from the peninsula of India, by several exhibitors, especially by Dr. CLEGHORN from the forests of Mysore; for this the Jury awarded a Prize Medal to him.

19. Myrobolans;—the fruit of various species of *Terminalia*, containing a considerable quantity of astringent matter, and therefore used in tanning as well as in dyeing; from Moorshedabad, Calcutta, Rohilkund, Cuttack, Mirzapoore, Assam, and the Rajpootana states.

20. *Quercus infectoria*, galls, from Calcutta and Chota Nagpore.

21. *Abutilon striatum?* from Calcutta and from Assam.

22. *Myrica sapida*, bark, from Rohilkund.

23. *Wrightia antidysenterica?* from Patna.

24. Haradah berries (*Terminalia sp.?*), from the hill tracts of Orissa.

25. Rerro, a purple dye, from Arrakan.

26. Thit-nan-weng, a chocolate dye, from Arrakan.

27. Sagah bark, from Singapore.

28. Ting-njet, bark and wood, used as a dark purple dye, from Arrakan.

29. Thit-tet, wood and bark used to dye red, from Arrakan.

30. Mooshe, from the Rajpootana states.

31. Mucha, from the Rajpootana states.

32. Kayee Kudrang, a yellow dye sent by SEYD OMAR from Malacca.

33. The-dan, a red dye, from Arrakan.

34. Borul, from the Rajpootana states.

35. Bunchong Balu wood, from the Celebes.

36. Muchkee, from the Rajpootana states.

37. Samak bark, from Singapore.

38. Lopisip bark, from the Celebes.

39. Benkita-barrung, produces a dark purple dye, from Borneo.

40. Kayu Oobah, a red dye, from Labuan.

41. Kayu Samuck, from Labuan.

42. Saracundraputtah (*Cassia fistula*), from Palamcottah.

43. Puttunghu bark, sent from the Nizam's country by Capt. Ogilvie.

44. Cherenjee bark, from the Nizam's country, sent by Capt. Ogilvie.

45. Avaraputtai (*Cassia auriculata*), from Palamcottah.

Of many of these dyes, little or nothing more than the name is known, and the Jury, having no evidence as to their use, are, therefore, wholly unable to express any opinion as to their probable utility in this country. They consider the series, however, as highly valuable and important. Several of the dye-stuffs are evidently rich in colour; most of them may be easily had in large quantities, and at comparatively low prices; they are, consequently, well worthy of the attention of practical dyers.

Specimens of gamboge, turmeric, myrobolans, and a yellow resinous substance resembling gamboge, called Gaju gum, are contributed from Ceylon.

A sample of lichen, or orchilla weed, from the Cape of Good Hope, is exhibited by C. Watermeyer (51, p. 952).

A specimen of cam wood, from the confluence of the rivers Niger and Tchadda, is shown by Dr. Mc William (5a, pp. 953, 954); and some crude indigo from Abbrokutu, is contributed by Dr. Beecham (12, p. 954).

In the collection from British Guiana, there is but one dye or colouring material, namely, the "Lana dye," exhibited by H. A. Kock (55 b, p. 930). This substance is obtained from the fruit of the Lana tree (*Genipa Americana*, Linnæus), a tree very abundant throughout the colony, particularly on the banks of the river Berbice; the colour dyed with it is a good bluish black. The colours dyed with the fruit of this tree are remarkably permanent, a fact which has very long been known, though hardly any attempt appears to have been made to introduce it to the notice of European dyers. The Jury deemed this specimen worthy of Honourable Mention.

Samples of fustic (*Rhus cotinus*); logwood (*Hematoxylon campechianum*); and turmeric, are included in the Trinidad collection of raw produce.

A promising specimen of lichen, or orchilla weed from the Falkland Islands (*Roccella fuciformis*), is exhibited by G. T. Whittington (p. 987).

The various dark-coloured resins of Australia have already been alluded to; the colouring matters of the different species of *Xanthorhœa*, though not remarkably brilliant, are well worthy of notice. Very fine specimens of some of these resins are exhibited by the Colonization Assurance Corporation. (See page 76).

Good samples of the Xanthorhœa resins are shown from Flinders' Island, by J. Milligan (81, p. 994).

A remarkable colouring material, called blood juice, the produce of a Norfolk Island tree, and said to be used for dyeing calico, and as an indelible marking ink, is contributed by Sir W. Denison (290, p. 997). The Jury deemed this substance worthy of Honourable Mention.

Specimens of Hinau (*Elæocarpus hinau*), a bark used in New Zealand for dyeing black (5, p. 1001), are exhibited by McVay; these will be again referred to as a tanning material. The flax and other substances shown in illustration of the use of this bark by the natives, in dyeing black, are remarkable for the depth and brilliancy of the dye.

Lichen, or orchilla weed, from New Zealand, is contributed by J. A. Smith (14, p. 1001): this sample appears to contain a good deal of colouring matter, and was, therefore, deemed worthy of Honourable Mention.

A very fine sample of Alkanet root (*Anchusa tinctoria*) is shown in the Austrian collections.

Specimens of Hungwa, or saffron; turmeric; and a red colour from China, are exhibited by Her Majesty's Consul at Shanghae (p. 1418); samples of whi-mei, a green dye; and of the fruit of the *Gardenia radicans*, used to dye yellow, are also shown.

In the Egyptian collection are specimens of indigo, saffron, and sumach.

The specimens of French madder, though not numerous, are of considerable interest and importance. A small series of samples of madder, and of garancine, as obtained from madder for the use of the dyer, are exhibited by the Chamber of Commerce at Avignon* (1049, p. 1229). The Jury awarded a Prize Medal for these specimens.

A good specimen of garancine is also shown by Lazare and Lacroix, of Avignon (905, p. 1223). This affords a highly-interesting example of the practical application of science to the improvement of a natural product. The exhibitors, finding their madder inferior to that grown in other localities, were led to institute a chemical examination of the soil; it was found to be deficient in lime, an element of all those soils in which the best madder is grown; the land was accordingly well manured with lime, and the result was a marked improvement in the quality of the madder. The Jury awarded a Prize Medal for this specimen.

Some excellent samples of orchil are exhibited by C. Mottet (932, p. 1224). For these, also, the Jury awarded a Prize Medal.

Madder, of very superior quality, is likewise shown in the Algerian Department of the French collection; in particular, the specimens of G. de Montigny, of St. Joseph, Oran (38, p. 1261), who also shows a fair sample of saffron, were deemed worthy of commendation, and the Jury accordingly awarded a Prize Medal for them.

The samples of madder, exhibited by J. Piglia, of Constantine (43, p. 1261), and of Dupré de St. Maur, of Orbul, Oran (23, p. 1261), were likewise considered very good, and each worthy of Honourable Mention.

A fine specimen of saffron, contributed by De Lutzow (34, p. 1261), of Bonn, Constantine, was deemed worthy of Honourable Mention.

A good sample of "woad," the blue colouring matter prepared from the *Isatis tinctoria*, and which is probably identical in nature with indigo, is shown by Giessler, of Tröchtelborn, near Erfurt (Zollv. 4698, p. 1089). This was deemed worthy of Honourable Mention.

Madder root, from Athens, is contributed by A. Malandrinus (3, p. 1400), and from Eubœa, by G. Phillippos (4, p. 1401).

The colouring matter of safflower, prepared in a concentrated form for the use of dyers, is exhibited by C. Jaeger (Prussia 469, p. 1078).

Extract of madder, said to be prepared by a new and cheap process, is shown by A. Scharenberg, of Neustrelitz (3, p. 1134).

A remarkable yellow resinous substance, somewhat resembling gamboge, and called pipitzahuac, but of which no description is given, is contributed from Mexico.

In the Portuguese collection, several specimens of dyeing materials are shown. The most important are a set of lichens, or orchilla weeds, namely, wood orchilla, from Angola, St. Thomas, and Mozambique; and rock orchilla from Angola, Vinnando Minho, Cape Verde Islands, and from Madeira (505 to 508 b). These were deemed worthy of favourable notice.

Wood orchilla from the Cape rock, and rock orchilla from the Berlingues Islands, of good quality, are shown by F. R. Batalha (509 and 509a). Some good samples of sumach are exhibited by M. B. Ferreira, junior (510, p. 1313). These were deemed severally worthy of Honourable Mention.

Two good samples of Russian madder are shown from the Government of Derbent. This important root is already cultivated to a considerable extent in Russia, but not nearly in sufficient quantity to meet the demand; so that large quantities are imported from Holland, and elsewhere, every year. The specimens shown, which are of good quality, are exhibited by Kerim Raghim Ogli, of Cubi (87, p. 1369), and by Babaieff Arakel (86, p. 1369). These were each deemed worthy of Honourable Mention.

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* Awarded also by Jury of Class II.

Besides these, the Russian collection includes safflower, from Telaff, in Tiflis, exhibited by POPIUS KVAVILOFF (90, p. 1369); saffron, from Baki, in Shemakha, exhibited by SERGIUS AYVAZOFF (91); yellow berries (*Rhamnus infectorius*), from Cubi, in Derbent (92); sumach, from Nookha, in Shemakha (93); and the wood of the *Statice coriaria*, from the GOVERNMENT of STAVROPOL (89).

A considerable number of specimens of dyeing materials from Spain are exhibited; the best are, the madder; woad or pastel blue (*Isatis tinctoria*); safflower or alazer (*Carthamus tinctorius*); wild sumach; and weld or "gualda" (*Reseda luteola*); shown by the AGRICULTURAL BOARD of SARAGOSSA (148, p. 1337-38). For these the Jury awarded a Prize Medal. (See page 71).

Superior samples of madder are likewise contributed by the Province of Murcia (86, p. 1334); D. ——, of Valladolid (142, p. 1337), and A. MATESANZ, of Segovia (144, p. 1337). These were severally deemed worthy of Honourable Mention.

Other specimens of madder are shown by the Province of Cadiz, which exhibits the wild or indigenous madder from San Lucar (138, p. 1337), by D. ——, of the Canary Islands (141, p. 139c), by D. ——, of Huelva, by D. MATESANZ, of Segovia, from Cuellar (140, p. 139c), by R. SEMOVILLA, of Segovia, from Cuellar (143, p. 139), and by D. ——, of Zamora (91, p. 1334). Extract of madder, for dyers, is also contributed by J. MARCOS, of Valladolid (147, p. 1334).

Samples of gualda or weld (*Reseda luteola*) are exhibited by J. GISBERT, of Alicante (137, p. 1337), by D. ——, of the Canary Islands (141, p. 1337, by D ——, of Gerona (79, p. 1333), by D. ——, of Murcia (86, p. 1337), by J. MARTINEZ, of Seville (145, p. 1334), and by D. ——, of Zamora (91, p. 1334).

Two specimens of saffron are shown; namely, by DONA E. CABELLO, of Ciudad Real (139, p. 1337), and by D. —— of Saragossa (92, p. 1334).

A good sample of Alkanet root (*Anchusa tinctoria*) is contributed by D. ——, of Murcia (86, p. 1334), and a fair sample of sumach, from Torrelobaton, is shown by D. ——, of Valladolid (146, 1337).

Three specimens of dye-woods are shown in the collection of Cuba woods, exhibited by the BOTANIC SOCIETY OF MADRID (186), these are—

Brazil wood	–	Cæsalpina sp.
Copey –	–	Clusia rosea (Lin.)
Fustete	–	Broussonetia tinctoria (Kunth).

In the collection from Tunis are shown three samples of indigo; one of saffron; dried pomegranates, said to be used for dyeing yellow; and a specimen of a dye-stuff named Gämmam.

A very valuable and numerous series of dye-stuffs is exhibited in the Turkish collection, including some of those well known in commerce, and also a few new ones. Samples are shown of—

1.	Madder	– – –	Smyrna.
2.	"	– – –	Ghiordes.
3.	"	– – –	Amassiah.
4.	"	– – –	Broosa.
5.	"	– – –	Monastir.
6.	"	– – –	Bergan.
7.	"	– – –	Bakir.
8.	"	– – –	Tripoli.
9.	"	– – –	Bulak Hissar.
10.	"	– – –	Koniah.
11.	"	– – –	Kukagasch.
12.	"	– – –	Cayadjik.
13.	Yellow berries	–	Angora.
14.	"	–	Sivas.
15.	"	–	Janina.
16.	"	–	Tokat.
17.	"	–	Kaissarieh.
18.	"	–	Wallachia.
19.	"	–	Koniah.
20.	"	–	Sila A. Minor.
21.	Safflower	– –	Amassiah.
22.	"	– –	Sparta.
23.	"	– –	Smyrna.
24.	"	– –	Constantinople.
25.	Safflower	– –	Moldavia.
26.	Saffron	– – –	Philipopoli.
27.	"	– – –	Tripoli.
28.	"	– – –	Saffranboli.
29.	Tabach	– – –	Koniah.
30.	Sirpik	– – –	Nish.
31.	Amteric	– – –	Tripoli.
32.	Alkanet	– – –	Bouldour.
33.	"	– – –	Constantinople.
34.	Kina	– – –	Mecca.

Besides these, a considerable number of samples of galls, valonia, sumach, and other similar substances, used both in dyeing, and also in tanning, are exhibited. (See page 93.) The substance called Tabach, from Koniah, appears to be the dried petals of a flower; it is a rich violet colour, and merits further examination. Sirpik is said to be used in dyeing yellow.

A good series of samples of madder, both in the form of root, and also reduced to a powder, for the use of dyers, is exhibited by the TECHNOLOGICAL INSTITUTE of TUSCANY (47, p. 1294), and forms part of the collection for which the Jury awarded them a Prize Medal. (See page 71.)

SECTION IV.—TANNING MATERIALS.

Notwithstanding the number of different substances which have from time to time been introduced for the use of tanners, it is, nevertheless, pretty generally acknowledged that there is nothing superior, or even equal to, good oak bark, and that all attempts to hurry the process beyond a certain point by the use of concentrated solutions of tan, &c., are for the most part failures, as the manufacture of good leather, to a great extent, depends on the process being conducted in a slow and gradual, but—at the same time—thorough and complete manner. Oak bark is, however, by no means the only astringent bark well suited to the use of the tanner, and in various parts of the world other similar substances are used with very great success. All these tanning materials, though they may not be considered, by the English tanner, as equal to the best oak bark, are nevertheless of value to him; they may be employed in conjunction with oak bark, or even as a substitute in times of scarcity, or when the price of bark is high: in fact, the very existence of such substances tends to keep down and equalize the price of bark, and prevent it from undergoing those great fluctuations in value which would necessarily occur were it the only tanning material available to our manufacture.

The quantity of the chief tanning materials imported in 1849, and the countries from which they were obtained, is shown in the following table:—

	Tanning Bark, &c.	Terra Japonica.	Sumach.	Valonia.
	Cwts.	Cwts.	Cwts.	Cwts.
Belgium – – –	141,392	–	140	–
Holland – – –	114,180	–	–	–
East Indian Empire –	–	169,140	–	–
Naples and Sicily –	1,166	–	218,380	–
Turkey – – – –	–	–	–	296,000
America – – –	42,318	–	–	–
Australian Territories	–	–	29,840	15,820
Morocco – – –	27,619	–	–	–
Norway – – –	12,784	–	–	–
Spain – – – –	9,594	–	440	–
Tuscany – – –	9,931	–	20	4,320
Australia – – –	4,563	–	–	–
Syria – – – –	–	–	–	4,280
Greece – – – –	–	–	–	10,480
Miscellaneous – –	5,035	–	2,980	2,520
Total – –	368,582	169,140	251,800	333,420

A valuable and instructive series of the various tanning materials, imported into England, or used by tanners, is exhibited by CURTIS BROTHERS and Co. (126, p. 204); the following Table shows the names of these substances:—

1 to 6. Oak bark –	Quercus pedunculata	England.
7 and 8. " –	" "	Flanders.
9 and 10. Larch bark	Pinus larix – –	Scotland.
11. Mimosa bark –	Acacia sp. – –	New South Wales.
12. Babool bark –	Acacia Arabica –	Bengal.
13. Cork-tree bark	Quercus suber –	Laruche.
14. " "	" " –	Rabat.
15 and 16. Hemlock bark – – –	Abies Canadensis	United States.
17. Sumach – –	Rhus coriaria –	Sicily.
18 and 19. Valonia	Quercus ægilops –	Smyrna.
20. "	" " –	Trieste.
21. "	" " –	Morea.
22. Divi Divi . –	Cæsalpinia coriaria	Maracaibo.
23. " –	" " –	Rio de la Hache.
24. " –	" " –	Savanilla.
25. Myrobolans –	Terminalia sp. –	Bengal.
26 and 27. Terra Japonica – –	Nauclea Gambir –	Singapore.
28. Cutch – –	Acacia catechu, &c.	Pegu.
29. Cutch, black –	" " –	Calcutta.

The Jury awarded a Prize Medal for this complete and instructive series.

A considerable number of tanning materials are also shown by Messrs. Bevingtons and Sons, as illustrations of the process of tanning generally (Class XVI., p. 518). The specimens exhibited are small, but valuable, as being shown in conjunction with the prepared leather, and therefore as illustrating the practical application of the several substances; the Jury deemed this series worthy of Honourable Mention.

An instructive and highly useful series of these substances are also shown in the collection of Liverpool Imports; these are as follows;—

Commercial Name.	Plant.	Whence Imported.	1848	1849
			Tons.	Tons.
Oak bark – –	Quercus sp. – –	Holland; Belgium	296	514
Cork-tree bark –	Quercus suber –	Rabat – – –	..	160
Divi divi – –	Cæsalpinia coriaria	Maracaibo – –	..	..
" – –	" "	Rio de la Hache –	..	..
" – –	" "	Savanilla – –	..	..
Algarobilla –	Prosopis pallida –	Valparaiso – –	..	400
Valonia – –	Quercus ægilops –	Smyrna – – –	..	..
" – –	" –	Camatena – –	..	..
Myrobolans –	Terminalia chebula	East Indies – –	185	851
Terra Japonica –	Acacia catechu –	East Indies – –	903	742
Cutch – – –	" –	Calcutta – – –		
" – – –	" –	Singapore – –		
Kassu – – –	Areca catechu –	Ceylon – – –	Rare.	
Sumach, ground	Rhus coriaria –	Trieste – – –	93	93
" " –	" – –	Palermo – – –		
" " –	" – –	Marseilles – –		
Sumach, leaves –	" – –	Trieste – – –		

Specimens of oak bark, gambier, myrobolans, sumach, and valonia are included in the collection of Hull Imports; the yearly importation of these substances into the port of Hull is about 2,500 tons.

A fine sample of pure Palermo sumach is exhibited by J. Kitchin (126a, p. 205*), as ground for the use of tanners and dyers.

Besides the tanning materials already imported, a considerable number of new or little known astringent substances are shown in the East Indian collection, some of which appear well to merit the attention of practical men. Amongst those exhibited are the following:—

1. Terra japonica, kut or cutch, and catechu, the well-known extracts of the *Acacia catechu*, and certain allied plants, from Rutnagherry, Calicut, Moorshedabad, Patna, Calcutta, Rohilkund, &c. Gambier, the extract of the *Nauclea gambir*, from Singapore.

2. Acacia or Babool bark, the bark of *Acacia arabica*, and *A. catechu*, &c., from Madras, Scinde, Shahjehanpore, Rohilkund, and Assam.

3. Mangrove bark, the bark of the *Rhizopora Mangle*, from Arracan, Malabar, and Singapore.

4. Turwar or cassia bark; Avaraputtai, Tangada jigota (*Cassia auriculata*), from Vizagapatam; and Saracondraputtai, *Cassia fistula*, from Madura and Tinnevelly.

5. Saul-tree bark, *Shorea robusta*, from the Saul forests.

6. Pomegranate rind, *Punica granatum*; Darunka pucke, Dadima jegota, from Kemaon and Vizagapatam; Dalumka khola, from the vicinity of Calcutta.

7. Jamoon bark, *Eugenia jambolana*, from Cuttack, and the Chota Nagpore division.

8. Samak bark, from Singapore.

9. Peal bark, from Cuttack.

10. Dhak gond, pulas, of butea kino, the red astringent exudation of the *Butea frondosa*, from Rajpootana, Cuttack, Vizagapatam, and Meerut.

11. Vangay or gum kino, *Pterocarpus dalbergoides*, from Malabar.

12. Kino, or astringent extract of the *Buchanania latifolia* (?), from the district of Chota Nagpore.

13. Majoophul, or gall nuts, *Ficus infectoria*, &c., from Chota Nagpore and Rohilkund divisions.

14. Sumrut ool Usc, or tamarisk gall, *Tamarix indica*, from Bombay and Lahore.

15. Divi divi, *Cæsalpinia coriaria*, recently introduced from South America, contributed by Dr. Falconer, from the Botanical Garden at Calcutta.

16. Teree, *Cæsalpinia sp.*, contributed by A. Sconce, from Chittagong.

17. Myrobolans, the dried fruit of various species of *Terminalia*, extensively used both in dyeing and for tanning; *Terminalia belerice*, Baheera bhura (or hurrah), from Mirzapore, Rohilkund, and Calcutta; *Terminalia chebula*, from Rohilkund and Patna. *Terminalia citrina*, from Patna, Moorshedabad, Cuttack, and contributed also from Assam by Captain Smith (p. 881). *Terminalia elata*, (?) Marada, from Mirzapore. *Terminalia angustifolia*, humtokee, from Calcutta.

18. Emblic myrobolans, aomla berries, *Phyllanthus emblica*, from Rajpootana.

19. Mochrus, *Bombax malabaricum* and *B. heptaphyllum*, from Meerut.

20. Gaub, the fruit of *Diospyros glutinosa*, from Calcutta.

From the Cape of Good Hope M. Thalwitzer sends samples of tanning bark (3 and 27, p. 949, 950), apparently the bark of a *Mimosa*. Deserving of Honourable Mention.

Some good samples of hemlock bark, illustrating its use as a tanning material, are exhibited by J. Allon, of Montreal (100, p. 195). These the Jury deemed interesting, and deserving of Honourable Mention.

Specimens of the bark of the hog-plum tree, *Spondias lutea*, abundant on the banks of the river Berbice, and which is commonly used in British Guiana for tanning, are shown by T. B. Duggin (56, p. 980). A sample of Courida bark, *Avicennia nitida*, a tree very common on the eastern coast of Demerara, likewise used in tanning, is exhibited by D. Shier (58, p. 980).

Mimosa bark, bark of the black wattle tree, *Acacia mollisima*, and mimosa extract, the inspissated decoction of the bark, are contributed by T. Button, of Launceston (22, 23, p. 993). These also were deemed worthy of Honourable Mention. A specimen of the same bark is likewise exhibited by — Rees (314, p. 998), as prepared for the use of tanners, by chopping into small fragments. Kino from the blue-gum, *Eucalyptus globulus*, the stringy bark, and other *Eucalypti* indigenous to Australia, are contributed by J. Milligan and H. Hull (288, p. 997), and by the Colonization Assurance Corporation.

Several good specimens of New Zealand tanning barks are exhibited by J. M'Vay (5, p. 1001). They are accompanied by hides tanned with the different barks, which are labelled Towai, Tanekaha, and Hinau, the latter being also used in dyeing black. The Jury considered these samples as deserving Honourable Mention.

Samples of New Zealand tanning barks are also shown by Tao Nui, a New Zealand Chief (Gillman, 44, p. 198*).

Some good specimens of oak bark from Bruges are exhibited by Strubbe and Baey of that city (97, p. 154). These the Jury deemed worthy of Honourable Mention.

Specimens of oak bark, in the state used by tanners, are shown by the Board of Agriculture of the Grand Duchy of Hesse Darmstadt (13, p. 1126, 1127).

Good samples of Portuguese sumach are exhibited by Manoel Baptista Monteiro, from Beira-guarda, Algaroe, &c. (510, 511, 512, 513, p. 1313).

Bark or rind of the wild pomegranate, *Punica granatum*, and of the wood and leaves of the sumach tree, are contributed from the Government of Shemakha, districts of Shoosha and Mookha, in the Russian empire (88 and 93, p. 1369).

In the collection of raw produce exhibited by the Agricultural Board of Saragossa (148, pp. 1337, 1338) is a good specimen of wild sumach; a good sample of sumach is likewise contributed from Torrelobaton, by D. ——— of Valladolid (146, p. 1337).

Specimens of tanning materials are exhibited by Elhage Aly Elmajboor, in the collection from Tunis (137, p. 1416). These were deemed worthy of Honourable Mention.

Excellent samples of several important tanning materials (p. 1386), well known in commerce, are shown in the Turkish collection; these include—

1.	Oak galls - - -	Kutaya.
2.	" - - -	Smyrna.
3.	" - - -	Damascus.
4.	" - - -	Adana
5.	" - - -	Koniah.
6.	" - - -	Constantinople.
7.	" - - -	Aidin.
8.	" - - -	Monastir.
9.	" - - -	Janina.
10.	" - - -	Djibba.
11.	Valonia - - -	Constantinople.
12.	" - - -	Smyrna.
13.	" - - -	Balak Hissar.
14.	" - - -	Bigha.
15.	" - - -	Adalia.
16.	" - - -	Aidin.
17.	" - - -	Ushak.
18.	" - - -	Sparta.
19.	" - - -	Broosa.
20.	" - - -	Adana.
21.	" - - -	Dardanelles.
22.	" - - -	Janina.
23.	" - - -	Kutaya.
24.	" - - -	Koniah.
25.	Sumach - - -	Kaissariah.
26.	" - - -	Constantinople.
27.	" - - -	Koniah.
28.	" - - -	Damascus.
29.	" - - -	Adana.
30.	" - - -	Moulah.
31.	" - - -	Wallachia.
32.	" - - -	Moldavia.

Section V.—Fibrous Substances.

This division is, perhaps, one of the most important of the whole series of raw produce, including as it does the materials for several of our most important manufactures—cotton, flax, hemp, and the numerous vegetable fibres employed in conjunction with, or as substitutes for, those substances. For convenience of arrangement, the subject is divided in the following pages into three distinct heads: the first, including the different varieties of cotton; the second, flax and hemp; and the third, consisting of the various other vegetable fibres.

Cotton.

The total quantity of cotton, at present annually imported into Great Britain is very nearly 800,000,000 pounds; the proportion in which it is imported from different countries is shown in the following Table, which represents the imports of 1849:—

	lbs.	Per cent.
United States - - - - -	634,504,050	83·9
East Indies - - - - - -	70,838,515	9·3
Brazil - - - - - - -	30,738,133	4·
Egypt - - - - - - -	17,035,928	2·2
British Guiana and West Indies -	944,307	0·1
Cuba - - - - - - -	292,578	–
New Granada - - - - -	258,650	–
Hayti - - - - - - -	245,032	–
Austrian Territories - - - -	199,527	–
Turkey - - - - - -	115,197	–
Venezuela - - - - - -	106,135	–
Peru - - - - - - -	82,011	–
Russia - - - - - - -	11,536	–
South African Colonies - - -	7,889	–
Miscellaneous - - - - -	89,524	–
Total lbs. - -	755,469,012	100·

A very useful collection of cottons of different countries, arranged so as to show the peculiarities of each fibre, is shown by Dr. Royle (107, p. 203*). An extensive series of the cottons imported into Liverpool is likewise exhibited in the Liverpool collection of imports (pp. 811, 812); these are accompanied by memoranda of the selling prices of each variety in the Liverpool market in October 1850, which, though very useful and instructive, it must be remembered do not express the true average value of the different cottons at all times, but merely their price at that particular period. It is evident that accidental circumstances may, at any time, cause a rise or depression in value of a particular cotton, as well as give rise to fluctuations in the price of cotton generally.

		Oct. 1850.
East Indian cotton -	Bengal - - -	5¼d.
Do. " -	Madras - - -	——
Do. " -	Surat (Bombay) -	5d. to 6¼d.
Do. (Bourbon)	Madras - -	7½d.
Smyrna cotton - -	Smyrna - -	7¾d.
Port Natal " - -	South Africa -	9d.
Venezuela " - -	Venezuela - -	——
Egyptian " - -	Alexandria - -	7¾d. to 11d.
Brazil " - -	Maranham - -	8¼d. to 9¼d.
Do. " - -	Pernambuco -	8¼d. to 9¼d.
Do. " - -	Maccios - -	8½d.
Do. " - -	Ceara - - -	8¼d.
Do. " - -	Bahia - - -	8¼d.
West Indian cotton -	Jamaica - -	10d.
Do. " -	Laguayra - -	7¾d.
Do. " -	——— - -	10d.
Do. " -	Carthagena - -	5½d.
United States " -	Bowed - - -	7¼d. to —
Do. " -	Mobile - - -	7¾d. to 8½d.
Do. " -	Mobile (Mammoth)	10d.
Do. " -	New Orleans -	7½d. to 10d.
Do. " -	Sea Island - -	8d. to 10d.
Do. " -	Sea Island (picked)	2s. 6d.

A good deal of uncertainty appears to prevail respecting the botanical distinctions to be noted between the various cotton plants of different countries; some botanists admitting the existence of a large number of distinct species of the genus *Gossypium*, whilst others consider them as chiefly varieties of a much smaller number of separate species. According to Dr. Royle, who has most recently investigated the subject, the different varieties of cotton may be classed under four distinct species of *Gossypium*, in the following manner:—

1. *Gossypium indicum* or *herbaceum;* the cotton plant of India, China, Arabia, Persia, Asia Minor, and some parts of Africa.

2. *Gossypium arboreum;* a true cotton, indigenous to India.

3. *Gossypium barbadense;* the Mexican or West Indian cotton, of which the Sea Island, New Orleans, and Upland Georgian cottons are varieties. It was long since introduced into the Island of Bourbon, and thence into India; hence it acquired the name of Bourbon cotton.

4. *Gossypium peruvianum*, or *acuminatum;* which yields the Pernambuco, Peruvian, Maranham, and Brazilian cotton, especially distinguished by its black seeds, which adhere firmly together: this variety, also, has long since been introduced into India.

The important discovery, by MERCER, of the influence of caustic alkali in modifying the fibre of cotton, has been already alluded to. He has shown that, by steeping cotton in a cold solution of caustic soda, the fibre loses its flattened ribbon-like form, and assumes a more or less cylindrical shape. This change gives rise to three remarkable effects: the fibre becomes smaller, it gains in strength, and at the same time it acquires an increased affinity for colouring matter. After a minute and careful examination of these effects, the Jury, being convinced of the high practical value of the process, determined to recommend the award of the Council Medal to Mr. MERCER (38, pp. 555, 556, see p. 69).

The collection of raw cotton exhibited by the Hon. EAST INDIA COMPANY (pp. 882, 883), is, as might be expected, large and highly interesting. It consists of a series of samples of the indigenous cottons of various parts of the Indian empire, and samples of the cottons raised in the various Government experimental farms during the last thirty years, illustrating the effects produced, and the improvements effected, by the numerous attempts which have been made during that period to improve the cotton cultivation of India.

In considering the native cultivation of cotton in India, it must be remembered that, besides the exports to Europe, very large quantities have every year been raised for home consumption by the native manufacturers, and for exportation to other eastern countries,—especially China;—the latter alone having, till within the last few years, generally exceeded the entire annual quantity exported to Europe. Thus, during the ten years preceding 1833 the quantity of raw cotton exported from India to England was about 250,000,000 of pounds; whilst in the same period the quantity exported from India to China, &c., was about 540,000,000 pounds. On comparing together the average total quantity of cotton imported into Great Britain in the years 1830, 1840, and 1850, from the United States and from India, it will be found that whilst the former, during those three periods, has increased in about the ratio of 500,000 bales, 950,000 bales, and 1,200,000 bales, the latter has increased in the ratio of 67,000 bales, 163,000 bales, and 300,000 bales: showing, therefore, that, large as the annual increased importation of American cotton into England has been, the increased consumption of East Indian cotton has, in proportion, augmented even more rapidly.

The chief varieties of native India cotton, named according to the districts where they are produced, are the—

1. Surat.
2. Broach.
3. Dharwar.
4. Tinnevelly.
5. Cuddapah.
6. Nellore.
7. Berar.
8. Coimbatore
9. Compta
10. Nagpore.
11. Belgaum.
12. Dacca.
13. Ladom.
14. Agra.
15. Guzerat.
16. Cutch.
17. Concan.
18. Saugur.

Of all these cottons it may be generally observed, that, though in some cases the fibre is beautifully fine, it is invariably short, generally badly cleaned, and too often injured, by careless collection, bad packing, and faulty inland transit. It must be borne in mind, that these short staple cottons of India cannot be compared with the long staple cottons of the New World; they are, in fact, quite different fibres—they must be treated in a different manner, and their uses are perfectly dissimilar. The question of how far long staple cottons can be advantageously cultivated in India is perfectly distinct from that of improving the production of short staple varieties. The real practical question to be considered is, not whether the East Indian cottons can be made to compete with the long staple American cotton, but whether, by care and attention, by judicious cultivation,—improved mechanical contrivances,—and the application of skill and perseverance, it may not be possible so to improve the common East Indian cotton as to give to it those characters and properties which will render it of more value to the manufacturer, by enabling him to use it even more largely, and with greater profit, than he is able to do at present.

On examining the samples of the native indigenous cottons of India, the chief causes of their inferiority are evident. No care or skill in the cultivation, of course, will render the fibre of short staple cotton like that of the long staple variety; but, in many cases, the fault is not the shortness of the fibre, it is, that the cotton has been ruined after it has grown and ripened: either by bad management the staple is broken, or, by exposure to the weather, and by the addition of dirt and impurity of all sorts, its value is most materially diminished. The difficulty rests not so much with the cotton as with the cultivator, and with the middleman: the indolent habits, and the dislike of the former to trouble of any sort, stand more in the way of improvement than anything else; whilst the want of proper encouragement to the native to persevere, and, in some cases, the opposition of the Brahmin, combine to prevent any real progress. In those cases where care and attention have been paid, the native cottons sent over are excellent; and there is no doubt that their value will slowly and steadily increase in the English market, if the cotton be sent to market clean, and in the state in which it is gathered.

From the samples of experimental cotton, illustrative of the various attempts which have been made to introduce the cultivation of American cottons into India, it is obvious that though the introduction of Sea Island—and the other long staple American—cottons may, for the most part, be said to have failed, yet the cultivation and improvement of the New Orleans cotton in India (which, though not the *finest*, is certainly the most valuable cotton in the world), have been attended with very considerable success. The experimental cottons grown from New Orleans seed at the Government farms, from 1830 down to the present time, prove, most satisfactorily, that any quantity of good, sound, useful cotton may be imported from India; and that it only needs time and perseverance to give it a high place in the estimation of our manufacturers. Among the best specimens may be noticed the samples taken from the produce of the Government farms at Coimbatore, imported by the "Beresford" and "Colonist," and the samples of Sea Island and New Orleans cotton from the experimental farms in Mysore. The specimens of cotton grown under the directions of Dr. WIGHT (p. 882), who has done so much to improve and extend the cultivation of cotton in India, are so good, that the Jury awarded to him a Prize Medal. The cotton grown at Cuddoor by F. D. MEPPEN is so remarkable for the goodness of its staple, its cleanness, and the careful manner in which it has been handled, that the Jury deemed it worthy of Honourable Mention.

A very promising sample of cotton, grown from Pernambuco seed, on Mr. HENTIG's estate at Sarawak, in Borneo, is exhibited. The staple is pretty long, though a little course and uneven; still, it is very clean, has a good colour, and there is no doubt it would find a ready market at a fair price. The Jury awarded a Prize Medal for this cotton.

Among the good samples of well-cultivated native cottons, those of Mr. G. T. FISCHER (p. 882), of Salem, may be mentioned. The Jury deemed these samples worthy of Honourable Mention.

A good sample of Pernambuco cotton is exhibited from

Tenasserim; the staple is fair, but a little unequal: it is a good, useful cotton, and has a healthy colour.

The cotton from New Orleans seed, cultivated at Belgaum, is somewhat degenerated; it is, however, very well cleaned, in good condition, and is a good, useful cotton. Some of the samples of American cotton from Dharwar are likewise worthy of commendation.

Besides these, other good samples of cotton are contributed by private individuals; special notice must be taken of the Burmese cotton contributed by Dr. Morton, of Moulmein (p. 882); the samples of cotton from Bagcheen, near the Chumbul River, exhibited by his Highness the Maharajah Jyajee Rao Scindia, of Gwalior (p. 882); the cotton contributed by his Highness the Rajah of Kotah, from the Rajpootana States (p. 882); and the cotton from Cutch, contributed by his Highness the Rao of Cutch (p. 882).

Mention may here be made of the very beautiful fibre of the "simool," or silk-cotton tree, *Bombax heptaphyllum*, which, owing to the shortness and want of strength of the fibre, combined with its peculiar elasticity, is incapable of being spun like ordinary cotton. It is occasionally, in India, more especially in Assam, spun into a very loose and large thread, which is then woven into cloth with a warp of some other fibre, and forms a soft, warm, and very light fabric. The silk-cotton, being a very tender fibre, cannot be used with advantage as a stuffing material alone; but it is highly probable that it might be very advantageously used in combination with other substances, not merely for purposes of upholstery, but even in the manufacture of mixed fabrics, and for various other uses in the arts. It was suggested by Dr. Percival, in 1787, and by Beckmann, in 1793, that this fibre might be advantageously employed as a substitute for beavers' fur, in hat-making; and Le Breton states that its importation into some countries was forbidden, for fear that it should be used to adulterate beavers' hair. Practical obstacles were, however, found to interfere with this application, and it appears that they have only recently been overcome.

Specimens of native, Bourbon, and Sea Island cotton, grown at Batticaloa and Jaffna, in Ceylon, are exhibited.

An interesting series of samples of cotton from Malta are exhibited by G. Pulis (p. 944), of Montebello, including Nankeen cotton, Sea Island cotton, and mastoidon cotton: the latter is a fine cotton; it has a very fair staple, both strong and silky.

Very promising specimens of cotton from Port Natal are exhibited by T. Bazley (30 b, p. 950), and C. Manuel, of Cape Town (11, p. 950). In both cases the staple is good, and it is evidently a fine and valuable cotton, but badly handled. To each of these exhibitors the Jury awarded a Prize Medal.

Samples of cotton from the West Coast of Africa are shown by Warwick Weston (1, p. 925). The staple, though short, is fine, and if well handled this would probably be a useful cotton: it was deemed worthy of Honourable Mention.

A specimen of wild cotton, collected from the banks of the Niger, is contributed by Capt. H. D. Trotter (5, p. 953).

Three samples from Barbadoes, exhibited by A. Reade (972), consisting of Persian or greenseed, common Demerara, and vine or Pernambuco cotton, are interesting; the latter very superior: they were deemed worthy of Honourable Mention.

A series of excellent cottons is contributed by different exhibitors from British Guiana. Amongst these may be mentioned fine, strong, and good-coloured Sea Island cotton from Batavia Plantation, on the river Mahaica, Demerara;—D. Blair (71 & 72, p. 981); for these the Jury awarded a Prize Medal.

Excellent Sea Island and other cotton is also shown by J. F. Bee (74, 76, p. 981) from Woodlands Plantation, on the river Mahaica; the staple strong and very good: for these also Honourable Mention was awarded.

Some very good samples of New Orleans and Pernambuco cotton, &c., are contributed by P. Hughes (74 a & b, p. 981), from Anna Regina Plantation, Essequibo: for these samples Honourable Mention was awarded.

An excellent specimen of uncleaned short staple cotton from the Klein Pouderoyen Plantation, river Demerara, is exhibited by A. D. Van der Gon Netcher (73, p. 981): this was deemed worthy of a Prize Medal.

A good sample of New Orleans cotton grown at Blacknow, Jamaica, by W. Finlaison (163, p. 987), was deemed worthy of Honourable Mention.

A remarkably fine specimen of Sea Island cotton is shown in the Trinidad collection. The seeds were imported from Jamaica; the produce is excellent, has a beautiful silky lustre, and is strong: it was considered worthy of Honourable Mention.

Some long, and strong, but rather coarse cotton is shown by the Agricultural Society of St. Helena (2, p. 955); it is in a tolerably clean condition.

Samples of cotton from Maitland, in New South Wales, are contributed by Messrs. Dudgeon (11, p. 989).

The collection of long staple cottons from the United States is, as has already been mentioned, remarkably fine. The samples leave nothing to be desired, either as to staple, handling, or packing. After a minute and careful examination of all the bales, the Jury being desirous of expressing their high appreciation of the degree of perfection to which the cultivation of this important staple has been brought in the United States, decided on recommending the award of the Council Medal to the Government of the United States (p. 1431), in testimony of the great and successful efforts made by the cotton planters of that country (see p. 69); whilst at the same time they determined to award a Prize Medal to each of the eleven following exhibitors, without attempting to draw any distinctions:—

S. Bond, of Memphis (37, pp. 1434, 1435).

W. Hampton, of Charleston, S. Carolina (172 b, p. 1448).

G. L. Holmes, of Memphis, Tenessee (316, p. 1454). "Louis Prolific."

J. V. Jones, of Charleston, S. Carolina (172, p. 1448).

J. R. Jones, of Charleston, S. Carolina (172a, p. 1448).

D. Lak, of Memphis, Tenessee (330, p. 1456).

W. W. M'Cleod, of Charleston, S. Carolina (172e, p. 1448).

J. B. Merriweather, of Montgomery, Alabama (164, p. 1447).

J. Nailor, of Vicsburg, Missouri (178, p. 1449).

J. Pope, of Memphis (32, p. 1434). "Dimes Prolific."

W. Seabrook, of Charleston, S. Carolina (172f, & 320d, p. 1454).

An instructive collection of small samples of cotton is contributed by Truesdale, Jacobs and Co., of New York (494, p. 1465); this, and also the collection of Eli Rayner, of Tenessee, were deemed worthy of Honourable Mention.

A fine sample of long staple Peruvian cotton, of a good and useful character, is exhibited.

Specimens of uncleaned Chinese cotton, "Meenhwa," and the same cleaned, "Hwae," are contributed by H. M. Consul at Shanghae (1, p. 1418); the cotton has a good colour, and a fine silky lustre, but it is so short that it could only be used for wadding, or to mix with other cottons; it is very well cleaned.

Several good samples of cotton are shown in the Egyptian collection; of these the Mako cotton, first quality, exhibited by Abbas Pasha (106, p. 1409); the Sea Island cotton, grown by T. W. Larkins (134, p. 1409), were deemed worthy of Honourable Mention.

Some interesting and promising samples of cotton are contributed from Algeria, demonstrating in a remarkable manner the progress being made in that colony; among these, in particular, may be specified the capital Louisiana cotton from M. Chuffart, of Birmandreis (17, p. 1260); the Jumel cotton from Dupré de St. Maur of Orbal, Oran (23, p. 1261); the clean, long, and useful Jumel cotton of 1850, from Morin of El Biar (39, p. 1261); and the strong, fine, and well-cleaned cotton from C. Pelissier of Kaddous (42, p. 1261): for each of these four, the Jury awarded a Prize Medal.

The collection of cottons contributed by A. Hardy, manager of the Hamma Nursery near Algiers (28, p. 1261), is also remarkably good; including Georgia, Louisiana, Jumel, New York, Macedonia, and Nankeen cotton of 1849 and 1850: for this the Jury awarded a Prize Medal.

Other fair samples of cotton are contributed by F. Grima of Philippeville, Constantine (26); Haloche of Drariah (27, p. 1261); and M. Benes (6, p. 1259): these were deemed worthy of Honourable Mention.

Good cotton cultivated near Lisbon is contributed by A. Sa Nogueira (538, p. 1313): this was deemed worthy of Honourable Mention. (539) and (540) are good Brazilian cottons from Algarve; they have a long and strong fibre, but are a little coarse and wild.

In the Russian collection there are two samples of cotton: Bourbon cotton, exhibited by Prince Niko Djidjivadze, from Imeritia (95, p. 1369); and native cotton from the district of Sharoor, government of Erivan, cultivated by Abdourza-Maram Ogli (94, p.1369). These were both considered worthy of Honourable Mention.

A fine sample of cotton is shown by M. Hurtell (p. 1428), from the Society Islands, which was deemed worthy of Honourable Mention.

Raw cotton, the produce of the province of Seville, raised from Sea Island seed on irrigated lands, is exhibited by J. B. Villars of Seville (162, p. 1339); it has a fine, long, and strong staple, of a very useful character, and was therefore deemed worthy of Honourable Mention.

A valuable and interesting series of samples of cotton is shown in the Turkish Collection of raw produce from various parts of that empire. The general character of these cottons is shortness of staple, and that peculiar wild and wiry fibre which is very wasteful in the mill, and which, therefore, meets with but little approbation, generally, from our manufacturers. These cottons burn very readily, leave but little ash, and, from the peculiar character of their fibre, are remarkably fit for the manufacture of candle-wicks; they are also employed advantageously in the preparation of wadding. The sample of "Lana cardic" from Koniah (2082) is coarse, short, and wild, resembling some of the native cottons of India; it is, however, well cleaned, as in fact all the Turkish cottons are. (See p. 69.) The localities from which these specimens are contributed are as follows:—

1. Adana.
2. Aïdin.
3. Baindir.
4. Baluk-Hissar.
5. Bigha.
6. Cassaba.
7. Damascus.
8. Dardanelles.
9. Drama.
10. Denizlou.
11. Koniah.
12. Magnesia.
13. Salonica.
14. Smyrna.
15. Soubougla.
16. Thersic, Saida.

Flax and Hemp.

The quantity of flax imported into Great Britain has, for a considerable number of years, been gradually increasing. Twenty years ago the annual importation was about 48,000 tons; ten years since it had increased to about 65,000 tons; and at the present time it is about 80,000 tons. The proportion per cent. of this quantity, imported from different countries, may be judged of by the following table, calculated on the average imports of the years 1840, 1844, and 1849:—

	1840	1844	1849
Russia – – –	69	7	74
Prussia – – –	11	10	10
Holland – –	9	8	6·5
Belgium – –	6·5	7	4·
France – – –	3·5	3·5	1·5
Other countries –	1	1·5	4·5

During the last few years, great efforts have been made to extend and improve the manufacture of this valuable fibre in various parts of the world. The increase under the last head in the preceding table, for 1849, is chiefly due to the importation of flax from Egypt. It must be remembered that, in addition to the above-mentioned quantity of flax annually imported, the manufacturers of England have consumed rather more than a quarter as much again, cultivated in various parts of the British empire, chiefly in Ireland. This proportion has also considerably increased during the last twenty years, and a most marked improvement in the quality of the flax itself has also been produced; a change in great measure to be traced to the persevering and most praiseworthy efforts of the Royal Society for the Promotion and Improvement of Flax in Ireland. The value of flax depends, in part, on the climate and soil in which it is cultivated; and in part, also, on the mode in which the fibre is prepared, on the care and skill with which the process is conducted, and on the constant and vigilant attention which is paid to it through the various stages of the operation. According to its quality, its value varies from about 40*l.* to 180*l.* per ton.

Another circumstance which has given a considerable impetus to the cultivation of flax, and is likely to produce, ere long, even yet more marked effects, is the introduction of the late R. B. Schenck's new process of steeping.

Formerly the separation of the fibre from the woody matter of the stem was effected by the process of "retting," of which there were three modifications—dew-retting, pond-retting, and river-retting. The stem of the plant consists, essentially, of two parts;—a wooden centre or core, the *shove* or *boon*,—and the external fibrous portion, which, when separated from the former, constitutes the flax. These two are cemented together by a glutinous matter, not soluble in water alone, and which must be got rid of by some means before the pure fibre can be separated from the woody shove. The old mode consisted, merely, in exposing the flax stems to air and moisture under circumstances favourable to fermentation or incipient putrefaction, so that the glutinous matter being destroyed, the fibre could then be easily separated from the shove. Whether this species of fermentation is effected by exposing the flax for some weeks to the action of the dew and rain, spread over meadows—whether it is effected by steeping it in ponds or pits of stagnant water—or, lastly, by sinking it in large wooden frames in the current of a deep and slow-flowing river; there are serious practical difficulties, which have long directed the attention of ingenious men to the possibility of discovering a new and less objectionable mode of preparing flax. During the slow retting of the flax a large quantity of certain putrid vapours is given off; the water, and the very air itself, are poisoned; and this, alone, is no trifling objection to the process. So serious an objection, indeed, have these putrid exhalations been found to the use of water-retting, that in some districts of Belgium, in Hainault and Namur especially, it is forbidden by law, as being dangerous to "public safety and the health of the inhabitants." In Flanders, however, no such laws are in force, and it is there commonly believed that dew-retted flax is, of necessity, meagre and dry. Many different modifications and peculiar modes of retting are followed in the various flax districts of Belgium, Holland, and France; and in different localities dissimilar modes of retting have long been in use, often involving very considerable variations in principle. Thus, at Courtrai, the flax crop is dried in the field and stored for some months in barns, before it undergoes the process of retting in the river Lys. In the district of Waes, it is retted immediately after being gathered, the green stems being at once thrown into pits of stagnant water. As, however, the whole operation, in every kind of water-retting, depends on the amount of fermentation produced (which must be enough to insure the decomposition of the glutinous matter, but not enough to cause any injury to the fibre), the process is necessarily slow, tedious, and very uncertain, especially towards the close of the operation, because then, the flax must be most carefully watched, in order to put a stop to the fermentation as soon as the desired effect is produced. A slight change of temperature, or a few hours' exposure, when the fermentation is complete, may produce the most disastrous effects, the fibre being in fact ruined. Dew-retting is of course even slower than water-retting; depending, as it necessarily does, on the nature of the season, and being greatly retarded by long-continued dry weather. In the very dry autumn of 1810, it was found impossible to prepare flax by this method, and recourse was obliged to be had to other methods of retting.

During the last half-century various attempts have been made to effect the separation of the fibrous from the woody portion of the flax stem by chemical and mechanical means. In several cases the results at first appeared to be very promising, but in every instance it was soon found that there were insuperable practical objections, which more than counterbalanced the advantages. Among chemical agents, solutions of sulphuric acid, caustic potash, caustic soda, quicklime, and soft soap, were all, in turn, tried and discarded; and among mechanical processes the ingenious contrivances of Mr. James Lee and Messrs. Hill and Bundy shared the same fate. Mr. Lee, having found a means of separating the fibre of flax without water-retting, and the discovery being considered one of very great importance, obtained a patent for his mechanical process in 1812, with the singular protection of a special Act of Parliament, by virtue of which he was exempted from specifying the particulars of his process during the first seven years of the duration of his patent. In 1817, and therefore before the publication of his specification, Messrs. Hill and Bundy took out their patent for machinery for breaking and preparing raw flax and hemp. The rival claims of these two inventors were investigated in 1817 by a committee of the House of Commons; but whatever may have been the comparative merit of the two processes, in the course of a very few years both were relinquished and forgotten. Since that time various other ingenious mechanical arrangements have been devised, but hitherto they have had very little success.

Schenck's process, for which he obtained a patent in 1846, is undoubtedly a very important improvement; it consists merely in steeping the flax stems in warm water, heated artificially to the temperature best suited to fermentation. By this simple means, the operation is rendered rapid and certain, all uncertainty from fluctuations in the temperature and weather is avoided, and the whole process is entirely under the command of the manufacturer. The temperature best suited for this purpose is about 80°, or from 80° to nearly 90°; above this point the process proceeds too rapidly, and the fibre is almost sure to be more or less injured. The time required is from about 70 to 90 hours.

From the facts and evidence brought forward by various independent exhibitors, it appears satisfactorily proved that the warm-water steeping increases the percentage of fibre obtained from the flax stem over that obtained by the old modes of retting by nearly one-fifth; and that, whilst the fineness and spinning qualities of the fibre are increased, the strength is in no way weakened or diminished, unless the process be permitted to proceed too far, an effect which need never happen, from the complete control over it which the manufacturer has throughout. Although there is no doubt as to the practical value of the use of warm water in flax-retting, yet the introduction of Schenck's process is far from removing all the difficulties of the flax manufacture; much still remains to be effected, and it is by no means improbable that, ere long, a yet more perfect process may be devised.

It is interesting to observe that the use of warm water in the preparation of vegetable fibre is not altogether new, it having been long employed by the Malays, and by the natives of Rungpoor, in Bengal. The process adopted at Bencoolen is stated by Dr. Campbell to consist in steeping the stems of the hemp in warm water, in which it is allowed to remain for two days and nights.

The old German process called "Molkenröst," sometimes used in preparing the finer sorts of flax, is also, to some extent, an application of the same principle. In this mode of retting, the flax was steeped for four or five days in a warm mixture of milk and water, and thus the desired degree of fermentation in the flax stems was produced. This operation must be distinguished from the more modern one, in which sour milk was used in order to give a good colour to linen, a process introduced by the Dutch towards the middle of the last century. The linen was boiled in a weak alkaline lye, and subsequently treated with sour buttermilk, for the purpose of aiding in removing the alkali, and dissolving the earthy impurities present in the fibre. Occasionally, also, salt of sorrel was used for the same purpose; and in 1775, Reuss states, that sulphuric and muriatic acids might be used for the same purpose; but that being too costly, they had not as yet come into general use. Of course, all processes in which boiling or even hot water is used are quite different in their mode of action from those in which only warm water is employed. When boiling water is used, it is with a view of dissolving and removing the useless matters which encrust the fibrous part of the plant; whilst, on the other hand, warm water is used to soften them, and to aid in their putrefaction or decomposition, through the agency of fermentation. In 1787, much interest was excited in Ireland by the publication of a plan for improving the retting of flax by the action of hot water; in this scheme, it was proposed to scald the flax-stems in boiling water to soften them, and to remove a portion of the extraneous vegetable matters which they contain; and it was conceived that after this treatment the subsequent retting of the flax would be more rapid, certain, and manageable; so that time would be saved, the noisome process of pond-retting be obviated, and the result be to yield a stronger and whiter fibre. The minute and careful experiments of Hermbstaedt, on the chemical principles involved in the retting of flax (made about the beginning of the present century), threw much light on the whole subject, and to some extent indicated the influence of temperature on the success of the operation.

The entire collection shown by the "Royal Society for Improving and Promoting the Growth of Flax in Ireland" (106, p. 203*) is so highly valuable, and so clearly illustrates the great advances which have already been made in these matters, and the important service which this society has already rendered to the country, that the Jury determined to mark their high appreciation of the Society's labours by the recommending the Council Medal. (See p. 69.) Among the individual specimens of particular merit may be mentioned the flax exhibited by **White**, of Antrim, **Preston**, of Belfast, and **Adams**, of Ballyderitt, near Coleraine (49, p. 198*): to each of these three the Jury awarded a Prize Medal.

A very useful and complete series of the principal commercial varieties of flax, hemp, and similar fibrous materials, commonly met with in the English market, is contributed by Messrs. **Hutchinson** (40, p. 197*). The samples, which are all good, are as follows:—

Flax.

French flax.
Flemish do.
Dutch do.
Friesland do.
Archangel do.
Riga flax.
English do.
Egyptian do.
New Zealand do.
Jute.

Hemp.

Petersburg best hemp.
Petersburg half-clean hemp.
Riga Rein do.
Riga Pass do.
American do.
Egyptian hemp.
India brown do.
India scum do.
Manilla do.
Italian do.

For this collection the Jury awarded a Prize Medal.

A numerous series of specimens are contributed by P. **Claussen** (105, p. 202*, 203*), in illustration of his patent process of making flax cotton. This process (patented August 1850) consists essentially in boiling the cut and crushed stems of the flax, hemp, or other plant, in a dilute solution of caustic soda, containing about one two-thousandth part of alkali. The fibrous matter is then removed, and plunged into a bath of dilute sulphuric acid, containing one five-hundredth part of acid, in which it is boiled for about an hour. It is next transferred into a solution containing about ten per cent. of carbonate of soda; and lastly, when it has remained in the latter for an hour, it is plunged into a weak solution of sulphuric acid, consisting of one part of acid to two hundred or five hundred parts of water; in this it is left for about half an hour, and the process is completed. The effect of these several processes is "to divide and split up" the fibre in a most remarkable manner, so as completely to alter its character. Flax thus treated is converted into a substance very nearly resembling cotton. It is probable that flax cotton can be advantageously used in the manufacture of mixed fabrics, as it appears capable of being spun with wool, silk, and other fibres. It may, therefore, perhaps hereafter lead to several new and important practical applications. For this ingenious process the Jury awarded a Prize Medal.

The idea of modifying the fibre of flax and hemp, so as to convert it into a kind of cotton is by no means new. In 1747, Lilljikreuzes and Palmquist described a mode of converting flax into "cotton" by boiling it for some time in a solution of caustic potash, and subsequently washing it with soap. In 1775, considerable quantities of refuse flax and hemp were converted into "flax-cotton" by Lady Moira, with the aid of T. B. Bailey, of Hope, near Manchester. The full details of the process employed do not appear to have been published; but from Lady Moira's letters in the "Transactions of the Society of Arts for 1775," it appears that the fibre was boiled in an alkaline lye, or a solution of kelp containing carbonate of soda, and subsequently scoured. The result of this was, that "the fibres seem to be set at liberty from each other," after which it may be "carded on cotton cards." It appears that at this time "flax cotton" was made and sold at threepence a pound; and Lady Moira states that she believes that it takes colours better than flax. It is curious to observe the fate of Lady Moira's scheme: she says, "I have no reason to be vain of the samples I have sent you, they merely show that the material of flax cotton, in able hands, will bear manufacturing, though it is my ill fortune to have it discredited by the artizans who work for me. I had in Dublin, with great difficulty, a gown wove for myself, and three waistcoats; but had not the person who employed a weaver for me particularly wished to oblige me, I could not have got it accomplished; and the getting spun of an ounce of this cotton in Dublin I found impracticable; and the absurd alarm that it might injure the trade of foreign cotton had gained ground, and the spinners, for what reason I cannot comprehend, declared themselves such bitter enemies to my scheme, that they would not spin for me. Such is my fate, that what between party in the metropolis and indolence in this place (Ballynahynch), I am not capable of doing my scheme justice. That it should ever injure the trade of foreign cotton is impossible. Though long accustomed to behold shoes and stockings looked upon in this part of the world by the generality as quite unnecessary, yet I cannot think but some apparel is requisite; and as the price of wool is so high, and the poverty of the people so great, I did wish to introduce amongst them that invention which I saw might be greatly improved, and turn the refuse of flax into comfortable clothing, and by a process so easy that every industrious wife and child might prepare it." Lady Moira states, that the flax-cotton gowns which she had had made, and which were worn by the members of her own family, were exceedingly durable; and the specimens of these fabrics, as well as of the flax-cotton prepared by her, which are still preserved in the Museum of the Society of Arts, &c., are highly remarkable for their beauty.

Subsequently to this, several attempts were made in Germany to convert flax into a fibre resembling cotton, which could be used, either alone or together with cotton, in the manufacture of cotton goods. In 1777, Baron Meidinger proposed to convert flax into a sort of cotton, by the action of alkaline solutions, &c. In 1780, a factory was established at Berchtoldsdorf, near Vienna, for the practical working of this process; and similar plans were subsequently brought forward by Kreutzer in 1801, Stadler and Haupfner in 1811, by Sokou in 1816, and by several others. At the factory at Berchtoldsdorf not only was flax converted into cotton, but likewise a useful cotton-like fibre was prepared from tow and refuse flax; and the same is said to have been done by Haag, near Pressburg, in 1788, by Göbell in 1803, and Segalla in 1811. Whether these various plans failed from the effects of jealousy and opposition, like that which prevented Lady Moira from introducing her "flax-cotton," is unknown, but it does not appear that any of them were long persevered in: it is probable that in most cases the neighbouring manufacturers set themselves against the introduction of flax-cotton; for Beckmann, who speaks of its manufacture near Brunswick, states, that the work-people determined not to use the new material, though, at the same time he observes, that excellent fustians were made which could not be distinguished from those manufactured with ordinary cotton. The extreme similarity of flax-cotton to ordinary cotton is also remarked by Des Charmes (1799), who states, that if the staple is cut before it is carded, it is not possible to distinguish it from cotton, either in its raw state or when manufactured. The matter was subsequently investigated by Berthollet, by Gay Lussac, and by Giobert, who employed alternately steepings in hot solutions of soap, alkali, and sulphuric or muriatic acid. Berthollet observes that equally fine cotton is obtained from the commonest refuse tow, as from the best flax.

A good sample of well-prepared flax is exhibited by Messrs. Cator and Nelson (46, p. 198*). It is shown not on account of superiority of fibre, but as a specimen of manipulation and treatment; it is very creditable, and was deemed worthy of Honourable Mention.

Some good samples of flax are exhibited by G. Mason (54, p. 199*); they are, 1st, flax grown, steeped, and scutched at Yately, North Hants; flax grown in South Hants; flax grown at Cobham, in Surrey; and flax grown at Farnborough. There are likewise samples of flax scutched at Winchester County Gaol, and several specimens of tow; and the whole is illustrated by a series of models of the tools and implements used in the preparation and working of flax. This series was deemed worthy of Honourable Mention.

Some excellent specimens of yellow flax, grown at Trimmingham, in Norfolk, by Mr. Warnes,* and some blue flax grown in Yorkshire, as well as some of the best Courtrai and Lokeren flax from Belgium, are exhibited and contrasted, both in the raw and partly manufactured states, by Messrs. Hives and Atkinson, of Leeds (45, p. 198*). They are very creditable, and fully entitled to Honourable Mention. (See p. 101.)

Excellent Courtrai flax is also exhibited, for best quality and finish, by Messrs. Marshall,* of Leeds (55, p. 199*); these also are well entitled to Honourable Mention. (See p. 101).

An interesting series of samples of flax, prepared by mechanical means alone, is exhibited by M. J. J. Donlan (43, p. 197*, 198*).

A number of good samples of raw and partially-dressed flax are also shown in connexion with thread and other manufactured articles: amongst them it will be enough to mention the specimens of Devon and Dorset flax, both watered and heckled, which are contrasted with good Polish and Russian flax in the Bridport series (Class XIV., 73 to 514); the golden flax grown at Chiswick, by J. P. Bull; the flax from Islay, grown by W. Simpson (pp. 510-513); the flax shown by Sadler, Fenton, and Co. (Class XIV., 18, pp. 510-513), and Jameson and Co., of Hull (Class XIV. 60); all of which, as well as the samples of flax from West Chinnock, in Somerset, shown by R. Hayward (Class XIV., 44, p. 512), and those from Crewkerne, shown by P. Loveless and by J. Brooks of Dinnington, are excellent.

Some good samples of hemp, accompanied by cloth manufactured from it in the Himalayas, are shown in the valuable collection of East Indian fibres.

Samples of Canadian flax are exhibited by M. Bastien, of St. Rise (70, p. 963), and of hemp, by F. Grice, of Montreal (71, p. 963). In both cases the quality of the fibre is good, but its preparation is faulty and objectionable; with a little more care the value of each would be considerably increased: they were both deemed worthy of Honourable Mention.

A good specimen of flax from Van Diemen's Land is exhibited by J. Dixon, of Skelton Castle, Isis (19, p. 99), and by F. Lipscombe (174, p. 995): these were both deemed worthy of Honourable Mention.

A few small samples of flax and hemp from the United States are contributed by E. R. Dix, of Vernon, New York (139, p. 1441). They are of fair average quality, but

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* Awarded a Prize Medal by Jury of Class XIV.

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not remarkably fine; they were, however, deemed worthy of Honourable Mention.

Fine samples of strong and well-prepared flax are shown from the Flax Spinning Mills of Schönberg, in Moravia (95a, p. 1012), by Jacob Birnbaum (95, p. 1612), and from the Patent Flax-retting Establishment at Ullersdorf, also in Moravia (96, p. 1012), the latter including raw flax—the same water-retted—and heckled flax. A Prize Medal was awarded to each of these three series.

The samples of Belgian flax are, as might be expected, excellent, and well sustain the high and acknowledged reputation which it has long enjoyed. Several of the specimens shown are remarkably strong, fine, and mellow. In particular, the Jury would specify the flax shown by David and De Boe, of Antwerp (98, p. 1154); Desmedt and Co., of East Flanders (104, p. 1154); J. B. Van Bogaert, of Grimbergen, in East Flanders (107, p. 1154), who also shows some excellent hemp. P. J. Verbeeck, of Grimbergen (113, p. 1154), and J. B. Van Wiele, also of Grimbergen, in East Flanders (114, p. 1154), who contributes pond-retted flax of 1850. To each of these five the Jury awarded a Prize Medal.

Fine samples of flax are also exhibited by Degraeve-Delforterie, of Ghelueve, West Flanders (90, p. 1154); F. Leclercq, of Longchamp, Namur (88, p. 1154); F. Vercruysse, of Dewbyck, near Courtrai; and J. C. Van Ackere,* of Wevelghem, in West Flanders (215, p. 1154-1158); these were deemed worthy of Honourable Mention.

Several good specimens of flax in its various stages of preparation are likewise contributed by Roels and Co., of Lokeren (83, p. 1154); De M. Laviolette, of Bruges (96, p. 1154); S. P. Van Hoey, of Hamme, in East Flanders (106, p. 1455); B. Haese, of West Flanders (115, p. 1154); and by the Flax Company of Ghent (230).

Among the samples of Belgian hemp, those of F. Verhelst, of Grimbergen, in East Flanders (102, p. 1159); Pierre Jean Van Riet, of Moerzeke, in East Flanders (103, p. 1154); and J. L. Gilta, of Appels, in East Flanders (105, p. 1154), were deemed the best: the Jury awarded a Prize Medal to each of these three.

In the Egyptian Collection of raw produce, several specimens of flax and hemp are shown. The flax of Faoum (107, p. 1409), that from Menauf (108, p. 1409), and the sample of hemp (152, p. 1409), were deemed worthy of Honourable Mention.

Very superior flax and hemp are contributed by some French exhibitors, especially from the Northern Departments. Among the exhibitors of flax may be specified L. Dumortier, of Bourbecque, near Lille (177. p. 1182), who shows flax of the year 1849, retted in the river Lys. F. Rouxel, of St. Brieux (362, p. 1174); Joubert Bonnaire, and Co., of Angers (552, p. 1205), who also show excellent hemp; and E. H. Laillier (559, p. 1205); to each of these four, severally, the Jury awarded a Prize Medal.

Among the French exhibitors of hemp, those deserving of special notice are Messrs. Besnard, Richoux, and Genest, of Angers (61, p. 1174). Lainé Laroche, and Max-Richard, of Angers (286, p. 1190); and Leclerc Brothers, also of Angers (576, p. 1205); to each of these three the Jury awarded Prize Medals.

In the Zollverein collection, the samples particularly deserving notice are those shown by A. Rüfin, of Rüstern, Liegnitz (34, p. 1049), specimens of flax swingled in the Belgian method, by the Baron von Lüttwitz, of Simmenau, near Ippeln (42, p. 1050); and G. Mevissen, of Dülken, near Düsseldorf (557, p. 1082): to these three the Jury awarded Prize Medals.

The samples of flax contributed by E. F. Elmendorf,* of Isselhorst, near Bielefield (470, p. 1078): Königs and Buecklers, of Dülken, near Düsseldorf (552, p. 1081); A. Bruenger, of Jöllenbeck, near Bielefield (559, p. 1082); and C. E. Hornig, of Brunswick (722, p. 1090); and P. Ollerdissen, of Ureutrup, near Bielefield (551, p. 1081); were severally deemed worthy of Honourable Mention.

A good sample of hemp is exhibited by the Landwirthschaftlicher Verein, at Sangerhausen.

Some samples of well-prepared flax are also exhibited from Saxony: those exhibited by C. Sommer, of Sornzig, near Mügen (1, p. 1104), J. Watteyne, of Lichtenburg, near Freiburg (2, p. 1104), and W. Gaetzschmann, of Zittau (3, p. 1104), were deemed worthy of Honourable Mention.

Specimens of flax and hemp prepared in a peculiar manner, are shown by S. L. Swaan, of the Hague (50, p. 1145).

In the Portuguese collection, there are several specimens of both flax and hemp. The hemp from Catharia, exhibited by the Duke de Palmella (530, Class I. and II., p. 1330), shown both in the state of dried stems and partially dressed, was deemed worthy of Honourable Mention.

Several specimens of flax and hemp from Rome are also shown. A sample of Centese hemp, contributed by the Chamber of Commerce of the city of Cento (3, p. 1285), was deemed worthy of Honourable Mention.

Hemp is also exhibited from Bologna, by the Count Bianconcini (4, p. 1285), and by Marco Minghetti (10, p. 1285).

A large and important series of flax and hemp samples is shown in the Russian collection of raw produce, and several of them are capital specimens. The flax is in considerable variety—from fine and silky, down to coarse and wiry; some of the specimens are a little unequal and irregular. Among the best may be mentioned those of Ardamatsky Brothers, from the government and district of Novgorod (99, p. 1069); E. Karnovitch, from the government of Jaroslaff (101, p. 1367); and those from Valk, in the district of Vinsk, government of Esthonia (106, p. 1369); some of the latter, in particular, are especially fine. The Jury awarded Prize Medals for these three.

Some excellent flax is also exhibited by Michael Babarikin, of Kholm, in the government of Pskoff (96, p. 1369); from the Farm of Gorigoretzk, in the government of Mohiloff (121, p. 1370); Clarke, Morgan, and Co., government of Vologda (114, p. 1370); S. Zakharoff, of Kholm, in the government of Pskoff, (108, p. 1370); and Kosma Milokroshetchnoi, of Pudjoi (110, p. 1370). The samples from these five exhibitors were deemed worthy of Honourable Mention.

Good specimens of flax are also contributed by John and Theodore Ardamatsky, of Soletz, in the government of Pskoff, (97, p. 1369); John Ardamatsky, of Porkoff, in the government of Pskoff (98, p. 1369); Melnikoff, of Melenkoff, in the government of Vladimir, (111, p. 1370). Theodore Vaniskoff, of Soletz, government of Pskoff (112, p. 1370); and the Velikoe Estate, in the government of Jaroslaff (105, p. 1369).

Of the samples of Russian hemp, the best are those exhibited by Krashenenekoff, from the district of Sevsk, government of Orel (100, p. 1369); Kosma Filemonoff, of Rilsk, government of Jaroslaff (103, p. 1369); and the Prince Volkhonsky, from the district of Sevsk, government of Orel (109, p. 1370). For each of these three series a Prize Medal was awarded by the Jury.

Very good samples of flax and hemp are exhibited in the Spanish Department of raw produce; among the best are the flax contributed by F. A. Valcoma, of Cacabelos, Leon (98, pp. 1334, 1335); the Province of Huesca (158, p. 1339); and by P. De Las Heras, of Segovia (161, p. 1339). These were severally deemed worthy of Honourable Mention.

Good specimens of flax are also contributed by J. M. Calderon, of Grenada (152, p. 1338); J. Pinan, of Leon (159, p. 1339); flax from Calateras, and Vega de Monasterios, by De Las Heras, of Zamora (91, p. 1339); flax from Camarzana, and Puebla de Sanabria (91, p. 1334); and by De Las Heras, of Saragossa; flax from Borja (p. 1339).

The best samples of Spanish hemp are those exhibited by J. M. Calderon, of Grenada (152, p. 1338); P. Martinez, of Valencia (156, p. 1338); and by Count Ripalda, from Valencia (163, p. 1339). For each of these three samples, the Jury awarded a Prize Medal.

A very excellent specimen of strong, though somewhat coarse hemp, is also shown by A. Diez De Ribera, of Grenada, (172, p. 1339); this was deemed worthy of Honourable Mention.

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* Awarded also by Jury of Class XIV.

Samples of hemp are contributed likewise by the Municipal Corporation of Castellon (153, p. 1338); D. DE ——, of Murcia (154, p. 1338); D. DE ——, of Saragossa (155, p. 1338).

Some interesting samples of water-retted flax from Angermaland, in the north of Sweden, are exhibited by JOHAN JOHANSSON (21, p. 1350). The flax is of very good quality, though not well manufactured; it was however deemed worthy of Honourable Mention.

In the Turkish collection, six samples of flax and two of hemp are exhibited; the latter are from Djanik, and Wallachia; the former from Eudemith, Djanik, Unia, Aidin, Drama, and Wallachia.

MISCELLANEOUS FIBRES.

In the various collections of raw produce, a very large number of other fibrous substances, used as substitutes for cotton, flax, and hemp, are shown; some of these are new or but little known, and among them are several which, from their valuable properties, seem likely, ere long, to become important articles of trade, and not merely to form excellent substitutes for the substances already employed by manufacturers, but even in some cases to lead to the development of new branches of industry.

An interesting series of hemp, flax, and other fibrous substances is contained in the Liverpool collection of imports, these include—

			1849	1850
			Tons.	Tons.
1. Dutch flax	Linum usitatissimum	Holland	78	153
2. Egyptian ditto	,, ,,	Alexandria	–	270
3. Tow	,, ,,	Holland	3	3
4. Hemp	Cannabis sativa	Canada	–	–
5. ,, Polish Ryne	,, ,,	Poland	–	–
6. ,, Petersburg	,, ,,	Russia	–	–
7. ,, white crown	,, ,,	Marienburg	–	–
8. ,, Italian garden	,, ,,	Italy	–	–
9. ,, Bombay	Hibiscus cannabinus	Bombay	129	212
10. Jute	Corchorus capsularis	East Indies	8,660	12,216
11. Sunn	Crotolaria juncea	,,	–	81
12. Coir rope	Cocos nucifera	Bombay and Calcutta	470	1,100
13. ,, yarn	,, ,,	,, ,,	200	370
			Bales.	Bales.
14. China-grass	Urtica nivea (?)	Canton and Hong Kong	150	320
			Tons.	Tons.
15. Picaba	Attalea funifera	Para	–	300
16. Manilla hemp	Musa textilis	Manilla	81	192
17. Brazil Palmetto	Carnanba palm	Para	Occasional.	
18. Brazil Jute	Unknown	,,	,,	
19. Spanish moss	Tillandsia usneoides	Brazil	,,	
20. Vegetable Silk	Chorisa speciosa	,,	,,	

Samples of flax from Holland, Belgium, France, and Russia are shown in the Hull collection of imports, and the quantity of flax imported annually is stated to be about 310,000 cwts. Specimens of hemp are exhibited also from Prussia and Italy, the yearly import of which is about 55,000 cwts.; and samples of East Indian hemp, Manilla hemp, and jute; of the latter, about 1,100 cwts. are annually imported.

Amongst fibrous materials, one of the most interesting is the "China-grass," of which numerous specimens are exhibited in various departments of the Building, some of the most complete and valuable series being in the English Gallery.

Although China-grass fibre is comparatively a new material in the hands of our manufacturers, yet it has been known to men of science for a very considerable time; but certain practical difficulties have hitherto prevented it from being usefully and profitably employed. China-grass fibre is obtained from *Urtica nivea*, abundant in China and in various parts of the Indian empire, where it has long been used by the natives, who, by the simple maceration of the plants, obtain from them a strong and very useful fibre. Of the various fibres examined by Dr. Roxburgh, at the commencement of the present century, with a view to the discovery of some cheap and good substitute for hemp, one of the most promising was the "Callooee" hemp, "Kankhura," or the "Ramy," of the Islands and Malay peninsula. This he found to be the produce of an Urtica, to which he gave the name of *U. tenacissima*. The plant was introduced in 1803, from Bencoolen to Calcutta, where it was cultivated for several years in the Botanic Garden, then under the charge of Dr. Roxburgh. A considerable quantity of Callooee hemp having been imported into England in 1814, its practical value was tested by some competent authorities; and as the reports were highly favourable as to its strength and other valuable qualities, the Society for the Encouragement of Arts and Manufactures awarded a silver medal to Captain Joseph Cotton, of the East India Company, for its introduction. The chief obstacle which interfered, however, with its use, was the difficulty which was found to exist in the preparation of the fibre from the stems of the plants; none of the processes usually adopted with flax or hemp were found to be at all suitable to them; and the rude, wasteful, and imperfect means employed by the natives in preparing the fibre for the manufacture of twine, thread, and fishing-nets, by the mere process of scraping, were wholly inapplicable on a large scale, and gave, besides, only a very inferior result. When macerated or retted in water, it was found that the fibre itself was more easily destroyed than the glutinous matter of the stem. It was hoped that the introduction of the machines of Mr. Lee, and of Messrs. Hill and Bundy, already referred to (see p. 97), would have obviated this difficulty; but such did not prove to be the case.

During the last forty years, various attempts have been made to devise a good and cheap process for preparing this fibre, but hitherto without much success; and consequently, till quite recently, the cost of the fibre was such as to preclude its being brought into the market as a substitute for flax. But recent investigations have shown that the *Urtica tenacissima* and the *heterophylla* may be obtained, in almost unlimited quantities, in various parts of India; and a process, which has lately been patented, appears, to a very great extent, to have removed the practical difficulties which previously stood in the way of its employment by manufacturers; so that in a few years it is probable that the Callooee hemp will constitute an important addition to the fibrous materials employed in the arts.

The process of Messrs. L. W. WRIGHT and Co., for the preparation of China-grass, &c., for which a patent was obtained in 1849, consists, essentially, in a very ingenious arrangement for boiling the stems in an alkaline solution, after they have previously been steeped for 24 hours in cold water, and for 24 hours in water of a temperature of 90°. The fibre is then thoroughly washed with pure water, and finally subjected to the action of a current of high-pressure steam till nearly dry. A very beautiful series of specimens illustrating the preparation of this fibre, the various stages of the process, the bleaching of it, and the uses to which it may be applied, both alone and in conjunction with other fibrous materials in the formation of mixed fabrics, is shown by Messrs. WRIGHT (42, p. 197*). For these the Jury awarded a Prize Medal.

Very beautiful samples of China-grass fibre are likewise shown by Messrs. HIVES and ATKINSON* (45, p. 198*), already mentioned as exhibiting superior samples of flax. For these two series the Jury awarded a Prize Medal.

Equally fine specimens are exhibited by Messrs. MARSHALL and Co.,* of Leeds (55, p. 199*), whose samples of flax have already been alluded to. For these samples also the Jury awarded a Prize Medal.

A valuable and instructive series of samples of New Zealand flax is contributed by E. W. TRENT (41, p. 197*), in illustration of its manufacture and uses. It is stated that the flax is prepared from the leaves of the *Phormium tenax*, without any process of steeping, and by a simple mechanical process, which the exhibitor suggests might be advantageously carried on in New Zealand itself. This series was deemed worthy of Honourable Mention.

Some interesting specimens, showing the native manufacture of New Zealand flax, are likewise exhibited by TAO NUI, a New Zealand chief (44, p. 198*). The flax is prepared for weaving, by soaking it for two days in water, twisting it into hanks, and then beating it with a mallet on a stone. This series was deemed worthy of Honourable Mention.

Good specimens of cocoa-nut fibre are shown in illustration of the various purposes to which it is now extensively applied, by J. BARSHAM (56, p. 199*), and by WILDEY and Co. (Class XXVIII., 40, p. 780).

In this department of raw produce, as in most others, the East Indian collection is peculiarly rich,—very interesting varieties of vegetable fibres being exhibited (pp. 382-384). The old investigations of Dr. Roxburgh, in the beginning of the present century, already referred to, are of much importance in connexion with this subject; and it is remarkable that though the value of some of these Indian fibres was well known to him, and that he repeatedly sent samples of them to this country, they have never received that attention from practical men which they certainly deserved, with the exception of one or two that have long since become considerable articles of import. Of these, we may instance the jute, the fibre of the *Corchorus capsularis*, and *C. olitorius*, of which, as has just been stated, more than ten thousand tons are annually imported into Liverpool alone. The following Table shows the comparative strength of several of these East Indian fibres, as ascertained by Dr. Roxburgh; but it must be borne in mind, that, in several instances, the fibres had evidently been very rudely and imperfectly prepared: the experiments were made in 1804.

		Breaking Weight.
		lbs.
1. Hemp (English) –	Cannabis sativa – –	105
2. Murga (Sanseviera)	Aletris nervosa – –	120
3. Aloe – – – –	Agave americana? – –	110
4. Ejoo – – – –	Saguerus Rumphii – –	96
5. Donsha – – –	Æschynomone cannabina	88
6. Coir – – – –	Cocos nucifera – –	87
7. Hemp (Indian) –	Cannabis sativa – –	74
8. Woollet comal –	Abroma Augusta – –	74
9. ——? – – –	Bauhinia – – – –	69
10. Sunn – – – –	Crotolaria juncea – –	68
11. Bunghi paat – –	Corchorus olitorius –	68
12. Ghu nala paat –	,, capsularis –	67
13. ——? – – –	Hibiscus manihot – –	61
14. Flax (Indian) – –	Linum usitatissimum –	39

It is evident, however, that these experiments could not be regarded as giving at all accurate comparative results; they only proved that many of the fibres were very strong, and well merited further trials. In 1808, Dr. Roxburgh made a second series of similar experiments, the results of several of which were as follows:—

		Breaking Weight.
		lbs.
1. Bow-string hemp –	Asclepias sp. – – –	248
2. Callooee hemp –	Urtica tenacissima – –	240
3. ——? – – –	Corchorus capsularis –	164
4. Sunn – – – –	Crotalaria juncea – –	160
5. Hemp (Indian) –	Cannabis sativa – –	158
6. Doncha – – –	Æschynomone cannabina	138
7. ——? – – –	Hibiscus strictus – –	128
8. Musta paat – –	,, cannabinus –	115
9. Bunghi paat – –	Corchorus olitorius –	113
10. Plantain – – –	Musa – – – – –	79

It is plain that the strength of all these fibres was ascertained under very unfavourable circumstances, and there is no doubt that they would have been found even yet more valuable had they been well and properly prepared. The principal vegetable fibres contributed from India are the following:—

1. "Callooee," "Rhea," or "China-grass," the fibre of *Urtica tenacissima*, and one or two other varieties of *Urtica*, already mentioned as well known in commerce under the name of "China-grass." Strictly speaking, it is probable that China-grass and Callooee hemp, are the produce of two distinct species of Urtica, though the fibre of the two is very similar, and, for all practical purposes, in fact identical. China-grass, as it is most commonly called, is the produce of the *Urtica* (*Boehmeria*) *nivea* of Willdenow, whilst the Callooee, Kalmoi, or Rami of Sumatra, is obtained from the *Urtica* (*Boehmeria*) *tenacissima* of Roxburgh. It is from this latter plant, also, that the Rhea of Assam is procured. The plants yielding this beautiful fibre are very abundant in many parts of the empire, and may be had in almost unlimited quantities. In the form of hemp, and when the fibre is well prepared, it is remarkably strong, and when thoroughly bleached, though the strength is then somewhat diminished, it acquires a most remarkably beautiful white silky lustre. Various specimens of this fibre are contributed from different parts of India; from Calcutta; from Assam, by Major HANNAY; BABOO DEONATH, and BABOO LAKENATH (pp. 882-884), from Rungpore, in the district of Moorshedabad, &c., and from Singapore: these the Jury deemed severally worthy of Honourable Mention. Some interesting samples of the fibre of the *Urtica heterophylla* are contributed by Mr. THOMAS (pp. 882-884); this plant is abundan[illegible] Mysore, and especially in the Neilgherries, flourishing in Alpine jungles: unfortunately, it is one of the most highly venomous of all the nettle tribe. It is stated that the Todawars prepare the fibre of this plant by boiling the stems in water, after which, they readily separate it from the woody parts, and then spin it into a coarse but very strong thread. The Malays simply steep the stems in water for ten or twelve days, after which they are so much softened, that the outer fibrous portion is easily peeled off.

2. "Yercum nar." The fibres of the *Calotropis* (*Asclepias*) *gigantea*, a plant which grows wild, abundantly, in various parts of the Bengal and Madras Presidencies, and is used by the natives in the manufacture of cord, called "Lamb-dore," or "Toondee coir." The fibre is of very remarkable strength: from some recent experiments made by Dr. Wight, its tenacity, as compared with some of the other Indian fibres when made into ropes, is as follows:—

		Breaking Weight.
		lbs.
1. Yercum nar – –	Calotropis gigantea –	552
2. Janapum – – –	Crotolaria juncea – –	407
3. Cutthalay nar – –	Agave Americana – –	362
4. Cotton – – –	Gossypium herbaceum –	346
5. Marool – – –	Sanseviera zeylanica –	316
6. Pooley mungu – –	Hibiscus cannabinus –	290
7. Coir – – – –	Cocos nucifera – –	224

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* Awarded also by the Jury of Class XIV.

Specimens of the Yercum, or fibre of *Asclepias gigantea* (and of the Tongoos, and of the *Asclepias tenacissima*), or bow-string hemp of Rajemahl, are sent from Coimbatore, and other districts in the Madras Presidency.

3. "Umbaree," or "Maestee pât;" the fibre of the Palungeo, or *Hibiscus cannabinus*, a plant common all over India, and cultivated in many parts for the sake of its fibre. The process, generally adopted, seems to be that of steeping the stems in water till putrefaction commences, when they are taken out, washed, and beaten until the fibre separates from the woody portion of the stem: this fibre is contributed from Madras.

4. "Marool," or "Moorva;" bow-string hemp, obtained from the *Sanseviera zeylanica*, a plant abundant in the southern parts of the continent of India, sent from Cuttack, Coimbatore, and other districts in the Madras Presidency: a good specimen is exhibited by F. LIMA (pp. 882-884).

5. "Jute," or "Pāāt," &c., the fibre of various species of *Corchorus*, especially *C. olitorius*, well known in commerce, one variety of it having been formerly called Chinese hemp. Many different samples of this fibre are contributed from Calcutta and from Madras. From Rungpore, in the district of Moorshedabad, samples of three varieties of jute are sent, called Suffed Hemonty Pat, Lall Hemonty Pat, and Lall Petrie Pat.

6. "Sunn," "Janapam," Indian hemp; the fibre of the *Crotolaria juncea*, likewise well known in commerce. Good samples are contributed from Coimbatore, &c.

7. "Dhuncha," or "Danche," obtained from the *Æschynomene cannabina*, used by the natives of Bengal to make fishing-nets; a remarkably strong though rather harsh fibre, pretty well known in commerce. The plant is commonly cultivated in Bengal: good specimens, accompanied by cordage and rope manufactured from it, are exhibited by Messrs. THOMPSON of Calcutta (p. 884): these were deemed worthy of Honourable Mention.

8. "Coir," the fibrous part of the husk of the cocoa-nut, *Cocos nucifera*, well known in commerce: good samples are sent from Calicut.

9. Nar, or aloe fibre, the produce of the *Agave vivipara*, and other allied species. A valuable and strong fibre is prepared in many parts of India, from different species of aloe. A very interesting series of these fibres, which are obtained from the large Hill aloe, and from the small aloe, illustrating the preparation of the fibre, exhibiting some of the uses to which it is applicable, and showing the facility with which it may be dyed of various colours, is contributed by Dr. HUNTER of Madras (pp. 882-884), who has also added many other valuable specimens to the Indian collection of fibrous materials. For these the Jury awarded to him a Prize Medal.

10. Specimens of aloe fibre are contributed from various parts of the Madras Presidency—Madras, Madura, Coimbatore, &c., and from Singapore.

11. Yucca fibre, obtained from *Yucca gloriosa*, is also sent from Madras, by Dr. HUNTER (pp. 882-884).

12. Ejoo, or Gommuti, obtained from the *Arenga saccharifera* (*Saguerus Rumphii*), or Gummuttee Palm, much esteemed in the Eastern Archipelago for making ropes and cables, in consequence of its extraordinary elasticity and durability in water; unfortunately, the value of this fibre is greatly diminished by its peculiar fragility. Very good samples of this fibre are contributed by TAN KIM SENG, of Singapore (pp. 882-884): these were deemed worthy of Honourable Mention.

13. Putwa, or Mawal fibre, obtained from the *Bauhinia racemosa*, a plant common throughout the lesser hills of India, contributed from Bhaugulpore, in the division of Patna.

14. Talli Nanas, fibre of the pine-apple, *Bromelia ananas*, from various localities. Good samples are exhibited from Madras, by F. LIMA (pp. 882-884), and Dr. HUNTER (pp. 882-884); from Singapore, by Captain H. MAN (pp. 882-884); from Travancore, &c. Some very beautiful specimens of fibre, called "ananas flax," are exhibited from Java, by L. WEBER (pp. 882-884): the real source of this fibre does not seem to be very certain, for though from its name it might be supposed to be pine-apple fibre, it more closely resembles that of the Urticas, or Boehmerias, already mentioned. It is so remarkably fine that the Jury awarded a Prize Medal to Mr. WEBER for it.

15. Plantain fibre, and Manilla hemp, obtained from the *Musa textilis* and *M. paradisaica*, contributed from Madras, from Dacca, and by the Rev. M. STORK, from Chittagong (pp. 882-884). Excellent canvas and ropes are shown, made of this fibre, which is extensively used in the Government establishments at Ceylon.

16. Marsdenia fibre, obtained from the *Marsdenia Roylii*, and contributed by his Highness the MAHARAJAH OF NEPAL (pp. 882-884).

17. Pulas, fibre of the *Butea frondosa*, used for making common cordage, from Beerbhoom, in the division of Moorshedabad.

18. Parkinsonia fibre, obtained from the stems of *Parkinsonia aculeata*, introduced from the West Indies, sent by Mr. ALLAN, from Madras (pp. 882-884); said to be well suited for the manufacture of paper.

19. Roxburghia fibre, obtained from the *Roxburghia gloriosoides*.

20. Artocarpus fibre, obtained from an *Artocarpus*: this and the preceding fibre are contributed by Mr. SIMONS, from Assam (pp. 882-884).

21. Trap fibre, obtained from the bark of the trap tree, a species of *Artocarpus*, contributed from Singapore.

22. Trophis fibre, from the *Trophis aspera*.

23. Daphne bark, the fibrous bark of the *Daphne cannabina*, used in the manufacture of Nepal paper.

Besides these, several other fibrous substances from different parts of India are exhibited, such as the fibres of the Palmyra leaf, *Borassus flabelliformis*, from Madras, the bark of the Sisse tree, contributed by Captain REYNOLDS (pp. 882-884), and a series of vegetable fibres from Arracan, called Theng-ban-shaw, Pathayon-shaw, Shaw-phyos, Ngan-tsoung-shaw, Shaw-me, and Ee-gywot-shaw, &c., which are Honourably Mentioned.

Several of the Indian fibres, already mentioned, are also contributed from Ceylon. Good samples are shown, both as mere fibres, and also in the various states of thread, rope, and coarse cloths; of coir, aloe flax, and the fibre of the Plantain, Hibiscus, and Sanseveria.

Specimens of aloe fibre are contributed from the Cape of Good Hope by C. WATERMEYER, of Green Point (17, p. 951).

Aloe fibre, obtained from the *Agave Americana* and *A. vivipara*, has been also sent from Barbadoes.

From St. Vincent, samples of the "Mahaut" bark in its raw state, the fibrous part in the state in which it is employed in the manufacture of fishing-nets, and samples of lapeto, used also in the manufacture of common cord and coarse lines for fishing nets, are exhibited by G. BULLOCK, of St. Vincent (p. 975).

Several interesting specimens of various fibres are shown in the collection from British Guiana: amongst these are specimens of silk-cotton, obtained from the *Bombax ceiba*, from George Town, Demerara, said to be exported to the United States, and used in the manufacture of hats. Exhibited by E. C. ROSS (76A and 76B, p. 981).

Plantain fibre, *Musa paradisaica* and *M. sapientum*, from Plantation Vigilance, East Coast, Demerara, exhibited by W. DAVIDSON (77, p. 981); and from Plantation Klein, Pouderoyen River, Demerara, exhibited by A. D. VAN DER G. NETSCHER (78, p. 982). It is calculated that about 8 cwt. per acre of this excellent fibre might be obtained: at present very little of it is used. It is worthy of remark that, in some of the first lists of premiums offered by the Society of Arts, about 1762, special attention was drawn to the beautiful fibre of the plantain:—"Whereas the stem of the Asiatic and American fruit-bearing plantain affords three sorts of fibrous materials which resemble hemp, hard silk, and cotton, all which have been experimentally found capable of being wrought into various sorts of manufactures; and, among others, into cordage, fustians, lawn, knitting, gauze, blonde lace, and excellent candle-wicks, sundry specimens of which manufactures may be seen in the hands of the Register of the Society,"—&c. This advertisement was continued for several successive years, but as no candidate came forward to claim the offered reward, it was at last discontinued.

Silk-grass fibre, the fibre of the *Agave vivipara*, from Plantation Vigilance, East Coast, Demerara; and Fibiiri fibre, obtained from the Ita palm, *Mauritia flexuosa*, from the River Berbice, are exhibited by T. B. DUGGIN (80 and 81, p. 982).

Mohoe or Mahoe-fibre, *Hibiscus elatus* or *Thespesia populnea*, from Demerara, is exhibited by J. F. BEE (82, p. 982). It is a very strong but coarse fibre, used for making cordage, coffee-bags, &c.

Some good samples of Yucca hemp, together with a leaf of the *Yucca serrulata*, from which it is obtained, and rope and cordage manufactured from it, are shown by J. T. THOMPSON, of Nassau, Bahamas (p. 976); also specimens of the fibre of the Palmetto, and of rope made from it. These were deemed worthy of Honourable Mention.

In the Trinidad collection are some specimens of the fibre of the pine-apple and aloe; and also of the fibre of the Mahagua, or Majagua, *Sterculea carribœa*.

Specimens of the leaf and fibre of the *Doryanthes excelsa* are contributed from New South Wales by Sir T. L. MITCHELL (p. 990), as well as some rope made of the latter. These were deemed worthy of Honourable Mention.

Some good samples of New Zealand flax, *Phormium tenax*, are contributed by various exhibitors. Amongst others, by TAO NUI, a New Zealand Chief (44, p. 198*); New Zealand flax, as prepared by the natives, by Rev. J. COLLINSON (3, p. 1000); J. ROBERTSON (4, p. 1001); J. CARADUS (25, p. 1002); and by TYRREL (1 and 28, pp. 1000 and 1002); New Zealand flax, cleaned and prepared by machinery, exhibited by WHYTLAW & SON (34, p. 1002). Each of these exhibitors was deemed worthy of Honourable Mention.

A bale of "New Orleans moss" (*Tillandsia usneoides*), prepared as a substitute for horse-hair, &c., as a stuffing material for upholstery purposes, is exhibited by G. HICKS (559, p. 1469). This substance possesses considerable elasticity, and appears to be very well adapted for the above-mentioned purpose: it is stated that it may be had in any quantity, and at a comparatively small price. The Jury awarded a Prize Medal for this fibre, which, though not altogether new in the London market, does not appear so well known as it deserves to be.

A sample of the fibrous husks of the maize, or Indian corn, also used for stuffing mattresses, is shown by F. O. KETTERIDGE, of Mount Vernon, New Hampshire (253, p. 1452). This substance, though not so good as the "New Orleans moss," being much more brittle and less elastic, was deemed worthy of Honourable Mention.

In the Austrian collections, specimens of fibrous wood divided into very thin and slender strips, and used instead of straw in the manufacture of a sort of plaited work, are shown by S. TANDLER, of Zinnwald, near Töplitz, in Bohemia (657, p. 1031). A Prize Medal was awarded for this ingenious application.

A specimen of *Cynosurus cristatus* is shown by L. VANDEN ABELE, of Appels, West Flanders (p. 1153). This also was deemed deserving of Honourable Mention.

Samples of China-grass, or nettle-fibre, *Urtica* (*Boehmeria*) *nivea*, from China, are exhibited by C. M. COPLAND (pp. 1421, 1422), and by Mrs. RAWSON (p. 1424).

A good fibre, prepared from the date palm (132), together with rope, string, nets, and brushes made from the fibres, are contributed from Broulos, Ghizeh, and other places in Egypt.

A useful fibrous material, proposed as a substitute for animal hair, and also for other purposes, obtained from the dwarf palm of Algeria, is exhibited by AVERSENG & Co., of Toulouse, in the Algerian collection (3, p. 1259). The Jury awarded a Prize Medal for the introduction of this substance.

A new fibrous material, proposed for wadding, for clothing, and for upholstery work, in stuffing mattresses, &c., is exhibited by C. G. FABIAN, of Humboldsaw, near Breslau (95, p. 1054). This substance, which is called "pine wool," is prepared from the leaves or needles of pine trees: it is soft and somewhat elastic, though the fibre is very weak, so that it would perhaps soon mat or felt together in mattresses. It has been found to be very cleanly, and peculiarly free from the attacks of insects, and might probably be advantageously employed, mixed with some stronger and more elastic fibre. The Jury awarded a Prize Medal for this substance.

A good sample of aloe fibre, prepared from the *Agave Americana*, is exhibited by the MARQUIS DE FICALHO (Portugal, 535, p. 1313). This was deemed worthy of Honourable Mention.

Specimens of flax, cotton, pita, or aloe fibre, and mallow fibre, are contributed from Madeira.

A fine and very beautiful fibrous material, called "Bejuco," is exhibited from the island of Luzon by the ECONOMICAL SOCIETY OF MANILLA (234, p. 1344). This substance is very strong, and is used in the manufacture of plaited work, and a sort of cloth remarkable for its strength and softness. The Jury awarded a Prize Medal for it.

Specimens of several of the textile fibres of Cuba are contributed by RAMON DE LA SAGRA (pp. 1338, 1339), including the Daguilla or fibrous inner bark of the *Lagetta lintearia*, together with cord made of it; cord and mats made of palm fibres; Magagua, the fibre of the *Paritium elatum*, and the fibre of the *Hibiscus cannabinus*. These were deemed worthy of Honourable Mention.

Samples of a valuable grass, the *Macrochloa tenacissima*, much used for the manufacture of cord, &c., and which might probably be advantageously employed by paper-makers, are exhibited by D. VILLARS, of Huesca (158, p. 1339). This was deemed worthy of Honourable Mention.

Plantain fibre, prepared from the stem of the plantain, *Musa sapientum*, is exhibited by A. VINAS, of Puerto Rico (160, p. 1339); and Pita, the fibre of the wild aloe, *Agave Americana*, is shown by P. DE LAS HERAS, of Murcia (161, p. 1339).

SECTION VI.—CELLULAR SUBSTANCES.

Comparatively few substances demanding the attention of the Jury are exhibited in this division: they may, in fact, be included under three heads,—namely, cork, rice paper, and amadou or German tinder.

The number of specimens of cork exhibited is very small: the most important series is a small collection shown by T. PEET (132, p. 205*) in illustration of its uses and the mode in which it is manufactured. This was deemed worthy of Honourable Mention. Samples are likewise shown by B. FRENCH (127, p. 205*).

Specimens of cork-wood (a very light wood, in certain respects resembling cork, and which might possibly be employed as a substitute for cork in some of its applications) are contributed from British Guiana by G. PONTIFEX (102B, p. 984) and T. B. DUGGIN (102, p. 984). Several similar light and porous woods, such as the polac of the Archipelago, used for making floats for fishing-nets, are shown in the East Indian collection.

Good samples of French cork, both in the rough state and when cut by De Bossimon's patent machinery, are exhibited by DUPRAT & Co.* (492, p. 1201). Some fine specimens of Algerine cork are likewise shown in the French Department in the collection exhibited by the COMMISSION OF WOODS and FORESTS (47, Alger., p. 1262). These were deemed worthy of Honourable Mention.

One specimen of good Portuguese cork is contributed by D——.

Very good samples of cork are shown in the Spanish collection by J. GUINART,* of Seville (188, p. 1341), and by the PROVINCE OF GERONA.* These were each deemed worthy of Honourable Mention.

Samples of "shola," the cellular pith-like stems of the *Æschynomene aspera* (*Hedysarum lagenarium*) from the vicinity of Calcutta, are shown in the East Indian collection. This remarkable substance, which closely resembles in appearance the well-known "rice paper," well merits attention, and promises to be available for several purposes in the arts. The specimens of shola are accompanied by various illustrations of the uses to which it is applied in India, including life-buoys, boxes, bottle-cases, and hats. From its loosely-cellular structure it is a very bad conductor of heat, and this, together with its great lightness, admirably fits it for the manufacture of hats. Shola is also used advantageously for purposes of ornament, and very beautiful models of temples and other eastern buildings are exhibited, which possess all the appearance of ivory, but with even more softness and delicacy of surface. These specimens were deemed worthy of Honourable Mention.

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* Awarded a Prize Medal by Jury of Class XXVIII.

Rice paper, made from the pith of *Aralia papyrifera*, from China, is likewise shown.

Two good series of specimens of prepared amadou, or German tinder, the leathery base of a fungus (*Boletus igniarius*), are exhibited, namely, in the Austrian collection, by BACHRICH (45A, p. 1009), and in the Zollverein Department by F. A. BECKER SAPP & Co., of Fredeburg (471, p. 1078). These were each deemed worthy of Honourable Mention.

SECTION VII.—TIMBER AND ORNAMENTAL WOODS.

The collection of timber and other woods, taken as a whole, is remarkably complete and interesting; and though in many instances it is obviously impossible for the Jury to enter into the consideration of individual woods, or to do more than enumerate the varieties of the specimens shown, and even difficult in all cases to do that,—yet they considered it desirable to prepare as complete a list as possible of the various single collections included in the Exhibition, so as to form, as far as was practicable, a catalogue of the chief woods of different countries. The Jury would especially draw attention to the very interesting and valuable collections of East Indian woods (p. 885); the complete and well-arranged collection of W. W. SAUNDERS (Class IV., p. 196*); the series of fine specimens shown by Messrs. FAUNTLEROY; the very instructive and excellent specimens exhibited by Messrs. LAWSON (135, pp. 205*, 206*), and by the FRENCH MINISTER OF WAR (p. 1262) in the Algerian collection of raw produce. Highly valuable, also, are the series of Canadian, Australian, and other colonial woods; and the numerous collection of the woods of Cuba, &c. &c.

The total annual importation of timber into Great Britain is nearly two million loads, or one hundred million of cubic feet, entered under the several designations of timber or unsawn wood, deals and planks or sawn wood, teak, staves, and lathwood.

The following Table shows the countries from which wood was chiefly imported in the year 1849:—

	Timber.	Deals.	Teak.	Staves.	Lath-wood.
Russia – – –	41,419	173,586	–	325	15,539
Sweden – –	28,679	79,843	–	150	1,119
Norway – –	28,930	50,805	–	95	103
Prussia – –	117,470	35,006	–	19,213	6,169
Hanse Towns –	2,441	68	–	1,012	–
Tuscany – –	2,299	9	–	–	–
Papal Territories	2,106	3	–	–	–
Western Africa –	1	–	9,596	–	–
British India –	1	2	17,459	56	–
Australia – –	977	540	1	4	–
British North America –	578,748	468,572	9	45,614	14,813
British Guiana –	4	19	4	103	–
United States –	13,832	839	–	13,309	–
Miscellaneous –	1,002	491	633	36	57
Total Loads –	817,909	809,783	27,702	79,917	37,800

Of the chief woods employed in ship-building, seven have been acknowledged as first-rate by the authorities at Lloyd's; and to this number must now be added an eighth, namely, iron-bark, which has, in fact, only been admitted as a first-class wood since the period of opening the Exhibition in May, 1851. These eight woods are—

1. English oak.
2. American live-oak.
3. African oak.
4. Morung saul.
5. East Indian teak.
6. Green-heart.
7. Morra.
8. Iron-bark.

The collection of woods from all parts of the world, exhibited by W. W. SAUNDERS (9), is particularly valuable from its extent and arrangement, the woods being all well labelled and classified according to their geographical distribution. The value of this collection is greatly enhanced by the density and weight per cubic foot of each wood being given. The Jury awarded a Prize Medal for this series, the value of which is considerably increased by the following classified catalogue:—

WOODS, NATIVE OF OR GROWN IN BRITAIN.

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Abele. *See* Populus.						
Abies excelsa (spruce fir) – –	Oxfordshire –	27	2	·434	31	Used for scaffold poles, ladders, common carpentry, &c.
Acacia. *See* Robinia.						
Acacia (?) – – – – – –	Mortlake – –	47	6	·758	75	
Acer campestre (maple) – –	Oxfordshire –	37	1	·593	84	Used for ornamental work when knotted; it makes the best charcoal; and turns well.
,, ,, – –	Epping – –	37	13	·605	562	Specimen from the lower part of the main stem of a young tree.
Acer pseudo-platanus (sycamore)	Wandsworth –	34	11	·555	598	Used in dry carpentry; turns well; and takes a fine polish.
Æsculus hippocastanum (horse chestnut).	,, – –	24	2	·386	895	Used for inlaying toys, turnery, and dry carpentry.
,, ,, ,,	Epping – –	29	15	·479	540	From the stem of a young and vigorous tree.
,, ,, ,,	Oxfordshire –	24	15	·439	25	
Alder. *See* Alnus.						
Alnus glutinosa (alder) – –	,, – –	23	8	·376	45	Used for common turnery work, &c.; and lasts long under water, or buried in the ground.
,, ,, – –	Epping – –	26	2	·418	543	Specimen taken near the ground.
Apple. *See* Pyrus.						
Arbutus unedo (Arbutus) – –	– –	44	12	·716	50	Hard, close-grained, and occasionally used by turners.
,, ,, – –	Lakes of Killarney.	45	6	·726	373	
Ash, common. *See* Fraximus.						
,, mountain. *See* Pyrus.						

WOODS, NATIVE OF OR GROWN IN BRITAIN—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Aspen. *See* Populus.						
Barberry. *See* Berberris.						
Beech, common. *See* Fagus.						
Berberris vulgaris (Barberry) –	– –	37	11	·603	83	Used chiefly for dyeing.
Betula alba (common birch) –	Epping – –	34	14	·558	557	Inferior in quality, but much used in the north of England and Scotland for staves for herring-barrels.
Bignonia radicans – – –	Mortlake – –	19	3	307	650	
Birch, common. *See* Betula.						
Blackthorn. *See* Prunus.						
Carpinus Betulus (hornbeam) –	Epping – –	40	5	·645	560	Very tough, and makes excellent cogs for wheels; forms a good charcoal; and is much valued for fuel.
,, ,, ,, –	– –	38	0	·608	798	
Castanea vesca (sweet chestnut)	Epping – –	27	6	·438	558	Specimen from the main stem, near the ground.
,, ,, (chestnut) – –	Cornwall – –	36	7	·583	796	Used in ship-building, and is much in repute for posts and rails, hop poles, &c.
Catalpa syringæfolia – – –	Mortlake – –	26	4	·420	295	Said to be very durable, and capable of a fine polish.
Cedar of Lebanon. *See* Cedrus.						
Cedrus Libani (Cedar of Lebanon).	– –	38	13	·621	660	Used for furniture, and sometimes for ornamental joinery work.
,, ,, ,,	Kew Gardens –	34	3	·547	76	
,, (?) ,, (cedar?) –	– –	36	12	·588	44	
Cerasus vulgaris (May Duke cherry).	Wandsworth –	41	1	·657	47	Cherry-wood is much used for common furniture.
,, ,, (common cherry)	– –	33	3	·531	86	Excellent for common furniture, and much in repute; works easily, and takes a fine polish.
,, ,, ,,	Epping – –	42	1	·673	555	
Cherry. *See* Cerasus.						
Chestnut, horse. *See* Æsculus.						
,, sweet. *See* Castanea.						
Cork-tree. *See* Quercus.						
Corylus Avellana (common nut)	– –	36	0	·576	85	The young wood is used for fishing-rods, walking-sticks, &c., &c.
,, ,, (hazel) – –	Epping – –	36	8	·584	552	
,, ,, (filbert) – –	Oxfordshire –	35	13	·573	94	
,, ,, ,, – –	Epping – –	37	4	·596	534	
Crab. *See* Pyrus.						
Cratægus oxyacantha (white-thorn).	Epping – –	45	14	·734	336	Hard, firm, and susceptible of a fine polish.
Cupressus sempervirens – –	Mortlake – –	34	10	·554	657	Fine-grained and fragrant; very durable.
Cytisus Laburnum (common laburnum).	Oxfordshire –	45	9	·729	20	Hard and durable, and much used by turners and joiners.
,, ,, ,,	Wandsworth.					
Damson. *See* Prunus.						
Elder, common. *See* Sambucus.						
Elm. *See* Ulmus.						
Euonymus europæus (lance-wood).	– –	34	0	·544	97	Wood used for skewers, and is hard and fine-grained.
Euonymus? – – – – –	Wandsworth –	32	6	·518	21	
Fagus sylvatica (common beech)	Epping – –	27	6	·438	559	Specimen from the lower branch of a large tree.
,, ,, ,,	Oxfordshire –	41	2	·658	26	Much used for common furniture, for handles of tools, wooden vessels, &c. &c., and when kept dry, is durable.
,, ,, ,,	Epping.	39	14	·638	559	
Filbert. *See* Corylus.						
Fir, Scotch. *See* Pinus.						
,, silver. *See* ditto.						
,, spruce. *See* Abies.						
Fraxinus excelsior (common ash).	Oxfordshire –	36	11	·587	24	Very tough and elastic; is much used by the coachmaker and wheelwright, and for making oars.
Furze. *See* Ulex.						
Hazel. *See* Corylus.						
Hedera Helix (Ivy) – – –	– –	29	10	·474	134	
,, ,, – – –	Oxfordshire –	37	12	·604	91	
Holly. *See* Ilex.						
Hornbeam. *See* Carpinus.						
Horse-chestnut. *See* Æsculus.						
Ilex aquifolium (holly) – –	– –	41	9	·665	48	The best white wood for Tunbridge-ware work; turns well, and takes a very fine polish.
Ivy. *See* Hedera.						
Juglans regia (common walnut)	Sussex – –	41	8	·664	663	Wood of a large branch.
,, ,, ,,	,, – –	36	1	·577	664	Specimen taken from the main stem; used for ornamental furniture; much in repute for gunstocks; works easily.

WOODS, NATIVE OF OR GROWN IN BRITAIN—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity.	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Juglans regia (common walnut)	– –	36	7	·583	898	From a very old tree.
,, ,, ,,	Sussex	20	5	–	662	Used for ornamental furniture.
Laburnum. *See* **Cytisus.**						
Lancewood. *See* **Euonymus.**						
Larch. *See* **Larix.**						
Larix europæa (larch)	Oxfordshire	35	0	·560	78	Used in house carpentry, and for ship-building; is durable, strong and tough.
,, (Scotch larch)	Scotland	29	4	·468	787	Used in ship-building.
Laurel. *See* **Prunus.**						
Lilac. *See* **Syringa.**						
Lime. *See* **Tilia.**						
Liriodendron tulipifera (tulip tree).	– –	27	2	·434	298	Apparently of little value; attains to a large size.
Locust. *See* **Robinia.**						
Magnolia glauca	– –	31	7	·503	296	
Magnolia grandiflora	Putney	37	5	·597	302	The tree in the United States grows with a clear stem of 60 to 80 feet high.
Maple. *See* **Acer campestre.**						
Morus nigra (common mulberry)	Mortlake	41	5	·661	654	Sometimes used for furniture, and by turners, but is of little durability.
Mountain ash. *See* **Pyrus.**						
Mulberry. *See* **Morus.**						
Negundo fraxinifolium	Wandsworth	33	15	·543	659	Rather fine-grained, but of little value.
Nut. *See* **Corylus.**						
Oak (*See* Quercus)	Marden, Kent	50	8	·808	730	Dug out of a deep cutting of the South-Eastern Railway.
Pear. *See* **Pyrus.**						
Pine. *See* **Pinus.**						
Pinus Picea (silver fir)	– –	23	2	·370	46	Used for house carpentry, masts of small vessels, &c.
,, ,,	Wandsworth	28	7	·455	607	
Pinus sylvestris (pine)	Oxfordshire	24	5	·389	36	Much used for rafters, girders, and house-carpentry.
,, ,, (Scotch fir)	,,	19	5	·309	43	Much used for house carpentry.
Plane. *See* **Platanus.**						
Platanus orientalis (plane)	Wandsworth	39	12	·636	96	An inferior wood, but much used in the Levant, for furniture, &c.
,, ,,	,,	33	7	·535	601	This wood shows a pretty mottled figure when cut with the ray.
,, ,,	– –	35	9	·569	797	
Platanus sp. (Scotch plane)	Scotland	37	6	·598	774	
Plum. *See* **Prunus.**						
Pomegranate. *See* **Punica.**						
Populus alba (Abele)	– –	27	11	·443	49	A light soft wood, of little value.
,, (white poplar)	Wandsworth	25	9	·409	661	
Populus dilatata (Lombardy poplar).	,,	21	13	·349	596	Soft and spongy; rapidly decaying unless kept dry.
Populus tremula (aspen)	Epping	31	2	·498	556	From the lower part of the main stem; used by turners, and for dry carpentry.
Populus sp. (Scotch poplar)	Scotland	34	6	·550	778	
Prunus armeniaca (apricot)	Mortlake	46	13	·749	309	Hard and fine-grained.
Prunus domestica (damson)	Wandsworth	45	8	·728	22	Hard and fine-grained, but not very durable; used for turning, &c.
,, ,, (Orleans plum)	Oxfordshire	44	8	·712	23	
Prunus Laurocerasus (laurel)	– –	46	14	·750	55	Hard and compact, taking a good polish.
,, ,, ,,	Epping	42	5	·677	545	Specimen from an old plant.
Prunus spinosa (black thorn)	Oxfordshire	43	11	·699	93	Hard, capable of a fine polish, but apt to split.
Punica granatum	Mortlake	39	4	·628	653	Hard and close-grained.
Pyrus aucuparia (mountain ash)	Yorkshire	38	6	·614	293	Fine-grained, hard, and takes a good polish; used in turnery, and for musical instruments.
,, ,, ,,	Epping	39	8	·632	535	
Pyrus communis (Bergamot pear).	Bermondsey	38	9	·617	19	Strong, compact, and close-grained; used for turning handles to tools, &c., and takes a good black dye.
,, ,, (pear)	Oxfordshire	38	10	·618	90	
,, ,, (garden pear)	Epping	40	1	·641	549	Specimen from the upper part of the main stem.
,, ,, (swan's egg pear)	Wandsworth	34	9	·553	604	
,, ,, (wild pear)	Epping	39	4	·628	544	Specimen from a young tree cut near the ground.
,, ,, ,,	,,	38	2	·610	551	Specimen from the upper part of the main stem.
Pyrus malus (apple)	Oxfordshire	36	0	·576	77	
,, (garden apple)	Epping	39	7	·631	548	Specimen from the upper part of the stem.
,, (crab)	Oxfordshire	45	5	·725	[illegible]	Specimen from a tree about twenty years old.
,, ,,	Yorkshire	45	6	·726	297	Hard, close-grained, and strong.
Pyrus Sorbus (service tree)	Epping	46	11	·747	554	Hard, fine-grained, and compact; much in repute by millwrights for cogs, friction rollers, &c.

WOODS, NATIVE OF OR GROWN IN BRITAIN—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Pyrus torminalis	Isle of Wight	42	7	·679	372	Strong and fine-grained; used for turners.
Quercus ilex (evergreen oak)	Wandsworth	47	5	·757	599	Wood very shaky when aged; is durable and strong, and makes an excellent charcoal.
,, ,, ,,	– –	47	4	·756	88	
,, ,, ,,	Surrey	40	2	·642	656	
Quercus pedunculata (English oak).	Sussex	39	0	·624	104	This oak is much esteemed for ship-building; the strongest and most durable of British woods.
,, ,, (pollard oak)	Wandsworth	44	10	·714	504	From an old pollard tree.
,, ,, (common oak)	Epping	40	14	·654	542	Part of a large lower branch.
,, ,, ,,	,,	40	11	·651	553	Part of a large branch.
Quercus sessiliflora (Welsh oak).	– –	37	11	·603	262	A good wood for ship-building; said to be inferior to the common oak.
Quercus suber (cork tree)	Botanic Garden, Chelsea.	51	10	·826	503	Heavy and durable, but very apt to split.
Quercus sp. (American oak)	Wandsworth	42	9	·681	608	Hard and compact.
,, (bastard oak)	Tackley, Oxon	33	6	·534	30	
,, (Spanish oak)	Oxfordshire	43	13	·701	29	Close-grained, and apparently a good wood.
Rhamnus alaturnus	Mortlake	48	6	·774	652	Hard and close-grained.
Rhamnus catharticus	Epping Forest	34	11	·555	539	
Rhamnus frangula	Epping	25	8	·408	541	
Robinia pseud-acacia (common acacia, locust).	,,	44	1	·705	550	Specimen from the upper part of the main stem; much used for treenails in ship-building, and in the United States is much in repute for posts and rails.
,, ,, ,,	Wandsworth	40	11	·651	600	
,, ,, ,,	Mortlake	55	6	·886	703	
Salix alba (white willow)	Surrey	24	14	·398	658	Used for toys, and by the millwright; is tough, elastic, and durable.
Salix caprea (palm sallow)	Oxfordshire	24	8	·392	799	Tough and elastic; is much used for handles to tools, and makes good hurdles.
Salix fragilis (crack willow)	,,	32	0	·392	28	Light, pliant, and tough; is said to be very durable.
Salix ——? (back sallow)	,,	33	8	·512 ·536 ·474	79 80 896	Tough and elastic; well adapted for turning.
Sallow. *See* Salix.						
Sambucus nigra (common elder)	,,	34	0	·544	27	
,, ,, ,,	Epping	37	11	·603	561	
Scotch fir. *See* Pinus.						
Service tree. *See* Pyrus.						
Silver fir. *See* Pinus.						
Spruce fir. *See* Abies.						
Sycamore. *See* Acer.						
Syringa vulgaris (lilac)	Wandsworth	48	15	·783	606	Very hard and compact.
,, ,,	Surrey	48	13	·781	655	
Taxus baccata (yew)	– –	41	9	·665	54	Used for making bows, chains, handles, &c.; the wood is exceedingly durable, very tough, elastic, and fine-grained.
,, ,,	West Grinstead	50	12	·812	801	
Thuja orientalis	Mortlake	34	14	·558	308	
Tilia europæa (common lime)	Wandsworth	27	3	·435	597	Used for cutting-blocks, carving, sounding-boards and toys.
Tilia sp. (Scotch lime)	Scotland	30	5	·485	773	Used for turning and carving.
Tulip tree. *See* Liriodendron.						
Ulex europæa (furze)	Ilfracombe	52	8	·840	314	Heavy, hard, and close-grained; in the north of Devonshire the stem reaches 6 inches in diameter sometimes.
Ulmus campestris (English elm)	– –	30	9	–	–	Used in ship-building for under-water planking, and a variety of other purposes, being very durable when kept wet or buried in the earth.
,, ,, ,,	– –	26	5	·489	317	
,, ,, ,,	– –	–		·421	105	
,, ,, ,,	– –	41	9	·665	779	
,, ,, (common elm)	Oxfordshire	34	13	·557	81	
,, ,, ,,	Epping	39	7	·631	537	Part of one of the lower branches of a young vigorous tree.
,, ,, (pollard elm)	West Grinstead	31	13	·509	802	From an old pollard tree.
Ulmus montana (wych elm)	Oxfordshire	35	14	·574	89	Thought to be better than common elm, and is used in carpentry, ship-building, &c.
,, ,, ,,	Epping	36	5	·581	538	
Vine. *See* Vitis.						
Vitis vinifera (vine)	Wandsworth	42	11	·683	609	
Walnut. *See* Juglans.						
Willow. *See* Salix.						
Yew. *See* Taxus.						

WOODS OF EUROPE.

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Abies excelsa (Dantzic deal)	– –	24	10	·394	114	
,, ,,	– –	30	7	·487	115	Specimen of wood of good quality.
,, ,,	– –	28	2	·450	116	,, ,, ,,
,, (spruce fir)	N. of Europe	17	10	·282	272	Used for common carpentry work.
,, (spruce)	– –	25	13	·413	321	
Arbutus Unedo (Kouramia, Coumaro).	Albania	52	0	·832	3	Hard and close-grained; used by turners.
Bay. *See* Laurus.						
Beech. *See* Fraxinus.						
Betula alba (Norway birch)	Norway	33	0	·528	341	An inferior wood; occasionally used in ship-building.
Birch. *See* Betula.						
Box. *See* Buxus.						
Buxus sempervirens (box)	Gallicia	60	15	·975	670	Used by turners, &c.
,, ,, ,,	– –	54	10	·874	34	Much used by turners, and for a number of useful purposes.
Castanea vesca (chestnut)	Portugal	40	13	·653	667	Considered a good wood when not too old.
Castano del Pais	,,	28	11	·459	669	Used in ship-building.
Chestnut. *See* Castanea.						
Chrysoxylon. *See* Rhus.						
Citron. *See* Citrus.						
Citrus aurantium (orange tree)	Albania	40	7	·647	15	Fine-grained; used by turners, and for ornamental work.
Citrus medica (citron)	Greece	31	0	·496	291	Fine-grained.
Citrus limonum (lemon tree)	Albania	47	9	·761	16	Hard, compact, and close-grained, with much the same character as the orange.
Coumaro. *See* Arbutus.						
Cupressus sempervirens (Oriental cypress).	Greece	36	5	·581	284	A very durable wood.
Daphne. *See* Laurus.						
Deal, Dantzic. *See* Abies.						
,, Prussian. *See* Pinus.						
Etia. *See* Salix.						
Ficus Carica (fig tree)	Albania	34	8	·552	14	Wood shrinks much in drying; is of little value.
Fig tree. *See* Ficus.						
Fraxinus —— ? (beech)	,,	39	0	·624	290	
Ftelia	,,	40	1	·641	12	Probably an elm.
Gavro	Albania	38	14	·622	6	
Juglans regia (Nogal del Pais)	Portugal	35	4	·564	671	Used in ship-building.
,, (walnut)	France	37	13	·605	899	Used for furniture.
Kouramia. *See* Arbutus.						
Koutsoupia	Albania	33	8	·536	9	
Laurus nobilis (Bay daphne Gr.)	,,	36	0	·576	7	
Leepa, or Lipa	Greece	28	13	·461	287	
Lemon tree. *See* Citrus.						
Melikoukia	,,	36	15	·591	285	
Melios. *See* Ornus.						
Nogal del Pais. *See* Juglans.						
Oak. *See* Quercus.						
Olea europæa (wild olive)	Albania	52	14	·847	2	Close-grained, and occasionally beautifully veined; much used for ornamental work.
Orange tree. *See* Citrus.						
Oriental cypress. *See* Cupressus.						
Ornus europæa (Melios)	,,	47	1	·753	5	The manna tree; wood compact.
Philike, or feliki	,,	48	0	·768	289	
,, ,,	,,	52	10	·842	1	Heavy and compact.
Pina del Pais	Portugal	28	13	·461	673	Used for common carpentry work.
Pine	Gallicia	33	9	·537	672	,, ,,
Pinus Laricio ? (sweet pine)	Portugal	28	15	·463	666	A strong and durable wood.
Pinus sylvestris (Dantzic fir)	Prussia	32	4	·516	271	Used in carpentry work.
,, (Riga fir)	,,	37	10	·602	270	,, ,,
,, (Prussian deal)	– –	43	6	·674	269	Used for decks of ships, and for carpentry work.
Pinus —— ?	Cadiz	38	14	·622	759	A heavy, hard pine.
Pournari. *See* Quercus.						
Prunari. *See* ditto.						
Quercus Cerris (Adriatic oak)	Trieste	37	15	·607	263	A strong and useful wood for ship-building.
Quercus pedunculata (Baltic oak).	Prussia	37	12	·604	260	Extensively used in ship-building.
Quercus sessiliflora (East country oak).	– –	40	1	·641	331	,, ,,
Quercus —— ? (Prunari Pournari).	Albania	51	13	·829	4	Heavy, but much given to split.
Quercus sp., Adriatic oak ?	Trieste	54	1	·865	728	Used in ship-building.
Rhus cotinus (Chrysoxylon, young fustic).	Albania	38	0	·608	13	Produces a yellow dye.
Ricchi	,,	52	14	·846	8	Much used for charcoal in Albania.
Roble del Pais	Portugal	64	0	1·024	668	Used for ship-building.
Salix —— ? (Etia)	Albania	34	15	·559	11	

WOODS OF EUROPE—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Salix ——? (Sklythra)	Albania	27	8	·440	10	Probably a willow.
Skina	,,	48	10	·778	288	
Sklythra. *See* Salix.						
Spruce fir. *See* Abies.						
Svedami	Greece	46	6	·742	286	
Young fustic. *See* Rhus.						
Zinzifin		47	7	·759	301	

WOODS OF ASIA.

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Acacia ——? (Popeeah)	Tavoy	23	3	·371	851	A large tree; wood used in house-building, &c.
,, ,,	,,	23	3	·371	853	A very large tree; wood used for posts, bows, and rollers, and for cotton gins.
Ægle marmelos (Bellee)	Ceylon	49	1	·784	583	
Amboyna. *See* Pterospermum.						
Anacardium latifolium (Bhela)	Gualpara	37	0	·592	807	Used for making chests and couches.
Andrachne apetala	India	33	14	·542	725	
Angelly wood. *See* Artocarpus.						
Annah-beng. *See* Fagræa.						
Artocarpus Chaplasha	India	34	12	·556	681	
Artocarpus hirsuta (Angelly wood).	Cochin	36	14	·590	475	Used in ship-building.
Artocarpus integrifolia (Jack-wood).	Travancore	35	10	·570	377	
Artocarpus ——? (Pynyathe, Tanabeng).	Tavoy	–		–	832	
Aultoovanchee	Travancore	31	6	·502	429	
Auyanny	,,	32	11	·523	691	
Averrhoa Carambola	India	39	11	·635	378	
Bah-nah-thoa	Tavoy	–		–	859	Used in boat and house-building.
Bellee. *See* Ægle marmelos.						
Betula Bhojpattra	Nepal	35	5	·565	1035	Wood moderately hard, compact.
Bhela. *See* Anacardium.						
Bignonia chelonoides	,,	42	8	·680	1031	A large tree.
Bignonia ——? (Tathee)	Tavoy	49	8	·792	816	A very large tree.
,, (Thuggainee)	,,	40	4	·644	837	A large tree, used in house building.
Black ebony. *See* Diospyrus.						
Boomota. *See* Swietenia.						
Cadooca Marum	Travancore	38	3	·611	444	
Calophyllum ——? (Thurappe, Chopee).	Martaban	43	0	·688	1072	Used for masts and spars, and for pestles to oil-presses.
Cambagum	Travancore	28	11	·459	396	
Canoo		36	0	·576	877	
Camphor wood. *See* Laurus.						
Cannal	Travancore	47	6	·758	403	
Cannao	,,	58	7	·935	402	
Caragagaloo	,,	33	0	·528	436	
Carapa ——? (Taila-oon.)	Tavoy	36	0	·576	880	Used in house-building.
Careya ——? (Kaza)	Martaban	46	0	·736	1036	Timber of large size; used for posts, &c.
,, (Kombo)	Gualpara	42	12	·684	810	Wood hard and strong; used for the stocks of matchlocks.
Caringosha	Travancore	45	5	·725	386	
Carivagah	,,	33	10	·538	410	
Caroogha	,,	44	10	·714	438	
Caroo Marum	,,	47	11	·763	405	
Carrintha	,,	34	4	·548	401	
Cassia	India	41	9	·661	698	
Castanea indica	,,	39	0	·624	689	
Castanea tribuloides (Cotoor, Chisee, Makoo Shingali).	Nepal	62	0	·992	927	Used for large mortars and pestles for grinding corn.
Catunguin	Manilla	42	11	·683	497	Used in ship-building.
Caultoo mooroonga	Travancore	45	14	·734	392	
Cedar	India	25	2	·402	353	
Cedar of Himalaya. *See* Juniperus.						
Cedrela Toona (Toon, Tunga, Poma, Jeea).	Gualpara	36	0	·576	1041	Wood very durable, and much used for furniture.
,, ,, ,,	India	32	9	·521	708	
Chambagum	Travancore	37	11	·603	383	
Chana	,,	20	7	·327	426	
Chasepoo. *See* Laurus.						
Chikagambhari. *See* Premma.						
Chinchona gratissima (Tungnusi).	Nepal	23	0	·368	931	Used for posts and rafters.
Chisee. *See* Castanea.						
Choomulloo. *See* Diospyrus.						
Choo-mnna. *See* Xanthophyllum.						

WOODS OF ASIA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Chopee. *See* Calophyllum.						
Chorangaree	Travancore	29	11	·475	443	
Cæsalpinea Sapan (Sappan)	– –	60	14	·974	67	Used for dyeing, and sometimes by the turner.
Coombool	Travancore	31	14	·510	407	
Cotoor. *See* Castanea.						
Coturnba	Ceylon	23	5	·373	587	Occasionally used in house-building in Ceylon, but not esteemed.
Cou-moo	Tavoy	–		–	–	Used in boat and house building.
Cusroo. *See* Quercus.						
Cynometra polyandra	India	52	10	·842	685	
Cynometra ——? (Maingga)	Martaban	48	7	·775	822	A small tree.
Dalbergia lanceolaria (Neddoon, Nedun, Nander-wood).	Ceylon	45	7	·727	588	Used and valued for house-building in Ceylon.
Dalbergia latifolia (East India ebony).	India	66	8	1·064	966	
Debool	Ceylon	38	3	·615	579	
Dheyri. *See* Taxus.						
Diospyrus melanoxylon (black ebony).	– –	61	2	·978	40	Used for turnery work, and for inlaying.
Diospyrus racemosa	India	34	11	·555	687	
Diospyrus ——? (Ryamucha, Choomulloo).	Martaban	50	3	·803	1071	Used in house-building.
Dipterocarpus ——? (Kunneanphew).	Tavoy	25	3	·403	871	Grows to a great size; used for beams and planks.
Domba	Ceylon	33	3	·531	585	Used for the outriggers of canoes.
Dombeya melanoxylon (St. Helena ebony).	St. Helena	71	9	1·145	716	
East India ebony. *See* Dalbergia.						
East India rosewood	India	–		–	986	
East India teak. *See* Tectona.						
Ehretia lævis	Botanic Garden, Calcutta.	–		–	1034	
Ekebergia ——? (Jiyakohi)	Gualpara	39	1	·625	958	
Eleocarpus serratus? (Weraloo)	Ceylon	33	8	·536	586	
Eriobotrya japonica (Loaquat)	India	46	11	·747	724	
Eugenia malacoensis (Jamboo)	Ceylon	30	4	·484	577	
,, ,, ,,	,,	30	14	·494	577	
Excœcaria?	Tavoy	–		–	821	
Fagræa fragrans (Annah-beng)	Martaban	52	8	·840	1037	Timber large, compact, very hard.
Ficus ——? (Thubboo)	Tavoy	21	0	·336	819	Used in house carpentry.
Gadeboo	Ceylon	21	3	·339	580	Used for making charcoal for gunpowder.
Galloopah	Travancore	53	0	·848	513	
Garcinia ——? (Pullowa)	Tavoy	45	8	·728	827	A large tree, used for posts.
Garcinia ——? (Purrah wah)	,,	45	8	·728	865	A strong durable wood.
Ghese. *See* Quercus.						
Gmelina arborea	India	32	3	·515	709	
,,	,,	32	6	·518	718	
Go-na	Ceylon	24	8	·392	582	
Gordonia? (Kaza)	Martaban	37	10	·602	1027	Large timber, used for ordinary building purposes.
Guacua	India	41	14	·670	710	
Guava. *See* Psidium.						
Gundrucy	,,	34	15	·559	697	Wood with a peculiar odour, resembling that of aniseed.
Heretiera ——? (Soondree)	,,	57	15	·927	493	Used in ship-building.
,, ,,	,,	49	15	·799	473	
Hibiscus macrophyllus	Tavoy	27	13	·445	806	A middle-sized tree, used for common building purposes.
,, ,,	,,	28	6	·448	826	
Hibiscus?	,,	–		–	804	Used for common building purposes; the bark is made into cordage.
Hopea floribunda (Tantheya)	,,	27	11	·443	808	A very large tree.
Hopea odorata (Tengaun, Thaengong).	Martaban	38	0	·608	954	Canoes are made of this tree, which produces a valuable resin.
,, ,, ,,	Tenasserim Coast.	40	12	·652	863	Used in boat-building, grows to a large size, and is abundant.
Hune	Burma	–		–	876	
Indian saul. *See* Shorea.						
Indian wood	– –	45	6	·726	342	
Iron-wood. *See* Metrosideros.						
Jack-wood. *See* Artocarpus.						
Jamboo. *See* Eugenia.						
Jeea. *See* Cedrela.						
Jeeah	India	36	11	·587	713	
Jiyakohi. *See* Ekebergia.						
Juglans pterococca	,,	39	14	·638	695	
Juniperus excelsa (Cedar of Himalaya).	,,	34	7	·551	1039	An excellent light wood.
Kaantha	Tavoy	–		–	856	Small but valuable timber.

WOODS OF ASIA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Kain-tha-phogee. *See* Symplocos.						
Kaunzo-kurro	Tavoy	43	0	·688	812	Used in boat-building.
Kayzai. *See* Laurus.						
Kaza. *See* Careya.						
,, *See* Gordonia						
Keahnaun	,,	–		–	837	
Keannan. *See* Xylocarpus.						
Keaza-Perroun	,,	–		–	947	Used in house-building.
Keetha. *See* Syndesmis.						
Keoun-lae. *See* Rottlera.						
Kombo. *See* Careya.						
Kuddoot-alain	,,	53	3	·851	840	Grows to a great size; used in house-building.
Kuddoot-neo	,,	34	0	·554	829	An inferior wood; used in boat-building.
,,	,,	34	3	·547	864	
Knenmounee. *See* Lagerstrœmia.						
Kullowa. *See* Laurus.						
Kuneenee. *See* Sterculia.						
Kunna. *See* Pierardia.						
Kunnean-phew. *See* Dipterocarpus.						
Kunneen-keunkee. *See* Bignonia.						
Kunneen-keunla. *See* Symplocos.						
Kurrowa. *See* Laurus.						
Kuzzoo. *See* Pierardia.						
Lagerstrœmia reginæ	India	46	[illegible]	·744	700	
Lagerstrœmia ——? (Kueumounee, Peema).	Tavoy	37	9	·601	839	
Laurus camphora? (Camphor-wood).	China	35	14	·574	897	A wood emitting an agreeable aromatic odour.
,, ,, ,,						
Laurus ——? (Kayzai)	Tavoy	43	3	·691	809	Used in house carpentry.
Laurus ——? (Kullowa, Kurrowa).	,,	30	0	·480	942	Produces the sassafras bark and camphor-wood of Martaban.
,, ,, ,,	,,	30	0	·480	818	
Laurus ——? (Lumpatch, Chasepoo).	Nepal	34	0	·544	955	Used in carpenter's work, and for beams.
Laurus ——? (Panatha)	Tavoy	43	0	·688	881	Used in house carpentry.
Laurus ——? (Sassafras)	India	32	12	·524	712	
Laurus ——? (Thuggoo)	Tavoy	–		–	951	Used for oars and rudders.
Lolsi. *See* Taxus.						
Loquat. *See* Eriobotrya.						
Lumpatch. *See* Laurus.						
Maikay. *See* Murraya.						
Mainggn. *See* Cynometra.						
Makoo-shingali. *See* Castanea.						
Manga chapui	Manilla	41	15	·671	500	Used in ship-building.
Maroothee	Travancore	37	7	·599	390	
Maunthaen or Sassefras	Tavoy	36	10	·586	901	Used in making house furniture.
Maymaka	India	51	12	·828	956	Used for timber of junks.
May-rang	Tavoy	48	9	·777	1043	Said to be very durable; used for the posts of houses on the banks of rivers.
Megeongee	,,	38	9	·617	945	A very large tree, used in house-building.
Melia Azadirachta	India	46	1	·739	722	
Metrosideros vera (iron-wood)	China	53	0	·848	494	Used for anchors by the Chinese.
Mimosa odoratissima	India	45	6	·726	711	
Mimosa polystachya	Botanic Garden, Calcutta.	32	0	·512	1032	
Mimusops Elengi	Tavoy	46	0	·736	924	A slow-growing tree.
Moluve or Moloba	Manilla	51	3	·819	499	Used in ship-building.
Moonga Vallah	Travancore	38	5	·613	411	
Mootoocorandy	,,	38	13	·621	440	
Morinda citrifolia	Botanic Garden, Calcutta.	28	10	·458	913	The root yields a red dye.
Morung Saul. *See* Shorea						
Munhacadamboo	Travancore	38	15	·623	394	
Murraya ——? (Maikay)	– –	60	13	·973	847	A strong tough wood.
Myrsine capitellata	Nepal	21	11	·347	911	Said to be compact and hard.
Nander wood. *See* Dalbergia.						
Nar, or sacred wood	Ceylon	55	0	·880	584	Used by the natives for building temples and royal palaces; an excellent wood.
Neddoon. *See* Dalbergia.						
Nedun. *See* Dalbergia.						
Neerovalum	Travancore	24	5	·389	423	
Nellee	Ceylon	34	8	·552	589	
Nelty, or Nelly	Travancore	42	5	·677	419	
Nerium tinctorium	India	39	14	·638	692	

WOODS OF ASIA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Nun Poungoo	Travancore	56	15	·911	379	
Odina Wodier	India	41	0	·656	684	
Osyris peltata (Phaoun)	Tavoy	29	10	·474	813	
,, ,,	India	30	8	·488	690	
Pah-doubh	– –	60	0	·960	969	
Palaepean. *See* Sapotea.						
Palah	Travancore	14	6	·230	404	
Palai	Borneo	23	13	·381	368	Used in the construction of canoes.
Palm	India	57	9	·921	705	
Palmist	,,	62	7	·929	52	The wood of one of the palms used for cabinet and marqueterie work.
Panacha	Travancore	44	14	·718	388	
Panatha. *See* Laurus.						
Peema. *See* Lagerstrœmia.						
Pen-lay-oun	– –	32	0	·512	887	Affords good crooked timber.
Pen-lay-peen	Tavoy	–		–	944	
Peroomarum	Travancore	27	14	·446	418	
Phaoun. *See* Osyris.						
Pienmahne	Tavoy	–		–	861	
Pienmah-pue	,,	–		–	853	
Pierardia? (Kuuna, Kuzzo)	,,	37	12	·604	824	
Pinus dammara	,,	39	0	·627	869	
Pinus longifolia	Nepal	–		–	1070	Excellent timber.
Pinus Webbiana	,,	21	0	·336	905	
Poma. *See* Cedrela.						
Poomaram	Travancore	29	8	·472	·432	
Poomdroo	,,	28	15	·463	406	
Poonah	,,	40	13	·653	417	
Poovem	,,	50	15	·815	399	
Popeeah. *See* Acacia.						
Pothiree	,,	35	4	·564	437	
Premna hircina (Chikagambhari).	Gualpara	43	0	·691	878	A strong odour like that emitted by the musk-rat, is given out by this wood; used for musical instruments.
Psidium pomiferum (Guava)	Travancore	44	0	·704	382	
Pterocarpus santalinus (Rea sandus).	India	46	14	·750	714	
Pterocarpus? (Thoun-kheea)	Martaban	51	9	·826	817	
Pterospermum indicum (Amboyna).	East Indian Islands.	39	10	·634	894	Much used for ornamental work.
Pullowa. *See* Garcinia.						
Purrah-wah. *See* ditto.						
Puzzeen-zwa. *See* Ternstrœmia.						
Pynyathe. *See* Artocarpus.						
Quercus Amherstiana (Tirbbae, Ryakle).	Martaban	57	10	·922	1047	Used for coarse furniture.
Quercus fenestrata	India	47	0	·752	679	
Quercus lanceaefolia	,,	41	10	·666	678	
Quercus lappacea	,,	51	4	·820	677	
Quercus semecarpifolia (Ghese, Cusroo).	Nepal	22	0	·352	836	Wood light, from a large tree.
Red sanders. *See* Pterocarpus.						
Regal wood	Thibet	54	6	·870	17	A very beautiful wood; much prized, and used by persons of high rank only.
Rhizophora decandra	India	46	0	·736	721	
Rottlera? (Keoun-lae)	Tavoy	37	9	·601	815	A large tree; wood used for rudders, &c.
Ryakle. *See* Quercus.						
Ryamucha. *See* Diospyrus.						
Sacred wood. *See* Nar.						
Saint Helena ebony. *See* Dombeya.						
Sandoricum ——? (Thittoo)	Tavoy	28	6	·454	820	Used for furniture.
Santalum album	India	47	13	·765	702	
Sapan. *See* Cæsalpina.						
Saphew. *See* Xanthophyllum.						
Sapotea? (Palaepean)	Tavoy	41	0	·656	811	A very large tree; wood used in building.
Sassafras. *See* Laurus.						
Satin wood. *See* Swietenia.						
Scytalia longan	India	44	8	·712	689	
Scytalia trijuga	,,	60	0	·960	696	
Scytalia ——?	,,	39	6	·630	715	
Shorea robusta (Indian saul)	– –	52	10	·842	339	A strong and durable wood; in great repute for ship-building.
,, (Morung saul)	Nepal	43	14	·702	123	
,, ,,	,,	45	14	·734	122	Much used in India for various purposes, where strength and durability are required.
Sonneratia? (Thaumma)	Tavoy	42	0	·672	814	A small tree.
Soondre. *See* Heretiera.						
Sophora robusta	India	42	4	·676	688	

WOODS OF ASIA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	oz.			
Sterculia ? (Kuneenee)	Tavoy	–		–	854	Tree of very large dimensions.
Swietenia chloroxylon (Satin wood, Booroota).	Ceylon	51	0	·816	578	Used for furniture, &c.
Swietenia febrifuga	India	54	14	·378	701	
Symplocos floribunda	Nepal	–		–	917	A large tree.
Symplocos ? (Kain-tha-phogee)	Tavoy	34	7	·551	867	Affords good crooked timber.
Symplocos ? (Kunneen-keunkee, Kunneen-keunla).	,,	34	4	·548	838	Used for beams, posts, &c.
Syndesma tavoyana (Keetha)	,,	–		–	855	Used in house-building.
Taaka. *See* **Tectona.**						
Taila-oon. *See* **Carapa.**						
Tanabang. *See* **Artocarpus.**						
Tantheya	,,	44	0	·704	858	
,, *See* **Hopea.**						
Tathee. *See* **Bignonia.**						
Taxus virgata (Dheyri, Lolsi)	Nepal	–		–	993	Grows to a large size; timber strong and good.
Teak. *See* **Tectona.**						
Tectona grandis (Teak, Taaka, Tekka).	Ceylon	47	3	·755	581	One of the best of the Ceylon woods.
,, ,,	Travancore	42	8	·680	376	A strong and durable wood; much valued for ship-building.
,, **(East Indian teak)**	Malabar coast	37	14	·606	121	The best kind of teak.
,, ,,	Moulmein	31	9	·505	119	
,, ,,	,,	32	1	·513	120	This quality of teak is not so good as the Malabar.
Tekka. *See* **Tectona.**						
Tengaun. *See* **Hopea.**						
Terminalia catappa	Botanic Garden, Calcutta.	30	0	·480	1,074	A noble ornamental tree; wood very good.
Terminalia chebula	India	42	10	·682	682	
Terminalia citrina	,,	60	2	·962	683	Very heavy and compact.
Terminalia —— ? (Thuphauga)	Tavoy	50	5	·805	823	
Ternstrœmia —— ? (Puzzeen-zwa).	,,	36	7	·783	830	A rather large tree; used for posts and rafters.
Tetranthera nitida	India	34	4	·548	899	
Teutha	Tavoy	54	0	·864	841	
Thaengong. *See* **Hopea.**						
Thallaroo	Travancore	44	0	·704	431	
Thambuvoo	,,	55	6	·886	581	
Thau-baun-po	Tavoy	–		–	888	An inferior light wood.
Thau-baun-thau-lay	,,	–		–	849	A strong durable wood, but does not saw kindly.
Thaumma. *See* **Sonneratia.**						
Thittoo. *See* **Sandoricum.**						
Thoun-Kheea. *See* **Pterocarpus.**						
Thoun-myuga	,,	48	0	·768	884	Used in house-building.
Thubboo. *See* **Ficus.**						
Thugguinee. *See* **Bignonia.**						
Thuggoo. *See* **Laurus.**						
Thuphanga. *See* **Terminalia.**						
Thurappe. *See* **Calophyllum.**						
Thymboo	,,	17	7	·279	860	A strong and durable light wood.
Thymboo, Thau-baun-po	,,	17	3	·275	825	Strong durable light wood, used in boat-building.
Tirbbae. *See* **Quercus.**						
Toon. *See* **Cedrela.**						
Town-pine	,,	28	13	·461	852	Used in boat-building, and much esteemed.
Town-suggah	,,	–		–	943	
Tunga. *See* **Cedrela.**						
Tungnusi. *See* **Chinchona.**						
Une	,,	–		–	949	Affords good crooked timber, used for boat-building.
Vallathorashel	Travancore	22	1	·353	415	
Vanava	Manilla	42	11	·683	496	Used in ship-building.
Vanneemooringa	Travancore	40	10	·650	400	
Vateria lanceæfolia	India	53	15	·863	694	
Vavoolagoo	Travancore	29	4	·468	397	
Vellilagoo	,,	28	8	·456	433	
Velty, or Vetty	,,	40	11	·657	416	
Venga	,,	47	1	·753	380	
Vinnee	,,	15	8	·248	435	
Vinny marum	,,	11	3	·179	434	
Vyashanthak	,,	41	0	·656	439	
Weraloo. *See* **Eleocarpus.**						
White dammar lout	India	–		–	948	
Xanthophyllum —— ? (Saphew, Choo-muna).	Martaban	33	10	·538	1,028	
Xylocarpus —— ? (Keannan)	Tavoy	46	9	·745	868	Used for furniture and in house-building.
Zeethee. *See* **Zizyphus.**						

WOODS OF ASIA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft. lbs.	oz.	Specific Gravity.	No. in Catalogue.	REMARKS.
Zizyphus —— ? (Zeethee)	India	35	11	·571	879	
——— ?	Travancore	–		–	72	A very light soft wood, forming a good substitute for cork to the entomologist.
——— ?	India	46	0	·736	374	
——— ?	Travancore	27	14	·446	424	
——— ?	,,	44	6	·710	447	
——— ?	Arracan	33	9	·537	492	
——— ?	India	43	5	·693	656	
——— ?	,,	45	4	·724	683	
——— ?	,,	50	5	·805	703	
——— ?	,,	70	1	1·121	704	
——— ?	,,	38	12	·620	706	
——— ?	,,	32	9	·521	707	
——— ?	,,	45	14	·734	717	
——— ?	,,	48	9	·777	719	
——— ?	,,	63	5	1·013	723	
——— ?	,,	38	14	·622	726	
——— ?	,,	37	5	·597	727	
——— ?	Tavoy	–		–	946	Used in house-building.
——— ?	India	41	0	·656	870	

WOODS OF AFRICA.

NAME.	Place of Growth.	Weight per Cubic Ft. lbs.	oz.	Specific Gravity.	No. in Catalogue.	REMARKS.
African oak	Sierra Leone	51	7	·823	124	Specimen of the best quality.
,,	,,	50	7	·807	125	An excellent wood for ship-building, and extensively imported for this purpose.
,,	– –	50	0	·800	126	Variety sometimes called "Silver oak."
,,	Sierra Leone	52	9	·841	258	
,,	West Coast of Africa.	43	11	·699	259	
,,	– –	50	9	·809	575	
African teak	– –	54	5	·869	369	Much used and esteemed for ship-building, another term for African oak.
Baphia nitida (Bar)	– –	36	7	·583	66	Used for dyeing and turning.
,, (Cam)	– –	34	13	·577	65	Used for dyeing and for turnery work.
,, (Cam wood)	Lion Hills	–		–	283	Used for dyeing.
Bar. *See* Baphia.						
Cam wood. *See* Baphia.						
Columbice	Madagascar	53	1	·849	206	
Fernando Po wood	Fernando Po	30	1	·481	127	Used in ship-building.
,, ,,	,,	45	14	·734	128	,,
Oldfieldia Africana. *See* African oak.						
Red Sanger wood	– –	61	0	·976	100	Heavy and compact.

WOODS OF NORTH AMERICA.

NAME.	Place of Growth.	Weight per Cubic Ft. lbs.	oz.	Specific Gravity.	No. in Catalogue.	REMARKS.
Abies alba (white spruce)	– –	23	13	·381	113	
Abies canadensis (hemlock spruce).	Upper Canada	23	0	·368	204	Used for common carpentry.
,, (hemlock)	United States	23	0	·368	647	
Acer eriocarpum (soft maple)	Upper Canada	36	14	·590	593	
Acer Negundo (box elder, ash-leaved maple).	United States	24	0	·384	621	
Acer rubrum (red maple)	,,	38	5	·613	620	
Acer saccharinum (sugar maple)	,,	38	6	·614	619	
,, ,,	,,	39	6	·630	618	
,, (bird's eye maple)	Upper Canada	40	15	·655	594	Used in ornamental work by carpenters and joiners.
,, (curly maple)	,,	36	10	·586	193	Used in common carpentry work.
,, var. (bird's eye maple).	– –	36	0	·576	330	Used for ornamental work; a peculiar growth of the tree.
Acer —— ? (hard maple)	Upper Canada	39	10	·634	595	
Ash. *See* Fraxinus.						
Balsam. *See* Picea.						
Bass wood. *See* Tilia.						
Beech. *See* Fagus.						
Betula nigra (black birch)	– –	35	7	·567	108	Much used for ship-building in Canada and Nova Scotia, but not a durable wood.
Betula —— ? (birch)	Upper Canada	30	11	·491	199	An inferior wood.
Birch. *See* Betula.						
Black gum. *See* Nyssa.						
Box elder. *See* Acer.						
Butter nut. *See* Juglans.						
Butter wood	– –	28	12	·460	564	Used in ship-building.

WOODS OF NORTH AMERICA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs	ozs.			
Button wood. *See* Platanus.						
Carya amara? (hickory) – –	United States					
Carya porcina (pignut hickory)	,, –	49	8	·792	613	The wood is stronger and better than that of any other kind of hickory.
Carya sulcata (shell-bark hickory).	,, –	43	2	·690	614	
Carya — — ? (hickory) – –	– –	47	8	·760	328	
Castanea vesca (chestnut) –	United States –	25	4	·404	646	
Cedar. *See* Larix.						
,, Pencil. *See* Juniperus.						
Celtis crassifolia (hack-berry) –	,, –	38	6	·614	641	Tough and elastic.
Cerasus virginiana (wild cherry)	,, –	32	3	·515	629	
Cercis canadensis (red bud, Judas tree).	,, –	33	7	·535	640	Wood close-grained and compact.
Cherry wood. *See* Prunus.						
Chestnut. *See* Castanea.						
Coffee tree. *See* Gymnocladus.						
Cornus florida (dogwood) – –	,, –	47	4	·756	639	Hard, close-grained, and strong.
Cupressus disticha (cypress) –	,, –	22	13	·365	648	Grows to an immense size.
Cypress. *See* Cupressus.						
Diospyrus virginiana (persimon)	,, –	44	6	·710	645	Hard and close-grained.
Dogwood. *See* Cornus.						
Elm. *See* Ulmus.						
Fagus americana (white beech)	,, –	42	2	·674	623	Used in dry carpentry.
Fagus ferruginea (beech) – –	Upper Canada –	36	9	·585	192	Used in dry carpentry; the wood has a more rufous tint of colour than common beech.
Fraxinus americana (American ash).	– –	35	10	·570	326	Tough and elastic, and much used.
,, ,, (white ash)	Upper Canada –	30	14	·494	202	
,, ,, ,,	,, –	33	5	·535	202	
Gleditschia triacanthus (honey locust).	United States –	40	6	·646	635	Very hard, and splits with great facility.
Gum tree. *See* Nyssa.						
Gymnocladus canadensis (coffee tree).	,, –	40	7	·647	634	Hard, compact, strong, and tough.
Hack-berry. *See* Celtis.						
Hackmatack. *See* Larix.						
Hazel. *See* Ulmus.						
Hemlock. *See* Abies.						
Hickory. *See* Carya.						
Hickory. *See* Juglans.						
Honey locust. *See* Gleditschia.						
Iron wood. *See* Ostrya.						
Judas tree. *See* Cercis.						
Juglans alba (hickory) – –	Upper Canada –	48	2	·770	591	
Juglans cinerea (butter nut) –	,, –	23	8	·376	191	
,, ,, –	,, –	22	4	·356	191	
,, ,, –	– –	26	8	·424	205	
,, ,, –	– –	30	7	·487	205	
,, (white walnut)	United States –	30	5	·485	627	Specimen from a young tree.
Juglans nigra (black walnut) –	,, –	28	15	·463	625	Wood strong, tough, and not liable to split.
,, ,, –	Upper Canada –	28	11	·459	198	
Juniperus bermudiana (red or pencil cedar).	Bermuda – –	34	15	·559	101	Used in ship-building and for making pencils.
Juniperus virginiana (red cedar)	United States –	26	10	·426	643	Used for making pencils, but not so good as the Juniperus Bermudiana, for this purpose.
,, (pencil cedar)	– –	25	9	·409	334	A light and durable wood.
Larix americana (hackmatack)	– –	37	9	·601	350	
,, ,,	– –	36	2	·578	349	Much used and esteemed in British North America for ship-building.
,, (Tamarack) –	Upper Canada –	23	15	·383	200	A good wood for ship-building purposes.
Larix —— ? (Cedar) – – –	,, –	18	6	·294	201	
Larix —— ? (Cedar) – – –	,, –	19	10	·314	201	
Liriodendron tulipifera (yellow poplar).	United States –	24	3	·387	632	
Live oak. *See* Quercus.						
Locust. *See* Robinia.						
Mapta. *See* Acer.						
Morus rubra (red mulberry) –	,, –	35	1	·561	642	
Mulberry. *See* Morus.						
Nyssa multiflora (sour gum, black gum).	,, –	40	6	·646	638	
Oak. *See* Quercus.						
Ostrya virginica (iron wood) –	,, –	48	11	·779	637	
Pawpaw. *See* Uvaria.						
Persimon. *See* Diospyrus.						
Picea balsamea (balsam) – –	Upper Canada –	19	0	·304	190	Used in carpentry.
Pine. *See* Pinus.						
Pinus mitis (yellow pine) – –	– –	23	8	·376	267	Used in carpentry work.
,, (American yellow pine).	– –	22	15	·367	112	Used in carpentry.

WOODS OF NORTH AMERICA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	ozs.			
Pinus resinosa (American red pine).	– –	26	11	·427	110	Used in carpentry.
,, (red pine)	United States	28	7	·455	316	A strong wood used in carpentry.
Pinus rigida (pitch pine)	South Carolina	32	0	·512	109	A strong and durable wood.
,, ,,	– –	42	2	·674	315	Much used in ship-building.
,, (Virginia pine)	– –	34	6	·550	266	
Pinus ——? (pine)	Upper Canada	22	8	·360	194	Used for the same purposes as common deal.
Platanus occidentalis (button wood, sycamore).	United States	26	8	·424	624	Much used for making bedsteads.
Poplar. *See* Populus.						
,, yellow. *See* Liriodendron.						
Populus ——? (poplar)	Upper Canada	20	11	·331	196	
Populus ——? (poplar)	,,	19	14	·318	196	A light inferior wood.
Prunus ——? cherry wood	,,	29	15	·479	195	
Quebec white oak	Canada	53	12	·860	780	Used in ship-building.
,, ,,	,,	54	6	·870	781	,,
Quercus alba (Quebec oak)	,,	33	11	·539	117	Used in ship-building, but not a durable wood.
,, ,,	,,	45	5	·725	118	A specimen, showing wood of an inferior quality.
,, ,,	– –	39	5	·629	324	Used in ship-building, but not much in repute.
,, (oak)	Upper Canada	47	14	·766	590	
,, (white oak)	United States	40	1	·641	610	
,, ,,	Upper Canada	44	4	·708	197	Used in ship-building.
Quercus rubra (red oak)	United States	32	2	·514	612	
Quercus tinctoria (black oak)	,,	34	14	·558	611	
Quercus virens (live oak)	,,	56	4	·900	574	The heaviest and hardest of the oaks.
,, ,,	,,	51	11	·827	325	
Red bud. *See* Cercis.						
Robinia Pseud-Acacia (locust)	,,	45	8	·728	320	Occasionally used in ship-building, but chiefly for treenails.
,, ,,	,,	41	11	·667	644	
,, (locust, treenail)	– –	41	8	·664	344	Used for treenails in ship-building.
Sassafras officinale (sassafras tree).	United States	37	4	·596	636	Specimens from a young tree.
Sour gum. *See* Nyssa.						
Spruce. *See* Abies.						
Sycamore. *See* Platanus.						
Tamarack. *See* Larix.						
Tilia americana (bass wood)	Upper Canada	25	0	·400	203	Even in grain like common lime-wood.
Treenail. *See* Robinia.						
Ulmus americana (elm)	,,	36	11	·587	592	
,, (American rock elm).	– –	36	3	·579	107	Used by ship-builders.
,, ,,	– –	36	15	·591	106	Used in ship-building.
,, (rock elm)	– –	37	10	·602	336	Much used in ship-building.
,, (swamp elm)	– –	33	10	·538	322	Used in ship-building, and preferred to English elm.
,, (white elm)	– –	34	5	·549	616	Used by wheelwrights.
Ulmus fulva (red elm)	United States	42	8	·680	617	
,, ,,	– –	31	2	·498	631	
Ulmus? (wych hazel, Quebec rock elm).	Canada	34	2	·546	776	Used in ship-building.
,, ,,	,,	43	11	·699	777	,,
,, ,,	,,	51	6	·822	775	,,
Uvaria triloba (pawpaw)	United States	22	7	·359	649	
Walnut. *See* Juglans.						

WOODS OF THE WEST INDIES.

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	ozs.			
Amerimnum ebenas? (Cocus)	– –	66	6	1·062	38	Used by turners.
Andira inermis? (Turkey wood)	Cuba	45	15	·735	729	A strong, durable wood.
Batuta	– –	54	11	·875	33	Heavy and compact.
Brazilletto. *See* Cæsalpina.						
Broad leaf. *See* Terminalia.						
Bubroma guazuma (bastard cedar).	Jamaica	41	1	·657	744	Tough, but not durable.
Bully tree, bastard. *See* Bumelia.						
,, black	,,	52	12	·844	749	
Bumelia salicifolia (bastard bully tree).	,,	51	9	·825	754	
Bursera gummifera (tropic birch).	,,	22	15	·367	734	Used for burning lime; soft, and not durable.
Cæsalpinia brasiliensis (Brazilletto).	,,	51	3	·819	51	Used for dyeing and for turning.

WOODS OF THE WEST INDIES—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	ozs.			
Calabash. *See* Crescentia.						
Cedar. *See* Cedrela.						
Cedar	– –	27	15	·447	364	From the Spanish ship "Gibraltar," built in 1757.
,, bastard. *See* Bubroma.						
,, common	Santa Martha	38	11	·619	731	Used for common carpentry.
Cedrela odorata (cedar)	Jamaica	23	8	·376	733	Largely used in Jamaica, for flooring, doors, &c.
Coccoloba uvifera (sea-side grape).	,,	51	9	·825	740	Hard, tough, and durable.
Cocus. *See* Amerimnum.						
Cœurbaril. *See* Hymenæa.						
Crescentia cucurbitina (calabash)	,,	35	0	·560	743	Rather soft, but tough and durable.
Dogwood. *See* Piscidia.						
Eugenia pimenta (pimento)	,,	60	3	·963	742	Hard, tough, and durable.
Ficus ——? (white fig)	,,	30	7	·487	739	Useless, except for fuel.
Fig, red	,,	25	9	·409	756	
,, white. *See* Ficus.						
Guiacum officinale (lignum vitæ)	– –	71	8	1·144	39	Used in machinery, and by the turner.
Hæmatoxylon campechianum (log wood).	– –	–		–	62	Used for dyeing, and occasionally by turners.
Hard wood	Trinidad	63	8	1·016	566	Used in ship-building.
,,	Saint Lucia	36	15	·591	570	,,
Hibiscus tiliaceus (blue mahoe)	Jamaica	36	8	·584	747	Remarkable for toughness.
Hogplum. *See* Spondias.						
Horseflesh, or Mangrove	,,	45	15	·735	129	Sometimes used in ship-building.
Hymenæa cœurbaril (Cœurbaril)	– –	60	14	·974	35	Used for ornamental furniture.
Laurus ——? (timber sweetwood).	Jamaica	44	11	·715	750	
Lignum vitæ. *See* Guiacum.						
Logwood. *See* Hæmatoxylon.						
Mahoe. *See* Hibiscus.						
Mahogany. *See* Swietenia.						
Mangrove. *See* Horseflesh.						
Muss wood	,,	36	6	·582	751	
Orange, wild	,,	53	14	·862	748	A hard and durable wood, but not a true Citrus.
Pimento. *See* Eugenia.						
Piscidia erythrina? (dogwood)	,,	54	13	·877	735	Wood hard and durable.
Potato wood	,,	29	8	·472	752	
Prickly yellow. *See* Xanthoxylum).						
Sabicu	Cuba	57	5	·917	674	An excellent wood for beams and planking in ships.
,,	,,	64	9	1·033	675	Used in ship-building, and much approved in the Government yards.
,,	,,	63	10	1·018	732	Portion of a large beam, which broke merely in falling from a truck.
Seaside Grape. *See* Coccoloba.						
Shad bark	Jamaica	41	4	·660	753	
Spondias graveolens (Hogplum)	,,	25	11	·411	741	Wood soft and valueless.
Swietenia Mahogani (Bay mahogany).	Honduras	26	8	·424	571	Used for furniture and for ship-building, called "Common southern."
,, ,,	,,	25	13	·413	772	Used in ship-building, called "Common southern."
,, ,,	,,	42	11	·683	770	Used in ship-building, called "Superior northern."
,, ,,	,,	31	11	·507	768	Used in ship-building, called "Good northern."
,, ,,	,,	36	0	·576	769	Used in ship-building, called "Common northern."
,, (Cuba mahogany).	Cuba	46	11	·747	458	Specimen from the exterior of the butt of a log.
,, ,,	,,	49	10	·794	456	Specimen from the exterior of the top of a log.
,, (Honduras mahogany).	Honduras	26	8	·424	466	Specimen from the outside of the butt of a log, quality inferior.
,, ,,	,,	39	6	·630	468	,, ,,
,, ,,	,,	26	2	·418	467	Specimen from the interior of the butt of a log, quality inferior.
,, ,,	,,	35	13	·573	471	Specimen from the interior of the butt of a log, quality good.
,, ,,	,,	34	11	·555	470	Specimen from the exterior of the butt of a log, quality good.
,, ,,	,,	44	1	·705	469	Specimen from the interior of the top of a log.
,, ,,	,,	36	9	·585	460	Specimen from the exterior of the top of a log.
,, (Spanish mahogany)	Cuba	48	6	·764	32	Much used for furniture.
Terminalia latifolia (broad leaf)	Jamaica	35	0	·560	753	
Timber sweetwood. *See* Laurus.						
Trinidad Mangrove	Trinidad	61	15	·991	569	Very hard, firm, and close grained
Tropic birch. *See* Bursera.						

WOODS OF THE WEST INDIES—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	ozs.			
Turkey wood. *See* Andira.						
Vallatah	Trinidad	58	12	·940	665	Used in ship-building.
Xanthoxylum clava-Herculis (prickly yellow).	,,	35	2	·562	757	
Yellow mast	,,	56	5	·901	745	Hard, but rather brittle.
———?	,,	56	2	·898	738	
———?	,,	37	11	·603	737	
———?	,,	67	3	1·075	736	

WOODS OF SOUTH AMERICA.

Acapu	Para	56	8	·904	760	The best wood of the country for standing exposure to the weather; much used in house-carpentry.
Amendoheira	Brazil	–		–	135	
Arandaia	,,	–		–	136	
Arapacu	,,	–		–	138	
Arapetiu semarelo	,,	–		–	137	
Bagre	,,	–		–	139	
Boubixa	,,	–		–	141	
Brazil. *See* Cæsalpina.						
Brazilian hard-wood	– –	58	9	·937	568	Used in ship-building.
Brazilian oak	Brazil	51	4	·820	785	,,
Bullet-wood	Demerara	58	0	·928	451	
Bupurana	Brazil	–		–	140	
Cabo dumxada	,,	–		–	142	
Cabui da vargem	,,	–		–	144	
Cabui vermelho	,,	–		–	143	
Cabui vinhatico	,,	–		–	145	
Canbuatan	,,	–		–	146	
Canela almeuca	,,	–		–	476	
Canela Cap^{m}. mor	,,	–		–	487	
Canela capororoca	,,	–		–	147	
Canela degusmo am^{a}.	,,	–		–	148	
Canela degusmo pr^{ta}.	,,	–		–	149	
Canela Jacu	,,	–		–	151	
Canela olio vermetha	,,	–		–	150	
Canela preta da vargem	,,	–		–	152	
Canela viado	,,	–		–	479	
Cangeranna asu	,,	–		–	491	
Cangeranna merin	,,	–		–	151	
Capororoca da serra	,,	–		–	154	
Capota depobre	,,	–		–	488	
Cara suja	,,	–		–	155	
Catulanhi braudo	,,	–		–	480	
Cedrela? (Cearo)	Para	29	3	·467	765	
Cæsalpina echinata (Brazil)	– –	58	13	·941	68	Used for dyeing and for turnery,
Corindiba rrozada	Brazil	–		–	156	
De Dejeunhecido	,,	–		–	157	
Demerara wood	Demerara	23	13	·381	783	Used in ship-building.
Embiu preto	Brazil	–		–	158	
Fruta de arara	,,	–		–	486	
Fruta de papagaio	,,	–		–	159	
Fruta de pouba	,,	–		–	160	
Fruta diauta	,,	–		–	477	
Garapeapunha am^{a}.	,,	–		–	161	
Giquita. *See* Hymenæa.						
Goiti	,,	–		–	162	
Greenheart. *See* Laurus.						
Guaracaho vermetho. *See* Inga.						
Gueimado	,,	–		–	163	
Guiné	,,	–		–	164	
Hymenæa ——? (Giquita)	,,	–		–	489	
Inga ——? (Guarncahi vermetho).	,,	–		–	485	
Itanba	Para	54	2	·862	767	A fine hard wood.
Jaburandi	Brazil	–		–	484	
Jacarunda. *See* Mimosa.						
Jetuaiba vermetha	,,	–		–	167	
Junduaiba	,,	–		–	165	
Jutuahiba amarila	,,	–		–	166	
King-wood	,,	43	11	·699	71	Used for turning and ornamental furniture.
Laurus chloroxylon (Greenheart).	Guiana	51	15	·831	788	An excellent wood for ship-building.
,, ,,	Brazil	56	5	·901	790	Used in ship-building.
,, ,,	Guiana	61	13	·989	789	,,
Limoeiro preto	Brazil	–		–	168	,,

WOODS OF SOUTH AMERICA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	ozs.			
Macácáubá	Para	43	13	701	766	A hard and handsome wood, used for furniture.
Majuba branea	Brazil	–		–	478	
Malcazado	,,	–		–	173	
Mantega	,,	–		–	171	
Marcanaiba	,,	–		–	172	
Massaranduba	Para	69	4	1·108	761	A hard wood of good quality.
Milho cozido	Brazil	–		–	170	
Mimosa ——? (Rosewood, Jacaranda).	,,	44	14	·718	37	Much used for ornamental furniture.
Mora excelsa (Morra)	Demerara	55	12	·892	572	A valuable wood for ship-building.
,, ,,	,,	57	15	·927	573	Sometimes called Demerara locust by ship-builders.
,, ,,	Guiana	62	13	1·005	676	A strong and durable wood, much used in ship-building.
,, ,,	,,	60	13	·973	782	
Morra. *See* Mora.						
Muquequeira	Brazil	–		–	169	
Notiga	,,	–		–	174	
Oaca	,,	–		–	178	
Obapeba asú	,,	–		–	176	
Obapeba depedra	,,	–		–	177	
Olio caburaiba	,,	–		–	482	
Oluranna vermª.	,,	–		–	179	
Orapitin vermelho	,,	–		–	180	
Orapóca amarela	,,	–		–	483	
Orilo manco	,,	–		–	175	
Pao amarella	Para	55	2	·882	764	A fine yellow wood, similar to Canary-wood.
Pao d'arco	,,	54	1	·865	763	Used by the Indians for bows, and it is much employed in machinery.
Pao prodrigo	Brazil	–		–	481	
Papante	,,	–		–	181	
Peguia vermelho	,,	–		–	182	
Piquia	Para	43	15	·703	762	Very tough; used for water-wheels and timbers for boats.
Rosewood. *See* Mimosa.						
Sabaó vermetho	Brazil	–		–	490	
Santa Maria	– –	37	8	·600	323	Occasionally used in ship-building.
Santa-Maria-wood. *See* South American hard-wood.						
Sardaó	Brazil	–		–	185	
Satin-wood	– –	55	5	·885	784	Used in ship-building.
Sibo	Brazil	–		–	184	
Sindiba da folha rredonda	,,	–		–	183	
Stink-wood	– –	52	11	·843	338	Has a very unpleasant smell.
South American hard-wood, or Santa-Maria-wood.	Brazil	47	14	·764	130	Used in ship-building.
South American hard-wood, or Sucapura.	,,	53	4	·852	131	,,
Taxumam	,,	–		–	186	
Tinga sui	,,	–		–	187	
Ytu	,,	–		–	188	
———?	Para	83	8	1·336	207	Remarkably heavy and tough.
———?	,,	48	2	·770	208	
———?	Brazil	–		–	210	Used for making sugar-boxes.
———?	,,	–		–	211	,, ,,
———?	,,	32	9	·521	213	,, ,,
———?	,,	–		–	281	
———?	Carthagena	25	0	·400	495	Used for boxes and common carpentry purposes.
———?	,,	–		–	501	Used for packing-cases.

WOODS OF AUSTRALIA.

Beef wood	– –	56	12	·908	356	Used for ornamental furniture.
Black gum, Borkee?	– –	56	11	·907	370	Hard and compact.
Blue gum	– –	48	3	·771	361	Used in ship-building, and thought to be a strong and durable wood.
Blue gum. *See* Eucalyptus.						
Borkee. *See* Black gum.						
Box	– –	59	1	·945	360	
Casuarina suberosa	– –	36	1	·577	56	
Cedar	– –	34	6	·550	357	
Dacrydium Fraklinii. *See* Huon Pine.						
Eucalyptus piperita (blue gum)	– –	57	4	·916	332	Used in ship-building; a strong and durable wood.

WOODS OF AUSTRALIA—*continued.*

NAME.	Place of Growth.	Weight per Cubic Ft.		Specific Gravity	No. in Catalogue.	REMARKS.
		lbs.	ozs.			
Eucalyptus resinifera? (gum wood).	– –	52	9	·841	333	Used in ship-building.
Eucalyptus ——? (stringy bark)	– –	49	4	·788	329	A good wood for making treenails; used in ship-building.
,, ,,	– –	56	5	·901	795	Used in ship-building.
,, ,,	– –	52	3	·835	367	
Eucalyptus?	Swan River	44	13	·717	472	The "Halifax Packet" is repaired with this wood.
Findersia Australis	– –	32	5	·517	57	
Gum wood. *See* Eucalyptus.						
Huon River pine. *See* Dacrydium Franklinii.	Van Diemen's Land.	25	2	·402	352	
Iron bark	– –	65	9	1·049	355	A very hard and compact wood.
Lemon	– –	30	14	·494	362	
Mahogany	– –	60	13	·973	359	
Myrtle	– –	36	11	·587	358	
New South Wales cedar	– –	29	4	·468	102	Used principally for joinery and furniture.
,, hard wood	– –	54	9	·873	792	Used in ship-building.
,, ,,	– –	54	11	·875	103	,,
,, ,,	– –	54	12	·876	791	,,
Remor	– –	39	1	·625	366	
Stringy bark. *See* Eucalyptus						
Swan River mahogany	– –	42	0	·672	563	
,, ,,	– –	44	0	·704	563	
,, ,,	– –	42	10	·682	474	
,, ,,	– –	43	8	·696	474	Used in ship-building; a strong durable wood.
Trydee	– –	44	13	·717	365	
————?	Moreton Bay	61	1	·961	347	From Mr. Lambert's collection.
————?	– –	31	1	·497	371	

WOODS OF NEW ZEALAND.

Ake	– –	40	4	·644	522	
Ake Ake. *See* Mohowrangs.						
Boriele. *See* Ephialtes.						
Cowdie. *See* Dammara.						
Dacrydium taxifolium? (Kikiteah).	– –	22	13	·365	351	
,, (Kahikateah)	– –	31	1	·497	513	
,, ,,	– –	29	11	·475	508	
Dammara Australis (New Zealand pine).	– –	25	3	·403	452	Much valued for masts and spars of vessels.
,, ,,	– –	26	13	·429	454	Specimen showing wood of the best quality.
,, (Cowdie)	– –	33	11	·539	353	
,, (Kowdie)	– –	35	9	·569	505	
Ephialtes ——? (Boriele Pureele).	– –					
Fagus	– –	33	3	·531	521	
Kahikatea. *See* Dacrydium.						
Karigatta, or Manook	– –	57	9	·921	520	
Káttár	– –	–		–	532	
Kikiteah. *See* Dacrydium.						
Kowdie. *See* Dammara.						
Manook. *See* Karigatta.						
Mero	– –	48	4	·772	523	
Mohowrangs, or Ake Ake	– –	63	3	1·011	517	
Mora, or Maire	– –	34	5	·549	514	
New Zealand pine. *See* Dammara.						
Podocarpus totarra (Totara)	– –	39	5	·629	509	
,, ,,	– –	32	10	·522	354	
Pohutukana	– –	52	2	·834	506	
Pureele. *See* Ephialtes.						
Purine	– –	52	5	·837	507	
Rawa Rawa?	– –	51	7	·823	527	
Rewarewa	– –	53	15	·683	515	Wood of good quality; hard, and compact.
Rimu	– –	34	[illegible]	·560	511	
Rowai	– –	43	13	·701	516	
Taneka ha	– –	36	7	·583	512	
Tangi	– –	33	14	·542	519	
Tariedy	– –	35	12	·572	518	
Totara. *See* Podocarpus.						
Towha	– –	35	4	·564	524	
Touwai	– –	43	6	·674	510	

A very beautiful series of about 160 samples of the most useful and ornamental woods from various parts of the world is shown by Messrs. R. and J. HARRISON (6, pp. 195*, 196*). The woods are all cut in the form of books, and admirably exhibit the grain and other peculiarities of each specimen. For this collection also, the Jury awarded a Prize Medal.

A collection of ornamental foreign woods, and other materials employed in cabinet-work, is shown by Messrs. R. FAUNTLEROY and SONS (135, pp. 205*, 206*). The number of woods about fifty, the specimens being all cut and polished, so as to show the grain and colour of the wood to the greatest advantage. Of most of the woods, two or three specimens are shown side by side, one in the rough, or with the bark on, one in section, and a third cut longitudinally and polished. For this series the Jury awarded a Prize Medal.

A valuable and instructive series of all the principal woods used for turning is shown by Messrs. HOLTZAPFFEL (14, p. 196*), the character of each wood illustrated by the end of the specimen being turned, so as to show how it works under the tool in the lathe. For this collection the Jury awarded a Prize Medal.

Some remarkably fine specimens of veneering, in walnut and rosewood, are exhibited by Messrs. E. SCOTT and Co. (19). To these the Jury awarded a Prize Medal.

A valuable and extensive collection of 63 of the timbers and ornamental woods of England is contributed by S. CROSS (136, pp. 206*, 207*, 208*). This was deemed worthy of Honourable Mention.

The series of Scotch woods shown in Messrs. LAWSON'S collection (Class III., p. 206) is interesting on account of the beauty of the specimens, the excellent manner in which they are arranged and shown, and the instructive mode in which the characters and peculiar properties of each tree are made evident. The sections of grafts and diseases of trees are peculiarly good. Praise is also due to this, as to all the other divisions of Messrs. Lawson's collection, for the excellent catalogue which accompanies it, and which is full of useful information. The following is the list of the timber, ornamental, and fruit-trees:—

Acer campestre	Field maple.
„ platanoides	Norway maple.
„ pseudo-platanus	Sycamore.
„ saccharinum	Sugar maple.
„ striatum	Striped maple.
Æsculus hippocastanum	Horse chestnut.
Alnus glutinosa	Alder.
„ incana	Hoary-leaved alder.
Amygdalus communis	Almond.
Arbutus unedo	Arbutus.
Caragana arborescens	Siberian pea tree.
Carpinus betulus	Hornbeam.
Castanea vesca	Sweet chestnut.
Cerasus lusitanica	Portugal laurel.
„ padus	Bird cherry.
„ sylvestris	Wild cherry.
„ vulgaris	Cherry.
Cratægus coccinea	Scarlet thorn.
„ oxyacantha	Hawthorn.
„ punctata	Dotted thorn.
Cupressus sempervirens	Italian cypress.
„ thyoides	White cedar.
Cydonia vulgaris	Quince.
Cytisus alpinus	Alpine laburnum.
„ laburnum	Laburnum.
„ scoparius	Broom.
Fagus sylvatica	Beech.
Fraxinus excelsior	Ash.
Ilex aquifolium	Holly.
Juglans regia	Walnut.
Juniperus virginiana	Red cedar.
Mespilus germanica	Medlar.
Ornus europæa	Flowering ash.
Pinus Canadensis	Hemlock spruce.
„ abies	Silver fir.
„ balsamea	American silver fir.
„ alba	White spruce.
„ nigra	Black spruce.
„ picea	Norway spruce.
„ larix	Larch.
„ microcarpa	American larch.
Pinus pendula	Weeping larch.
„ cedrus	Cedar of Lebanon.
„ sylvestris	Scotch fir.
„ laricio	Corsican pine.
„ laricio austriaca	Black Austrian pine.
„ pinaster	Pinaster.
„ strobus	Weymouth pine.
„ cembra	Swiss stone pine.
Populus alba	White poplar.
„ nigra	Black poplar.
Prunus domestica	Plum.
„ spinosa	Sloe.
Pyrus aucuparia	Mountain ash.
„ communis	Pear.
„ malus	Apple.
Quercus cerris	Turkey oak.
„ coccinea	Scarlet oak.
„ ilex	Evergreen oak.
„ pedunculata	Common oak.
„ sessiliflora	Ditto.
Robinia pseudo-acacia	Locust tree.
Rhododendron arboreum	Rhododendron.
„ ponticum	Pontic ditto
Salix alba	White willow.
„ Babylonica	Weeping willow.
„ caprea	Goats' willow.
„ Forbyana	Forby's willow.
„ fragilis	Crack willow.
„ Russelliana	Bedford willow.
„ triandra	Basket willow.
„ viminalis	Osier.
Sambucus nigra	Elder.
Taxus baccata	Yew.
Thuja occidentalis	Arbor vitæ.
Ulmus campestris	Elm.
„ montana	Wych elm.
Viburnum opulus	Guelder rose.

The collection of foreign woods included in the Liverpool series of imports is also highly deserving of notice: many of the specimens are unusually fine, and they are all well shown and arranged. (See p. 69.)

Besides these more important collections, various single specimens deserving Honourable Mention are exhibited. Among these are some samples of woods grown in Perthshire and Argyleshire by the Marquis of BREADALBANE (134, p. 205*); a sample of Scotch fir grown in Strathavon, from Sir W. MURRAY, Bart. (137, p. 208*); a series of Irish woods exhibited by J. LONG (47, p. 198*); a small collection of Irish woods contributed by J. CLASSON (22, p. 196*). These were severally deemed worthy of Honourable Mention.

Beautiful specimens are exhibited of St. Domingo mahogany, from Messrs. GILLOW and Co. (15, p. 196*); and some remarkably handsome oak veneers from an oak grown in Whittlebury Forest, Northamptonshire, are also exhibited by Messrs. GILLOW (Class XXVI. 186, p. 748). These were severally deemed worthy of Honourable Mention.

A picture-frame exhibited by D. SAMUELS (21A, p. 196*), formed of various common English woods, chiefly oak, elm, and ash, was deemed worthy of Honourable Mention.

Some good specimens of English woods are likewise exhibited by F. C. FITCH (8, p. 196*).

Several specimens of bog wood of different kinds, and from various localities, are shown. Among these are slabs of bog oak, yew, and fir, from Lord DILLON (138, p. 208*); and bog fir from the Marquis of BREADALBANE (134, p. 205*). These were severally deemed worthy of Honourable Mention.

In connexion with the various collections of wood, attention must be paid to the different processes for seasoning and preserving it from the influence of the weather, dry rot, and the attacks of insects, boring-worms, &c. These and other causes form very serious obstacles to the use of wood for many purposes; and accordingly a number of plans have from time to time been proposed, having for their object the cheap and effectual preservation of wood. Among these schemes, five in particular have attracted especial attention; namely, the plans of Messrs. KYAN, BOUCHERIE, BURNETT, BETHELL, and PAYNE. Of these, the first and last are not represented in the Exhibition, and therefore do not come before the Jury, though the machinery employed by Mr. Payne is exhibited, but without any specimen of impregnated or preserved wood.

Sir W. Burnett exhibits an interesting series of specimens in illustration of his mode of preserving wood, &c., and in proof of its efficacy (7, p. 196*). This process, which consists in impregnating it with a solution of chloride of zinc, was patented in 1836, four years after the date of Kyan's patent, in which a solution of corrosive sublimate was employed for the same purpose. The specimens shown are highly satisfactory, and clearly prove the high preserving power of the solution of zinc. The Jury awarded a Prize Medal for this process.

The specimens shown by Mr. J. Bethell (21, p. 196*) are likewise highly interesting and satisfactory. The process employed in this case, and for which a patent was obtained in 1838, consists in thoroughly impregnating the wood with oil of tar containing creosote, and a crude solution of acetate of iron, commonly called pyrolignite of iron. The idea of preserving wood by the action of oil of tar, or similar liquids, is by no means new. In 1756, Hales recommended that the planks of ships should be soaked in vegetable oil to prevent the injury to which wood is subject when alternately exposed to wet and dry; and, indeed, many ships were built in which a hollow place was cut in one end of each beam or stern-post, so that it might be constantly kept filled with train oil. Among other ships so constructed, the "Fame," 74, may be mentioned. When, after some years, this ship was repaired, it was found that, as far as the oil had penetrated—namely, from 12 to 18 inches from the end—the wood was quite sound, whilst the other parts were more or less decayed. In 1805, Mr. Maconochie proposed to saturate with resinous and oily matters inferior woods, and thus render them more lasting. This proposal was practically carried out in 1811 by Mr. Lukin, who constructed a peculiar oven for the purpose of thus impregnating wood under the influence of an increased temperature. The scheme, however, had but very partial success, for either the heat was too low and the wood was not thoroughly aired and seasoned, or it was too high and the wood was more or less scorched and burnt. The importance of oil as a preserving agent for wood is also shown by the fact that whalers, and other ships employed in the oil trade, the timbers of which become thoroughly saturated with oil or grease, invariably last longer—and are less subject to decay of any sort—than other vessels. It is also well known that the staves of old tallow-casks make a more lasting and durable fence than any other sort of wood—an effect entirely due to the protecting influence of the oil with which they have become saturated.

The operation, as conducted by Mr. Bethell, is carried on in a strong cylindrical vessel connected with a powerful air-pump, so that in the first instance a vacuum being formed, and subsequently a pressure of several atmospheres applied, the liquid may as much as possible be forced into all the pores of the wood. It is stated that wood thus prepared is not only protected from decay, and from the attacks of insects, but also that it becomes stronger and tougher in consequence of the layer of bituminous matter with which the woody fibre becomes encrusted. Among the specimens exhibited are portions of railway sleepers which have been in use for several years, and which are perfectly sound, whilst others from the same situation, but not prepared, are quite destroyed. Portions of piles which have been four years in the sea in Lowestoft harbour, and which are quite sound, are also shown. This process has been extensively employed in the preparation of railway sleepers for more than ten years, and the result of its application appears in every case to be highly satisfactory where the process has been well and properly conducted. The Jury therefore awarded a Prize Medal for it to Mr. Bethell. (See p. 153.)

The mere seasoning of wood, though it will not altogether prevent its decaying, nevertheless considerably diminishes its tendency to do so, and is of the very utmost importance in many cases. The value of any process for seasoning wood depends, of course, to some extent, on the time required for its completion. A valuable series of specimens is shown by Mr. C. H. Newton (20, p. 196*) in illustration of Davison and Symington's patent process for speedily and effectually seasoning wood by exposing it to the influence of a rapid and continuous current of heated air, so that it soon becomes thoroughly dry. The practical value of this process appears to be satisfactorily proved, and the Jury accordingly deemed it worthy of Honourable Mention.

A fine specimen of elm, cut across the grain, and well seasoned by steeping in water and very slow drying, is shown by Sir W. Murray, Bart. (137, p. 208*).

A sample of Welch oak, stated to be seasoned by a new process, which renders it better suited to the purposes of the cabinet-maker, is exhibited by W. Evans (9a, p. 196*).

The collection of East Indian woods, exhibited by the Honourable East India Company (p. 884) is by far the most extensive series of woods in the whole Exhibition, and constitutes a very valuable part of the great collection of Indian raw produce. It is remarkable for the large number of specimens, the excellence of many of them, and the valuable practical information to be gained by their examination. The collection consists of many hundred specimens, and includes several minor or local collections of great interest. Amongst these are the valuable collections of Drs. Roxburgh and Wallich (884, 885); and extensive series of the woods of the Malay peninsula, Amherst, Tavoy, Tenasserim, Prince of Wales Island, Assam, Cuddapah, Madras, Orissa, &c.

Considering the extent and importance of Dr. Wallich's collection, the Jury would certainly have awarded to him a medal had not the fact of his being a member of the Jury precluded them from doing so. They awarded a Prize Medal to Mr. Commissioner Blundell (p. 885), for a very valuable collection of Amherst woods. They also awarded a Prize Medal to Messrs. Almeida of Singapore (p. 890), for fine specimens of Lingoa-wood and Kayu-buka.

The smaller series of woods contributed by Messrs. A. P. Onslow, of Ganjam; D. Mayne, of Cuddapah (p. 188); Walter Elliott of Vizagapatam; J. E. Chapman; Lieut.-Col. Tulloch; The Commissary-General of Madras; Captain Ogilvie, of Masulipatam; Captain Maitland, and Major Balfour, of Madras; Dr. Hunter, of Madras; Dr. Wight, of Coimbatore; Captain Marquart, of Chittagong; and J. R. Colvin, of Moulmein (pp. 888, 891), were also severally deemed worthy of Honourable Mention.

The nature and properties of many of these Indian woods is very little known; and though, for the most part, it is not probable that it would be found worth while to import them into Europe, yet their importance to India is every year increasing, and must necessarily continue to do so, as the demand for timber in India for railways and other engineering works increases. For such uses it is desirable, not only that the wood should be strong and not liable to decay from mere exposure to the weather, but, also, that it should work freely, and be able to withstand the ravages of the various insects to which wood of all kinds is more or less exposed in tropical countries. It is true that even the most porous and spongy woods may be rendered to some extent capable of resisting all such influences, by being impregnated with various solutions, as in the processes just adverted to; but it is obviously far better, when possible, to select such woods as are naturally saturated with resinous and aromatic substances, as in this latter case all cost of preparation is saved, besides that the preserving matter is far more perfectly disseminated throughout the whole of the wood than can possibly be effected by any artificial process after the tree is felled.

In examining the comparative value of different sorts of wood, it is of the first importance to ascertain the nature of the encrusting matter deposited throughout the cells and tubes of the wood. For all practical purposes, those woods appear to be best in which the cells are lined with resinous matter; those filled with hygroscopic gummy matter are, for the most part, of less value; they are seasoned with difficulty, and are always more liable to decay. The best woods are those having a strong fibre, protected from all external influences by a coat of resinous matter, or at least of a matter insoluble in water, and one which does not attract atmospheric moisture.

It is probable, also, that some of the ornamental and other woods of India will become articles of import when their properties and uses are better known and appreciated by our artizans.

Dr. Wallich's collection consists of about 450 specimens, and may be divided into the woods of Nepal, those of Tavoy, those of Gualpara, and those grown near Calcutta.

In the following general list of the woods contributed by the Indian Government, Dr. Wallich's collections are numbered 1, 2, 3, 19, and 23.

No. 1.—WOODS OF NEPAL (DR. WALLICH.)

No.	Name.	Newar.	Porbuttea.	Remarks.
1	Acacia mollis	– –	– –	A large tree; soft wood.
2	,, frugrans			
3	,, ,,	Joolchumahl	– –	Very large tree; useful wood.
4	Acer lævigatum	Sustendi	Cherouni	Used in building.
5	,, sterculiaceum	– –	– –	Very large tree; soft wood.
6	,, oblongum	– –	– –	Very large tree; good wood.
7	Adamia cyanea	Bansook	Bansook	A shrub.
8	Alnus nepalensis	– –	– –	Pale brown; a hard wood.
9	Andromeda ovalifolia	Juggoochat	Angaree	A shrub; soft wood; used for fuel.
10	,, formosa	Sheaboge	– –	Large tree; fine grain; hard wood.
11	,, cordata	– –	– –	Brown wood.
12	,,			
13	,,			
14	Aralia digitata	Leesaong.		
15	,, nodosa			
16	,,	– –	– –	A soft wood; used for boxes.
17	Bauhinia	– –	Koila.	
18	,,	– –	– –	A large tree.
19	Berberis pinnatifolia	Milkissee	Jumne-munda	A shrub; yellow wood.
20	,, asiatica	Matekissee	Chitra	,, ,,
21	Betula leptostachya	– –	– –	A tree; good wood.
22	,, cylindrostachya	– –	– –	,, wood shaky.
23	,, Bhojpattra	Bhojpattra	– –	,, good wood.
24	Bignonia.			
25	,, chelonoides	– –	– –	A large tree.
26	Briedelia	– –	– –	,, hard, fine-grained wood.
27	Brucea napalensis	– –	– –	A shrub.
28	Buddlia paniculata	Sinna	Narumpattu	,,
29	Cæsalpinia.			
30	Camellia Kissi	Kisii	– –	A tree; close-grained wood.
31	Capparis	– –	– –	A shrub; white and hard.
32	,,	– –	– –	,,
33	Carpinus viminea	Chukisse	Konikath	A tree; good, hard wood.
34	Castanea tribuloides	Cotoor and Chisee Makoo and Shingali.	– –	,, hard and heavy wood.
35	Cedrela hexandra	Toon	– –	,, close and hard; used for furniture.
36	Celastrus	– –	– –	Soft, but fine-grained.
37	,, verticillata.			
38	,,	– –	– –	A tree; soft, and very fine-grained.
39	Celtis	Koosikma	Khori.	
40	Cerasus Puddum	– –	– –	,, soft wood.
41	Chamærops Martiana			
42	Champa	– –	– –	Palm tree; a good soft wood.
43	Cinchona gratissima	Tungnusi	Tungnusi	A shrub; a coarse wood; used for posts.
44	Conyza candicans	Bhoea	Phusrae.	
45	Cordia myxa (?)			
46	Coriaria napalensis	Bhojkinsi.		
47	Cornus oblonga	Easee	Easee	Fine hard-grained wood.
48	,, capitata	– –	– –	Very large tree; hard wood.
49	Corylus ferox	– –	– –	Light wood.
50	Cotoneaster affinis	– –	– –	A small tree.
51	,, obovata	– –	– –	,,
52	Cratægus arbutiflora	Rooes	– –	Very strong.
53	Cyathea spinulosa	– –	– –	Fern tree.
54	Dalbergia.			
55	Daphne Gardneri	– –	– –	A shrub.
56	,, cannabina	– –	– –	,,
57	Diospyros	Tendoo.		
58	Ehretia serrata	Nalshima	– –	A tree; soft, tough wood; used for posts.
59	,, macrophylla	Poegulsee	– –	,, ,,
60	Elæagnus	– –	– –	A shrub.
61	,,	Chusee	– –	,,
62	Embelia	– –	– –	,,
63	Eriobotria elliptica	Michul	Michul	A tree; hard, brown wood; compact.
64	Euonymus	Veysoor	Junghuree	A large tree; close-grained wood.
65	Euonymus tingens	Kuroori	– –	Brown, close-grained, hard.
66	,, echinata	– –	– –	A small tree.
67	,, pendula	– –	– –	,,

No. 1.—WOODS OF NEPAL (DR. WALLICH)—*continued.*

No.	Name.	Newar.	Porbuttea.	Remarks.
68	Euonymus pendula	– –	– –	A small tree.
69	Eurya napalensis	Earansea	Juguee.	
70	„ variabilis	Chickouni	Chickouni	Brown, compact, hard.
71	„ „	– –	– –	„ „
72	Fagara floribunda	– –	– –	Very coarse.
73	„ „			
74	Ficus	Doodae-kath	Doodae-kath	Soft wood; used for gutters.
75	„	Pillaksi	Kaffræa	Soft, light wood.
76	„	– –	– –	„ „
77	„			
78	„	– –	– –	Light wood.
79	„	– –	– –	Tolerably hard.
80	„	– –	– –	Coarse, brown, hard wood.
81	„	– –	– –	A large tree; soft wood.
82	Fraxinus floribunda	Dakkuree	– –	A tree; like English ash.
83	Frezieria ochnoides	– –	– –	Brown, close-grained, hard wood.
84	Gardenia florida	Eandorkomulsoang	– –	A shrub.
85	„ „	– –	– –	Light brown, fine-grained, hard wood.
86	„ „	Bundhali	Bundhali.	
87	Gastonia palmata.			
88	Gordonia integrifolia	Goechasse	Chillounea	A tree.
89	Gualtheria fragrantissima	Dhoree	Dhoseongree	A shrub.
90	Guarea	– –	– –	Tolerably hard; pale brown wood.
91	Holboellia latifolia	Bagul (T)	– –	A climber.
92	Hovenia dulcis	– –	– –	Very large tree; coarse wood.
93	Hydrangea altissima	– –	– –	A climber.
94	„ trigyna.			
95	Hymenodictyon flaccidum	– –	– –	„
96	Ilex dipyrena	Munasi and Gulsima.	Karaput	A tree; heavy, hard, fine-grained wood.
97	Jasminum arboreum	Anjoo	– –	Hard and compact.
98	„ dispermum.			
99	„ chrysanthum	– –	– –	White and fine grained, but brittle.
100	Juglans pterococca	– –	– –	Very large tree; coarse brown wood.
101	Justicia Adhatoda	Alesi	Kath.	
102	Laurina	Tapahaco.		
103	Laurus	Chasepoo	Lumpatch	Large tree; useful wood.
104	„ glandulifera	– –	– –	Coarse, soft wood.
105	„ caudata.			
106	„ albiflora	– –	– –	Large tree.
107	„ „	Pahela.		
108	„ „	Phetpetta	Balukshee	Fine brown wood, used for chests.
109	„ „	Chausoma.		
110	„ „	Chikihul-tussipoo	Sami-lumpata.	
111	„ „	Keebula	Kalechampoo.	
112	„ „	Pumlasi	Khorkula	Large tree; strong and durable wood.
113	„ „	Khulsi.		
114	„ „	Bulooksee	Sengoulu and Tijpaut	Excellent wood.
115	„ „	Phusree	Phusree	Greyish-brown wood.
116	„ lanuginosa	– –	– –	Hard, light-brown wood.
117	„ (Tetranthera bifaria)	Juttrunga	Pahelakath.	
118	Leucosceptrum	– –	– –	Soft, inferior wood.
119	Leycesteria formosa.			
120	Ligustrum napalense	Billae, or Bancha	Billae, or Bancha	Heavy, hard, compact wood.
121	Limonia	Hakoolnal	Kailkat	Soft, white, tough; good for turning.
122	„ crenulata	– –	– –	Very hard, yellow wood.
123	Loranthus	Eea	Lissokatta.	
124	Ludia	Mulloka	Antheel.	
125	Magnolia insignis	– –	– –	A tree; soft, but fine-grained.
126	Melia	Baksi	Bukaena.	
127	Meliacea (?)	Kangu Kurroo (B).		
128	Menispermum laurifolium.			
129	Michelia Kisopa	Chobsee	Champ, or Chaump	A tree; useful wood.
130	Millingtonia pungens.			
131	Morus lævigata	– –	– –	A large tree.
132	Myrica sapida	Kobusi	Kaephul	Like birch-wood.
133	Myrsine semiserrata	Birusee kalikaut	Bireesee kalikaut	Hard, handsome wood.
134	Olea glandulifera	– –	– –	A large tree; very hard, heavy wood.
135	Oleina	– –	– –	Hard, handsome wood.
136	Osyris napalensis	Shoori	Shoori.	
137	Panax polyacanthus	– –	– –	Large tree.
138	„ „	Lubtesee	– –	Soft, spongy wood.
139	„ „			
140	„ „			
141	„ pendulus	– –	– –	Handsome wood.
142	Photinia dubia	– –	– –	Fine-grained, hard wood.
143	„ integrifolia	– –	– –	Coarse brown wood.
144	Phyllanthus Emblica	– –	– –	Handsome, hard, brown wood.
145	Pinus excelsa	– –	– –	Very compact wood.
146	„ longifolia	– –	– –	Excellent timber.
147	„ Brunoniana	– –	– –	Soft, useless wood.

No. 1.—WOODS OF NEPAL (DR. WALLICH)—*continued.*

No.	Name.	Newar.	Porbuttea.	Remarks.
148	Pinus Webbiana.			
149	,, Deodara	- -	- -	Fragrant wood.
150	Podalyria napalensis	Portugalla	Oosihn.	
151	Podocarpus macrophylla	Goonsi.		
152	Polygonum	Tauntue	Tuknee	Used only for fire-wood.
153	Polypodium giganteum	- -	- -	Fern tree.
154	Premna	Toomulse.		
155	Prunus glaucifolia	Rainpuplee	- -	A large tree.
156	,, adenophylla	- -	- -	,,
157	,, ferruginea.			
158	Psychotria rotata	- -	- -	Fine-grained, hard, brown wood.
159	Pyrus indica (?)	Passy	Mehul	Fine grain; compact, brown wood.
160	,, vestita	- -	- -	Soft wood.
161	,, foliolosa.			
162	,, ursina.			
163	Quercus spicata	- -	- -	A very large tree; good wood.
164	,, semecarpifolia	Ghese and Cusroo	- -	,, ,,
165	,, lamellosa	Shulsee and Phrarat	- -	Very hard, and good wood.
166	,,	Gomulsee	Bunaroo	Soft wood.
167	,, lanata	- -	- -	A very large tree.
168	,, lamellata.			
169	,, polyantha	Soosi-Singhah.		
170	Rhamnea	- -	- -	A large climber.
171	Rhamnus virgatus	- -	- -	Very hard and heavy wood.
172	Rhododendron arboreum	Tuggoo	Bhorans	Good wood; used for gunstocks.
173	,, ,, (white)	Teuggoo Tuggoo	Saphed Bhorans	A large tree; hard, brown wood.
174	,, campanulatum	Teotosa	Cheriala	A large tree.
175	Rhus Bukki-amela	Subuchunsee	Bukki-amela	A large tree; good timber.
176	,, (?)	Guarnusi	Dubdubea (?)	Very light, soft wood.
177	,, succedaneum	- -	- -	A large tree.
178	,, juglandifolium	Chose	Bhalaco	Reddish-brown wood.
179	Rondeletia cana	- -	- -	Close-grained, reddish wood.
180	,, coriacea	Julsi	Kongeea.	
181	Röttlera	Teeta-Kath	Labtesee.	
182	,, tinctoria	- -	- -	Small and inferior timber.
183	,, (tinctoria?)	- -	- -	Hard, fine-grained, brown wood.
184	,, arborea	- -	- -	Coarse, soft wood.
185	Rubus Gouriphul	Eesi	Escaloo.	
186	Sabia parvifolia	Mhasoosee	Mhasoosee.	
187	Salix	Bhoelasi	Bhoelasi.	
188	,, Babylonica	Tissee and Bhosee	Tissee and Bhosee	Very large tree.
189	,, ,,			
190	Schoepfia fragrans	- -	- -	A shrub; coarse, light, soft wood.
191	Securidaca reniformis	- -	- -	A soft, white wood.
192	Smilax	Doduan	Doduan.	
193	Sphærocarya edulis	Lushpoo, Ael, or Ealmarisee.	Bun Amb	A handsome wood; used for posts and fuel.
194	Sphærosacme fragrans	- -	- -	A coarse, soft wood.
195	Spondias axillaris	Lupshe	- -	A tree.
196	,, ,,	Sillaephul	- -	,,
197	Symplocos	Gooki	- -	Inferior wood.
198	,, floribunda	- -	- -	A large tree; fine-grained wood.
199	,, (?)	Paunlah	Kalikath	A large tree; soft, white, compact wood.
200	,,	Bulsima.		
201	,, (?)	- -	- -	A large tree; pale brown, hardish wood.
202	,, pulcherrima	- -	- -	A small tree.
203	,, lucida	- -	- -	Hard, fine-grained wood.
204	Taxus virgata	Lolsi	Dheyri	A large tree; good and strong timber.
205	Ternstroemia napalensis	- -	- -	Soft and spongy wood.
206	Tetradium (?) cymosum.			
207	,, (?)	- -	- -	A very large tree.
208	Thunbergia coccinea.			
209	Turpinia pomifera	Phurasee and Signa	- -	A large tree; light soft wood.
210	Uncaria pilosa.			
211	Urtica	Jeonagkun	Latasishnoo.	
212	,, salicifolia.			
213	Viburnum (?)	Loshima		
214	,, erubescens	- -	- -	A middle-sized tree.
215	Vitis	- -	- -	Spongy, coarse wood.
216	Wightia gigantea	- -	- -	A large climber.
217	Ziziphus incurva	Kadubusi	Harobaer	A good wood.
218	———	Choorosi	- -	Very fine wood.
219	———	Joolshima		
220	———	Khura	- -	Useless wood.
221	———	Kujulsee	Kujulsee	Strong, good wood.
222	———	Kurani	Birouni.	
223	———	Mucuna	- -	A climber.

The wood of several species of *Briedelia* forms excellent timber. The Assuma, *Briedelia montana*, is common in Canara, where it attains great size, and, for building purposes, seems little—if at all—inferior to teak; it is said to resist the action of water quite as well.

No. 2.—WOODS OF GUALPARA (DR. WALLICH).

Acacia odoratissima	Jatikorai	Hard wood; used for furniture.
,, marginata	Korni	Yields good planks.
Alstonia scholaris	Chatiyan	Used for common furniture.
,, antidysenterica	Dudkhuri	A large tree.
Anacardium latifolium	Bhela	Used for chests, couches, &c.
Andrachne trifoliata	Uriam	Used for common furniture.
Antidesma	Boro-helock	,, ,,
Aquilaria agallochum	Aggur	Contains a volatile oil.
Artocarpus chama	Kangtali chama	An immense tree; used for canoes.
Bautrinia sutra	Tukra	A close-grained, soft, tough, yellow wood.
,, bacuria	Bakuri	An open-grained, soft, tough wood.
Bhiza moya	Moj	A close-grained, hard wood.
Bignonia calais	Kolai-beng	Used for fuel only.
Briedelia stipularis	Kohi	Close, hard, tough wood.
Butea frondosa	Potash	Open, soft, tough wood; used for common furniture.
Callicarpa arborea	Khoja	Used for mortars, pestles, and common furniture.
Calyptranthes	Jam	Used for common planks.
,,	Saljam	A close, tough, hard wood.
Careya	Kombo	Close, hard, strong, tough wood.
Cassia fistula	Sonalu	,, used for ploughs.
Castanea	Golsinggur	Excellent hard, tough timber.
,,	Nikari	Excellent timber; used for canoes and furniture.
,,	Kangta Singgur	Somewhat inferior to preceding.
Cedrela Toona	Toon, or Tungd	Brown, aromatic wood, rather brittle; used for furniture.
Chrysophyllum acuminatum	Pithogarkh	A white, tough wood; used for furniture.
Croton oblongifolium	Parokupi	A close-grained, rather brittle wood; used for common furniture.
,, ,,	Lalpatuja	Hard, close-grained wood; used for canoes.
Dalbergia monsita	— —	Close, hard, tough wood; used for common furniture.
Decadia spicata	Bongyera	,, ,,
Dillenia pilosa	Daine-oksi	Open, but hard and tough; used for canoes.
,, pentagyna	Oksi	,, but closer wood.
,, speciosa	— —	Close and hard, but rather brittle.
Ekebergia	Jiyakohi	Valuable wood, like mahogany.
Fagara rhetza	Bajarmondi	Close, hard, tough, good wood.
Ficus undulata	Bakhalpani	Open, soft, rather tough wood; used for canoes.
Ficus oppositifolia	Khoskadumor	Soft, open, brittle wood.
Gordonia	Bonjam	Useful for turning.
Gmelina arborea	Gambhari	Light and durable wood; used for turning.
Jambolifera pedunculata	Holkholi	Used for gun-stocks.
Lagerstrœmia parviflora	Sida	A large tree; close, tough, good wood.
,, reginæ	Jarul	,, excellent wood.
Laurus salicifolia	Horisongher	Used for common furniture.
,, champa	Kurka champa	,, ,,
Meliacea	Tokor	A large tree; used for planks, canoes, and common furniture.
Mimusops (?)	Chalpata	Used for coarse furniture.
Myginda	Silapoma	,, ,,
Myristica	Jheruya	,, ,,
Nauclea cadamba	Kodom	A noble tree, yellow wood; used for common furniture.
Nerium tomentosum	Adhkuri	Used for furniture.
,, antidysentericum	Dudkhuri	,, and for turning.
Phyllanthus (?)	Horinhara	Used for coarse furniture.
Premna hircina	Chikagambhori	A large tree; the wood has a very peculiar aromatic odour.
,, flavescens	Bukdholi	Very inferior to the preceding.
Quercus	Tima	Used for coarse furniture.
Rhamnus	Bangla	Used for chests, stools, &c.
Rhamnus	Premna (?)	Used for chests, canoes, &c.
Sapindacea	Dophari	Used for coarse furniture.
Schinus niara	Niyor	A hard, close-grained, rather brittle wood; preferred for furniture.
Spondias amara	Amra	Not used.
Sterculia	Bahelli	Used for canoes.
,, urens	Odla	Ditto, rope made from the bark.
Stravadium acutangulum	Hendol	Poor wood, but much used.
Terminalia bellerica	Bauri	Used for canoes.
,, moluccana	Joynal	Light and durable timber; used in boat-building.
,, hilka	Hilkha	Used for canoes and furniture.
Tetranthera caduca	Pangeh-Petiya	Used for common carpentry.
,, ,,	Haola	Close, soft wood; used for coarse furniture.
,, paromonja	Paromuja	,, ,,
,, dorodmeda	Vagnal	,, ,,
Tornex japonica	Uluyaohama	Used for small canoes.
Trophis (?) aspera	Saora	Used for joiners' work.
Uvaria suberosa	Bandookola	A soft, close-grained, brittle wood; used for planks, posts, beams, &c.
Vangueria edulis	Moyen	Used for coarse furniture; a small tree.
Vernonia	Magor	,, ,,
Vitex acuminata	Angchhui	A very close, hard, brittle wood; used for mortars, oil-mills, &c.
,, babula	Babla	A close, soft, tough wood; used for common furniture, &c.
,, leucoxylon	Bhodiya	Used for making ploughs.
———?	Chotagotadhora.	
———?	Chung	A large tree; close, tough wood; used for furniture.
———?	Kalajiya	Wood not used.
———?	Nikari	Used for canoes and furniture.

"Chatiyan" or "Sativeen," *Alstonia scholaris*, grows to a large size in the forests of Canara, the wood is white and compact, and well adapted for turning purposes.

The "Jarrol" or "Jarul," *Lagerstræmia Reginæ*. This tree grows to a great size in the Chittagong district, though the forests are now, to a great extent, cleared of the best variety. It is considered an excellent wood for ship-building; it is tough, has the character of standing well in water, and is much used for beams, rafters, and boards.

The "Gomar" or "Gambhari," *Gmelina arborea*, is abundant in the Morung and Chittagong forests. It is a weak wood, but is in great estimation for picture-frames, sounding-boards, organ-pipes, Venetian blinds, and all sorts of light work in which shrinkage is to be avoided. Its specific gravity is 0·466; its strength, according to Captain Baker, compared to teak, as 499 to 869.

"Toon," *Cedrela Toona*, is a somewhat coarse-grained wood, but very extensively used throughout India for furniture and interior carpenters' work.

No. 3.—WOODS FROM CALCUTTA (Dr. Wallich).

From the Botanical Garden.

Cassia nodosa – – –	–	A very lerge tree.
Celtis australis – – –	Jeebun.	
Chaulmoogra odorata.	–	Ditto.
Clerodendron phlomoides.		
Coccoloba uvifera.		
Ehretia lævis.		
Garcinia paniculata.		
Gardenia latifolia.		
,, lucida.		
Ludia spinosa.		
Mimosa capensis.		
,, odoratissima – –	–	A large tree; excellent timber.
Mimosa polystachya.		
Morinda citrifolia.		
Morus mauritiana.		
Nauclea undulata.		
Premna spinosa – –	Guniaru.	
Scytalia longan.		
,, litchi.		
Sonneratia apetala – –	Keorora.	
Spondias acuminata –	–	A large tree.
Sterculia augustifolia.		
Terminalia catappa –	–	A noble tree; good wood.
Urtica pulcherrima.		

A very fine specimen of mahogany, grown in the Botanic Garden at Calcutta, is also exhibited, showing that excellent "Spanish mahogany" may be raised in the East Indies. This is a matter of some importance, for although there are many woods in India which rival the mahogany in beauty, there is hardly any known wood which combines all the valuable qualities of the latter, uniting at the same time a rich colour, a fine grain, and the character of working kindly and freely under the tool.

No. 4.—WOODS FROM SERAMPORE, NEAR CALCUTTA (J. Marshman).

Adenanthera pavonina.
Dalbergia latifolia.
,, ougeinensis.
,, sp.
Diospyros montana.
,, sapota.
Dillenia pentagyna.
Careya sphærica.
Cinchona gratissima.
Erythrina ovalifolia.
Eugenia polypetala.
Gmelina arborea. Gomar wood.
Mimusops hexandrus.
Putranjiva Roxburghii.
Robinia macrophylla.
Santalum album. Sandal wood.

These specimens are from Dr. Carey's Botanic Garden near Calcutta. The blackwood or "rosewood" sit-sâl (*Dalbergia latifolia*) grows to a very large size on the Malabar coast. It is a close-grained, greenish, black wood, beautifully marked with lighter-coloured veins. It is a heavy, close-grained wood, and is much used in the manufacture of furniture, as it takes a very high polish. For engineering purposes, and especially for gun carriages, it is very valuable, and in consequence large forests of it have been formed in waste places in the North West provinces of Hindustan.

"Sandal wood" (*Santalum album*) is well known and esteemed, on account of its peculiar perfume. It is used in cabinet-work, for fans, beads, ornaments, and all sorts of carved fancy-work. The bark of this tree contains a beautiful red colouring matter, which, however, does not appear to be practically made use of.

No. 5.—WOODS OF THE NORTHERN CIRCARS (W. Elliott and A. P. Onslow).

Cumba.
Goomoodoo.
Unkoodoo.
Undooroo.
Iscarawsee.
Ghantha.
Goompana; Odina wodier.
Ganara.
Wood apple; Kroroeet; Feronia elephantum.
Tangada; Auvarai marum; Cassia auriculata.
Paya.
Aunon.
Togaru; Morinda citrifolia.
Borroogа; Bombax sp.
Induga; Thacthan marum; Strychnos potatorum.
Nuckaroo; Cordia myxa.
Tabica.
Tellavoolemara.
Nullavoolemara; Diospyros chloroxylon.
Velture; Mimosa cinerea.
Nulla muddi; Pentaptera tomentosa.
Tella muddi; Pentaptera glabra.

No. 6.—WOODS OF ORISSA.

Abher ebony, or Kendoo manjau.
Bandanum, or Bundum.
Kungrah.
Toomekachava; Kakatulu; Diospyros eboncaster.
Sissoo; Yekereachava kurra; Dalbergia sissoo.
Dammer wood; Geoglama kurra.
Red wood; Panevapah wood; Maha nambo.
Goomoodoo.
Tadah.
Somedah; Sornida kurra; Swietenia febrifuga.
Yegaseh; Peak salvo; Pterocarpus marsupium.
Bokkum; Cæsalpinia sappan.

No. 7.—WOODS OF CUDDAPAH (D. Mayne).

Acacia Arabica – –	Nalla tooma; Siah kekur; Karoo
Aegle Marmelos – –	Velum.
Alangium hexapetalum	Wooslooya; Akola.
Bassia longifolia – –	Yessa; Mohi ka jar; Yelloopai.
Bergera Koenigii – –	Kurri pakoo; Kurie pah: Kurie vipin.
Borassus flabelliformis –	Thatu kurra; Tar; Panungkutta.
Butea frondosa – –	Palau samoo; Pinmass; Palan marum.
Canthium parviflorum.	
Chloroxylon Swietenia –	Hurugulu.
,, dupada –	Chadaculu.
Cordia Myxa – – –	Sunna creekoe; Chota gonee; Sina naru villam.
,, – – –	Ooroo perukee; Sahra gonei; Peroo nanee villam.
Dalbergia arborea – –	Kanoogoo; Kung; Poongum.
Diospyros ebenaster –	Kadum berriya.
Erythroxylon areolatum.	
Eugenia jambolana.	
Feronia elephantum –	Veluga kurra; Korveet vella marum.
,, ,, –	Konda vallarpga; Junglee; Korveet kaloo.
Ficus religiosa – –	Ranee; Peepal; Arasa.
,, glomerata – –	Medee; Gol leer; Altee maram.
,, infectoria – –	Jovee; Kall alun.
Hibiscus populneus –	Paris kajhar; Poorsum marum.
Mimosa cinerea – –	Vellatorreo; Wardil; Vidatil.
,, suma – – –	Jammee; Vaunee.
,, ferruginea –	Tella toorna; Keckursafaed; Vil villum.
Phyllanthus emblica –	Oosarica; Amlah; Toopoo nellee
,, ,, (black)	Nulla oosarica; Siah amla; Nelee kadamboo.
Pterocarpus santalinus –	Chendanum; Chanda soorkh; Segapoo chendanum.
Sapindus rubiginosa –	Koopooloo; Reeh; Manee poongum.
Shorea robusta – –	Yepal; Yepa aussenee; Saul.
Spondias mangifera –	Konda marindee; Jungle arm; Katoo maitlarum.
Strychnos nux-vomica –	Mooshtee; Bachla; Mooltee.
,, potatorum –	Chilla ginga; Chill bingore; Naumbore; Naronbal; Taitan.

Swietenia febrifuga	Somee; Some'ka ther; Semmarum
Tamerindus indica	Chinta kurra; Nulee; Pooleya marum.
Terminalia alata	Muddee; Maroodum; Jungle kameng.
,, chebula	Karaka; Kharurna; Kadookaee.
,, belerica	Thandra; Tandra; Tanee.
Tetranthera monopetala	Mara manaidee; Junglee rai; Dorrake waste.
Vangueria spinosa	Pedda munga; Bangaree kulakree.
Wrightia antidysenterica	Palavardnee; Palava renoo; Veppallai.
Zizyphus jujuba	Pedda raijoo; Soona bur.
,, ,,	Pala raijoo; Dordhoa bur; Yelandis.
	Auray; Aree.
	Beekee; Bikee; Biklee.
	Beet cadapa; Beet kurpa.
	Bunka thada: Baktra.
	Checkranee; Chickranee; Seckram.
	Chindaca; Soorjsiah Katoo valay
	Corivee; Korivee; Korvee.
	Dhourah; Dhowar.
	Duntha; Bekul.
	Gopee.
	Goothee; Gootheeree.
	Gengaramin kurra (tulip tree).
	Jany Janee.
	Konda erookee; Junghy gorei.
	Kondapala; Khernee ku lakree.
	Keernee: Khernee.
	Mahal; Mohul.
	Muskaka jhar; Muske' ka thar.
	Narva; Narvikelahree.
	Nameluddoojoo; Junglee shaumbaloo.
	Neroodee; Chinna neroodee.
	Poda; Pallas.
	Peak saul; yengasee: yagasee.
	Polkee (black); Nulla polkee; Siah polkee.
	Polkee (white); Tella polkee; Suffai polkee.
	Pedda tapasee; Baree tapasee.
	Pedda neeroodlee: Barra neeroodee.
	Rudra kadapa; Roodra kurpah.
	Swam; swamoo kurra.
	Sarapappoo; Chara; Cheronjee kaghar sarai.
	Soonkasoola; Sunkesarkelakree; Vadee narainin.
	Vadusa; Warsa.
	Yalama; Yelama; Dhaura.
	Yerra polkee; Nulla polkee; Sagharee kala kree.
	Yeumaddy; Euamaddee; Eumuddee.

The "Saul" or "Sâl," *Shorea robusta*, belonging to the family of *Dipterocarpeæ*, is perhaps the most valuable and extensively used of all the timber trees of India. It is a heavy, close-grained, light-brown wood. From the bad and careless manner in which the trees are felled, and from the injudicious mode in which the timber is squared, its value is often considerably diminished. The Saul timber brought down to Calcutta is seldom more than 30 feet in length. Its specific gravity varies from 0·92 to 1·182, and in strength and tenacity it is considerably superior to the best teak. From Captain Baker's excellent experiments, it appears that, compared with teak, its strength is about as 1121 to 869. From Major H. Campbell's valuable experiments, unseasoned Saul broke with a weight of 1308 lbs., seasoned Saul with 1319 lbs., and teak wood with 1091 lbs. It is unquestionably the most useful known Indian timber for engineering purposes; as a building wood, unless very well seasoned, it is somewhat apt to shrink.

"Kadum berriya," *Diospyros ebeneaster*, a variety of Coromandel or Calamander, a striped wood, having a light-brown colour; it is a handsome furniture wood, which turns well, and is admirably adapted for veneering, and all sorts of cabinet-work.

"Hurugulu," *Chloroxylon swietenia*, yields the beautiful wood used for veneering and other cabinet-work, commonly called Satin-wood: the tree never grows to a large size.

"Chinta kurra," *Tamarindus indica*, is a strong and handsome wood, used for furniture, for washermen's boards, and in the manufacture of oil and sugar mills.

"Palan" or "Pallas," *Butea frondosa*. The wood of this beautiful and useful tree is hardly distinguishable from teak, the timber is large, but it is almost always knotted and gnarled.

No. 8.—WOODS FROM MADRAS (The Commissary-General and Captain Maitland.)

1. Atta; Anthen marum.
2. Ansena; Pterocarpus sp.
3. Chittagong wood; Aglay; Chickrassia tabularis.
4. Ervombalu wood; Hoombilly marum; Feriola buxifolia.
5. Mango wood; Am; Mang cuttai, Mangifera indica.
6. Noonah.
7. Paris kajhar; Poorsum marum; Hibiscus populneus.
8. Peddawk wood.
9. Pala; Pala kurou; Paulai marum; Mimusops hexandra.
10. Rosewood; sissoo; Eatty marum; Dalbergia.
11. Satin-wood; billa kurra; Chloroxylon Swietenia.
12. Saul; tapai; aussena; Shorea robusta.
13. Trincomalee wood; Berrya Ammonilla.
14. Teak; jarkoo; jake marum; saywan; Tectona grandis.
15. Woodia; oathay marum; Odina Wodier.

"Chittagong" wood, *Chickrassia tabularis*: the wood of this tree is white, tough, and close-grained; it is, however, but little used.

No. 9.—WOODS OF TRAVANCORE (Col. Frith).

NAME.	Colour.	Specific Gravity.	REMARKS.
1. Ahguilh	Light yellow	0·674	Very abundant; used for furniture.
2. Attoo vunjee	Amber colour	0·480	Very cheap; used for firewood.
3. Aranellah	Dark brown	0·645	For building common houses.
4. Chinny	Rather dark	0·515	From 8 to 16 feet in circumference; used for building canoes.
5. Cherrotimba	Dark	0·843	About 3 feet in circumference; used for house-building, tools, &c.
6. Cherro tanny	Light	–	Firewood.
7. Careemaradoo	Dark brown	–	2 to 6 feet in circumference; used for carts and building.
8. Chorocadamboo	Yellow	0·529	Used for packing-cases.
9. Chitta linny	Red	0·847	1 to 1¼ feet in circumference; used for furniture.
10. Cherro vunjee	Brown	0·644	Used for firewood.
11. Cherro nalampella	Light brown	0·483	For making canoes.
12. Cherro canny	,,	–	Only for firewood.
13. Cundalahpallah	Bamboo	–	For making sandals.

No. 9.—WOODS OF TRAVANCORE (Col. FRITH)—*continued.*

NAME.	Colour.	Specific Gravity.	REMARKS.
14. Channy marrom	Brown	–	For building common houses.
15. Channy vengah	Light yellow	–	1 to 6 feet in circumference; house building.
16. Carrimarriddy	Dark	–	1 to 4 feet in circumference; used by wheelwrights.
17. Cherropoona	"	–	Building houses.
18. Conjah marrom	Red	–	Furniture, &c.
19. Conjee marrom	Light red	0·650	"
20. Cahannee	Brown	–	Used for oil-mills, &c.
21. Dhannee	Dark	0·733	Very strong, but knotty: used for common buildings.
22. Ellahneel	Light red	0·779	A small tree; used for temples, pagodas, and for furniture.
23. Eramboo	Dark brown	–	For common houses.
24. Jackwood	Yellow	0·554	2 to 10 feet in circumference; used for furniture, &c.
25. Kullentake	Brown	0·749	Buildings, wheelwrights' work, &c.
26. Karanchilly	Dark	0·519	Buildings and small boats.
27. Kye attee	Ash colour	0·972	Carts and buildings.
28. Kanjarum, or nux vomica	"	0·796	For making cots.
29. Kar-itty, or black wood	Black	0·948	2 to 4 feet in circumference; strong wood; used for furniture.
30. Kanj arom	Ash colour	–	Used for common buildings.
31. Manja cadamba	Yellow	–	Used for packing-cases.
32. Moolu venga	Copper colour	0·831	Used for common buildings.
33. Masoodah	Ash colour	–	2 to 8 feet in circumference; used for building.
34. Myle Ella	"	–	Used for carts, building, &c.
35. Mally velly ravah	Light Brown	0·664	For building houses only.
36. Munjaddy	Purple	0·667	" "
37. Myle Ellah	Light green	0·896	" "
38. Manny marootha	Flesh colour	–	For carts, and building houses.
39. Magadamboom	White	0·462	Used for light work generally.
40. Munny martha	Brown	0·607	1 to 6 feet in circumference; used for furniture.
41. Manja cadamboo	Light yellow	–	Used for packing-cases.
42. Muttalla	Brown	–	Used for light work.
43. Neelahampellah	Light brown	–	Used for house building, ceilings, &c.
44. Nanamboo	Brown	–	Used for common buildings.
45. Neelumpallah	Light brown	–	Used for light work.
46. Nurmanjee	Bamboo	–	" "
47. Nurmarithy	Brown	0·615	Building common houses.
48. Nulampallah	Dark brown	–	2 to 4 feet in circumference, and 30 feet long; used for common houses and carts.
49. Odoorah venga	"	0·853	4 feet in circumference, and 40 feet long; a strong good wood, used for wheels, gun-carriages, &c.
50. Oddyanga	"	–	Used for common building purposes.
51. Oddamarrom	Dark	–	3 feet in circumference; used for tent-pegs, mallets, &c.; very strong wood.
52. Paul teak	Brown	0·739	Used for furniture, gun-carriages, &c.
53. Poon	"	0·623	2 to 4 feet in circumference, and 80 feet long; used for masts.
54. Pongah	"	0·988	For building houses.
55. Pooly otty	Black	0·858	2 to 8 feet in circumference; strong wood; used for furniture.
56. Poddy vaga	Brown	0·400	4 to 10 feet in circumference, 40 feet long; strong, never splits; used by wheelwrights.
57. Ponghu	"	0·960	3 feet in circumference; used for building.
58. Thevahdarum, or cedar wood.	Flesh colour	0·457	2 to 8 feet in circumference; used for palanquins, cabin fittings, furniture, &c.
59. Tharanchilly	Bamboo	–	5 to 8 feet in circumference; used for canoes only.
60. Tekkeer attoovye anjelly	Brown	0·528	4 to 6 feet in circumference; for house and ship-building.
61. Tharanjulla	Bamboo	0·576	Used for common buildings.
62. Tambagum	Brown	0·910	5 feet in circumference; very strong wood; used for houses, blocks, &c.
63. Venpalla	Ash colour	–	Only used for carved figures, sandals, &c.
64. Vatanboo	Brown	0·434	Only used for firewood.
65. Vatanboo	Light brown	–	2 feet in circumference; used for railings, fences, &c.
66. Varoodah	Yellow	0·855	Used for building houses.
67. Velha ahguill	Light brown	–	2 to 4 feet in circumference; used for furniture.
68. Veytty	"	–	Used for making carts, ceilings, &c.
69. Veimboo	Flesh colour	0.483	2 to 4 feet in circumference; used for tables, &c.
70. Vella ahguill	White	0·602	2 feet in circumference, 50 feet long; used for furniture.
71. Vella carduntha	Brown	–	3 to 6 feet in circumference, 40 feet long; strong wood, used for furniture.
72. Velty marron	Purple	0·623	Used only for firewood.
73. Vataloo	"	–	" "
74. Velty taddy	Brown	0·635	" "
75. Vanpuggalah	Light yellow	0·604	Used for light work.
76. Vutty marithy	Brown	0·595	Building common houses.
77. Vuddamba	"	0·750	" "
78. Vally canjarum	"	0·703	" "
79. Vellaneermaradoo	Light yellow	0·573	Used for furniture.
80. Vellallava	Brown	–	Used for light work.
81. Yuttamba	"	–	Used for building houses, and light work.

These woods, as well as the collections from Palamcottah (No. 11), from Paulghaut (No. 12), from Tinevelly (No. 13), from Canara (No. 14), and from Penang (No. 30), were selected and sent over by the late Col. Frith; they are exhibited by Lieut.-Col. BONNER, military storekeeper of the Hon. East India Company. The specific gravities have been calculated from comparatively imperfect data, and therefore can only be regarded as rough approximations.

No. 10.—WOODS OF HINDOSTAN (Dr. ROXBURGH).

	Weight per cubic foot.	
	lbs.	ozs.
1. Artocarpus Chaplasha	34	12
2. Averrhoa Carambola	30	11
3. Castanea indica	39	0
4. Cedrela Toona	32	9
5. Cynometra polyandra	52	10
6. Diospyros racemosa	34	11
7. Dombeya melanoxylon	71	9
8. Engelhardtia pterocarpa	39	14
9. Gmelina arborea	32	3
10. Guacua	41	14
11. Gundruey	34	15
12. Jeah	35	11
13. Lagerstrœmia Reginæ	46	8
14. Loquat	46	11
15. Melia Azadirachta	46	1
16. Acacia odoratissima	45	6
17. Nerium tinctorium	39	4
18. Odina Wodier	41	0
19. Osyris peltata	30	8
20. Palm	57	9
21. Quercus fenestrata	47	0
22. " lancifolia	41	10
23. " lappacea	51	4
24. Red Sanders	46	14
25. Santalum album	47	13
26. Sassafras	32	12
27. Scytalia	44	8
28. " trijuga	60	0
29. Sophora robusta	42	4
30. Swietenia febrifuga	54	14
31. Terminalia Chebula	42	10
32. " citrina	60	2
33. Tetranthera nitida	34	4
34. Vateria lancifolia	53	15

Specimens of the wood of the Indian cedar, *Cedrus Deodara*, and of the cypress, *Cupressus torulosa*, from the Himalayas, are shown by Dr. ROYLE; the former—recently introduced into this country as a beautiful ornamental tree,—appears to promise well as a useful timber tree; the wood works well and freely.

No. 11.—WOODS OF PALAM-COTTAH (Col. FRITH).

NAME.	Colour.	Specific Gravity.	REMARKS.
1. Ebony	Very dark	–	Heavy and brittle, very hard, makes beautiful furniture.
2. Eroompooley	Red	–	Used for building and for common carts.
3. Mountain teak	Light	0·849	Used for shafts, &c.
4. Oonay	Brown	1·001	Used for shafts, staves, splinter-bars, &c.
5. Portia, or Poovarsay	Rather dark	–	Used for gun-stocks, and wheelwrights' work.
6. Palava	Light brown	0·647	Used for musket-stocks.
7. Selavaugn	Dark	–	Used for wheelwrights' work, spikes, &c., and for making cots.
8. ,,	White	–	Not of much use; sap-wood.
9. Toomoosora	Dark	–	Very tough; used for spokes, staves, felloes, &c.
10. Tamarind	,,	1·382	Heart-wood, very hard and tough; used for tent-pegs, and for furniture.
11. ,,	White	–	Young wood; of little use.

No. 12.—WOODS OF PAULGHAUT JUNGLE (Col. FRITH).

NAME.	Colour.	Specific Gravity	REMARKS.
1. Ab Eney	Brown	–	A large tree; used for furniture.
2. Beimboo	Yellow	–	A large tree; used for building and for furniture.
3. Benteak	Light	0·591	Inferior; used for building, and common carts.
4. Cedar	Reddish	0·507	A large tree, wood aromatic; used for furniture.
5. Cedar-root	,,	–	Very aromatic; used for ornamental furniture.
6 Cautovanga	Dark	–	Very strong; used for wheelwrights' work.
7. Chadachey	Light brown	–	A small tree; used for buildings and carts.
8. Eroopoottoo irvolly	Brown	0·861	Used for buildings and bullock-yokes.
9. Ittee veittee	Black	–	A small tree; used for furniture.
10. Kullen teak	Dark	–	The best teak; very strong and large.
11. Kurroovalagom	Light brown	0·704	A small tree; used for naves of wheels.
12. Kurroomardoo	Dark	–	Strong wood; used for wheelwrights' work.
13. Kuroongaulee	,,	–	A heavy and hard wood; used for furniture.
14. Muroodoo	Light	–	A small tree; used for buildings.
15. Nova	White	–	Used for shafts, cart-poles, &c.
16. Oome teak	Dark brown	–	Third-rate teak.
17. Oodoogoo	Red	–	A large tree; used for ploughs and building.
18. Portia	Brown	–	A small tree; used for musket-stocks.
19. Teak	Light	0·852	Second-rate teak.
20. Vangay	Light brown	0·788	A small tree; used for beams and carts.

No. 13.—WOODS OF TINNEVELLY (Col. Frith).

NAME.	Colour.	Specific Gravity.	REMARKS.
1. Arrava ponpathera	Light brown	–	Used for building, handspikes, tools, &c.
2. Auttee	Red	–	Used for furniture.
3. Augeneepelah	Brown	0·484	General work.
4. Cangoo	Whitey brown	–	Handspikes and wheelwrights' work.
5. Eloopay	Red	–	Building in general.
6. Hill teak	Light brown	–	General purposes.
7. Karootauley	Black	–	Fancy work.
8. Koongheelyurn	Light brown	–	Used for building purposes; yields dammer.
9. Kotamaram	Brown	0·723	Building in general.
10. Mookersey	Red	–	,, ,, ,,
11. Munjet Kerddumpah	Light straw	–	,, ,, ,,
12. Mathgirie vamboo	Whitey brown	–	A strong light wood; used for general purposes.
13. Marootho	,,	–	Building in general.
14. Mathgirie vamboo, old	Red	–	A strong light wood.
15. Naungoo	,,	1·009	Used for building, wheelwrights' work, handspikes.
16. Nuffell	,,	0·717	Building in general.
17. Nelly	Light brown	–	,, ,,
18. Nurryveroosoo	Whitey brown	–	,, ,,
19. Nagakunny	,,	–	,, ,,
20. Oonnay	,,	0·928	A strong wood, used for wheelwrights' work, handspikes.
21. Oosulay	Light brown	0·832	Building in general.
22. Polava	,,	–	Musket-stocks, and building purposes.
23. Paulay	Deep straw	–	Fancy work
24. Pooversoo	Red	0·860	Used for making bandies.
25. Ponpathera	Whitey brown	0·683	Used for building purposes.
26. Poonnay	Deep straw	–	,, ,,
27. Poovey	Light brown	0·840	,, ,,
28. Paselay	Whitey brown	–	Used for furniture.
29. Sammerm	Red	–	Furniture of any description.
30. Sarakontay	Whitey brown	–	Building in general.
31. Sampayapaulay	Light brown	0·792	Building purposes.
32. Thothakutty	Red	–	Furniture of every description.
33. Thunnaka	Whitey brown	–	Making trunks.
34. Thokay	Red	0·950	Building purposes.
35. Vangay	Light brown	–	Wheelwrights' work.
36. Vakauley	,,	–	Building in general.
37. Vamboo	Light straw	0·795	,, ,,
38. Vankay	Light brown	0·888	,, ,,
39. Veroosoo	Whitey brown	–	,, ,,
40. Vakanatty	,,	–	,, ,,
41. Vemmary	Brown	0·786	,, ,,

No. 14.—WOODS OF COIMBATORE (Dr. Wight).

1. Acacia amara	Woonga marum.
2. ,, leucophlœa	Velan marum. Vel vaila.
3. ,, odoratissima	Caroo vangai marum. Curry vangay.
4. ,, speciosa	Vel vangay marum.
5. ,, Sundra	Caroongaly marum. Currengally.
6. Ailanthus excelsa	Peroo marum. Pethawkoo kurra.
7. Balanites Ægyptiaca	Nunjoonda marum.
8. Bignonia xylocarpa	Vadungoorany marum. Vaducoornie.
9. Briedelia spinosa	Morlloovanai marum. Moolloo vangay.
10. Capparis grandis	Vellai toarattie.
11. ,, divaricata (?)	Toarathe marum.
12. Chrytea collina	Woodoogoo marum.
13. Cocos nucifera	Nasel thenna marum. Gollana kurra.
14. Conocarpus latifolia	Vella naga marum. Tella narudoo kurra.
15. Cratœva Roxburghii	Marvolinga marum.
16. Dalbergia latifolia	Irrooppoottoo marum (black wood).
17. ,, paniculata	Putchalia marum.
18. Dillenia pentagyna	Pinnai marum. Ponna kurra.
19. Erythrina Indica	Moorookoo marum.
20. Euphorbia nereifolia	Yellai kullic.
21. ,, tirucalli	Katti. Katti milk.
22. Eugenia caryophyllifolia	Nawel marum. Naridon kurra.
23. Ficus indica	Allum vildo.
24. ,, tsiela	Eichie marum.
25. Grewia tiliæfolia	Sadaichie marum.
26. Hymenodictyon utile	Paroonjoly marum.
27. Inga dulcis	Cadookapooly marum. Cookapuly.
28. ,, xylocarpa	Irroovaloo marum. Erovaloo.
29. Morinda citrifolia	Munjul paouttai. Munjay paoullay.
30. Nauclea cordifolia	Mangul cadumbai marum.
31. ,, parviflora	Neer cadumbai marum.
32. Odina Wodier	Annaikarai marum.
33. Phœnix sylvestris	Etcha marum.
34. Prosopis spicigera	Parumbai marum.
35. Pterocarpus marsupium	Vana kurra.
36. Salvadora persica	Coku marum.
37. Terminalia Belerica	Vellai murdoo.
38. ,, Chebula	Pilla maroodoo.
39. ,, glabra	Kurai maroodoo marum.
40. Ulmus integrifolia	Ayah marum.
41. Zizyphus yelundai (?)	Kurkutta marum.
42. – –	Camoogoo marum (Camoogoo wood).

"Nur cadumbai marum," *Nauclea parviflora*, is rather common in the forests of Canara, especially below the Ghauts; it is valued as yielding excellent flooring planks.

Only two specimens of wood are contributed from Bombay, namely, teak, and a variety of olive, lately identified by Dr. Stocks; the latter appears to be a good and valuable wood for some sorts of work

No. 15.—WOODS OF CANARA (Col. FRITH).

NAME.	Colour.	Specific Gravity.	REMARKS.
1. Black wood	Black	–	A very large tree, used for ornamental furniture.
2. Bannapoo	Light	–	Used for building and for farm implements.
3. Bengah	Rather dark	–	,, ,, ,,
4. Bow	Dark	–	,, ,, ,,
5. Boblice	Light	–	Used for building purposes.
6. Bengah	Rather light	–	,, ,,
7. Beety	Black	–	Used for furniture.
8. Bhoguy	Light	–	Used for house and boat-building.
9. Bellah	Light brown	–	From 2 feet to 3 feet in diameter, 10 feet to 24 feet in length; used for house-building.
10. Bhoguy	Dark brown	1·107	Strong and heavy; used in house and boat-building.
11. Billamundy	Brown	–	House-building.
12. Colasumpoghey	White	–	5 feet in circumference, from 20 feet to 30 feet in length; used for common buildings
13. Hebalsoo	Yellowish	–	Yields beams of 2 feet square, and 20 feet long; used in house and boat-building.
14. Halsoo	Yellow	–	Used in building, and for furniture.
15. Hoonvalloo	Brown	–	1 foot to 2 feet in circumference, 10 feet to 20 feet long; used for common purposes.
16. Hedeeh	Light	–	Used for making combs and similar light work.
17. Honeh	Brown	–	8 feet in circumference, 20 feet long; used in house and boat-building.
18. Holahonuka	Light	–	3 feet to 4 feet in circumference, 30 feet long; used for beams in building.
19. Jack	,,	–	A very large tree; used for furniture.
20. Jumbeh	Brown	–	4 feet to 6 feet in circumference, 30 feet long; used for building and furniture.
21. ,,	Brownish	–	1 foot in circumference, 20 feet long; used for beams of houses.
22. Kalabagy	Light	–	House-building.
23. Kundully	Yellow	–	,, ,,
24. Marraveh	Darkish	0·820	A heavy wood; used for beams and posts.
25. Madthy	Light brown	–	Used for house and boat-building, and for furniture.
26. ,,	Dark	–	3 feet in circumference, 40 feet long; used for beams of houses.
27. Sagwany	Brown	–	Third sort of teak.
28. ,,	,,	–	Finest sort of teak.
29. Teeravah	Light	–	Not strong; used for light work.

No. 16.—WOODS OF MALABAR FORESTS
(J. E. CHAPMAN).

1. Jamboo; a very heavy wood.
2. Kad kud.
3. Kelaho.
4. Koompoly.
5. Kendel; a heavy, strong, dark wood.
6. Kunganee.
7. Kursing.
8. Kumdee.
9. Marlee; a very heavy, brown wood.
10. Ombah.
11. Pood goossa.
12. Ruccuh korurah; a very straight-grained wood.
13. Satannah; a light, soft, close wood.
14. Sarrah.
15. Seerass.
16. Sood beebo.
17. Sawree; a white, soft wood, very light.
18. Teh pully.

"Jamboo," or Jambu, *Mimosa xylocarpa*. This tree grows to a large size: on account of its strength and toughness, it is much valued for house-building.

"Mairtee," *Pentaptera coriacea*, a very common tree both above and below the Ghauts. The wood is very durable, and is therefore used in house, ship, and boat-building.

These woods were collected, in 1846, by Dr. Gibson, Conservator of Forests in the Bombay Presidency, for Mr. Chapman, in connexion with the projected "Great Indian Peninsula Railway." Previous to the appointment of Dr. Gibson, the forests in this presidency, particularly those south of Bombay and between the western Ghauts and the Indian Ocean, were almost entirely left to the management of the natives in their immediate neighbourhood; the consequence of this was, that, as the country under British rule became more settled, and as the population in those districts increased, the forests were gradually destroyed, the timber being cut down in the most reckless and wasteful manner, and a considerable quantity of it burnt, for the mere purpose of affording ashes for manure. Regulations have now, however, been adopted, under the superintendence of Dr. Gibson, for the preservation and maintenance of forests, so that, for the future, such thoughtless and inconsiderate destruction of them will be prevented. At present, the Government and mercantile yards of Bombay are chiefly supplied with timber from the Concan, to the north of the latitude of Bombay. In the Deccan, the supply of timber, of any size, is very limited; it has, therefore, for the most part, to be brought from a distance, and the expense and difficulties of transit present serious obstacles to its employment in buildings of all descriptions. Mr. Chapman states, that a short time since, when Viccajee Merjee, Esq., an enterprising Parsee capitalist, built a house at Hyderabad, he was obliged to have all the principal beams carried up from Bombay, a distance of more than 500 miles; and at the present time, most of the timber of the country is greatly diminished in value, being of necessity cut down, and reduced to shapes and sizes most convenient for land-carriage. From Dr. Gibson's reports it appears that the forests of Soonda and Canara, if properly managed, will, in a few years, afford a large and regular supply of first-rate timber.

No. 17.—WOODS OF ROHILKUND.

These are from the districts of Bareilly and Phillibheet—

1. Acacia Arabica.
2 ,, catechu.
3. Bassia latifolia
4. Bombax heptaphyllum.
5. Calyptranthera sp.
6. Cedrela sp.
7. Chowlace (?)
8. Dalbergia sissoo.
9. Goslum (?)
10. Grewia.
11. Khumar (?)
12. Mulberry.
13. Melia Azadirachta; neem or nimb.
14. Acacia serissa.
15. Nauclea parvifolia.
16. ,, cordifolia.
17. Phyllanthus Emblica.
18. Rohunee (?)
19. Shorea robusta.
20. Urseina (?)
21. Wrightia mollissima.

The "Sissoo wood," *Dalbergia Sissoo*, somewhat resembles the finer sorts of teak, but it is tougher, and more elastic. It usually grows to a height of about 30 feet, but is generally more or less crooked, and therefore not suited for beams, though highly valued by the ship-builders of Bengal. The wood is said to harden with age. When fresh, its specific gravity is 0·691; when seasoned, 0·764; and according to Captain Baker, compared with teak, its strength is as 1030 to 869. It has a light greyish-brown colour, with darker coloured veins, and when examined with a lens, the pores of the wood are found to be nearly filled with dry resinous matter.

"Neem wood," *Melia Azadirachta*, a large tree, which is used for making carved images, as it is not liable to the attack of insects.

No. 18.—WOODS OF ASSAM.

These woods, grown in the forests of the province of Assam, are contributed by Mr. MARTIN, Major HANNAY, and Captain REID (p. 884):—

1. Acacia.
2. Agar.
3. Babue.
4. Cattul.
5. Cham (Artocarpus chama).
6. Dalbergia Sissoo.
7. Hindoo palm-toan (?)
8. Korai (Acacia marginata) (?)
9. Laurus Sassafras, Goondsora.
10. Nadosur (?)
11. Nahoo (Casuarina equisetafolia) (?)
12. Oak, hingoree.
13. Poma (Cedrela Toona).
14. Ratta.
15. Shullock.
16. Saul.
17. Terminalia bhota (?)
18. Top sopa.

No. 19.—WOODS OF TAVOY (Dr. WALLICH).

	Burmese.	
1. Acacia	Popeeah	A very large tree, used for posts and rollers.
2. ,,	Paingadoo.	
3. Anacardium	Thubbamboo	A large tree, used in boat-building.
4. Artocarpus	Thouenben	,, ,, ,,
5. ,,	– –	A large tree.
6. ,,	Pynyathe or tannaburg	Wood not used.
7. Bignonia	Thathee	A very large tree.
8. ,, (?)	Thuggainee	A large tree, used in building.
9. ,,	Lainbha	A middle-sized tree.
10. Calophyllum	Turra-phee	Used for masts, &c.
11. Carapa	Taila-oon	Used in building.
12. Careya	Kaga	Large timber tree.
13. Castanea martabanica	Norne or Zitha.	
14. Cerbera Manghas	Kulloon	Wood not used.
15. Dillenia	Zimboon	Used in building.
16. Dipterocarpus grandiflora	Ain or aintha	An immense tree.
17. ,, ,, ,,	Kunnean-phin	Used as timber.
18. Euphorbiacea	Yamala	Used for frames of lacquered ware.
19. Eurya	Thaun	Used for fuel only.
20. Excoecaria (?)	Thurrotha.	
21. Ficus	Thubboo	Used in house-carpentry.
22. ,,	Thuppan	Large tree; wood not used.
23. Garcinia	Pullowa	Large tree, used for posts, &c.
24. Grewia	Miaya.	
25. Heritiera Fomes	Kunnazoo	Very large tree: very hard and durable wood.
26. Hibiscus macrophyllus	– –	Used in building.
27. ,, ,, (?)	– –	,, ,,
28. Hopea floribunda	Tantheya	A very large tree.
29. Lagerstrœmia	Kuenmounce or puma	Used in building.
30. Laurus	Kullowa or kurrowa.	
31. ,,	Panatha	Used in house-carpentry.
32. ,,	Maythen	A large tree, good useful wood, much used.
33. ,,	Keemna	Small tree, used for posts.
34. ,,	Thuggoo	Used for oars, &c.
35. ,,	Thitya	Very large tree, used in building, &c.
36. ,,	Kayzai	Used in house-carpentry.
37. Mimusops	Thubbae	Used in ship-building.
38. ,, Elengi	– –	
39. Murraya	Maikay	A tough close-grained wood, used for handles.
40. Myristica	Thounsanga	A large tree, used in boat-building.
41. ,,	Koathee or Kunneen	A large tree, used in flooring houses.
42. Osyris peltata	Phaoun.	
43. Pierardia (?)	Kunna or Kuzzo.	
44. Pinus Dammara	– –	A very large tree, used in building.
45. Pterocarpus (?)	Puddow	A large tree, used for furniture, &c.
46. Rottlera	Mimasko.	
47. ,,	Keoun-lae	A large tree, used for rudders, &c.
48. Sandoricum	Thittoo	Used for furniture.
49. Sapotea (?)	Palaepean	A very large tree, used in building.
50. Sonneratia (?)	Thaumma	A small tree.
51. Sterculia (?)	Kununu	An enormous tree.
52. ,,	Thikadoo.	
53. Symplocos (?)	Kain-tha-phogee	Used in boat-building.
54. Syndesmis Tavoyana	Ku-tha	A very large tree, used for building, boxes, &c.
55. ,, ,,	Kunnun Keunkee Kunnun Keunla	Used for beams, posts, &c.
56. Terminalia	Thuphanga.	
57. Ternstrœmia	Puzzeen zwa	A large tree, used in building.
58. Uvaria	Thubbor	A large tree, used for boat-building.
59. Wrightia antidysenterica	Lathou	Small tree, not used.
60. Xylocarpus	Keannan	Very durable timber.
61. Zizyphus	Zeethee	Hard and durable wood.
62. ——— ?	Alunaun	Strong and very durable timber, used in ship-building.
63. ——— ?	Bah-nah-thoa	Useful timber.
64. ——— ?	Con-moo	Good timber, used for building houses and boats.
65. ——— ?	Kaantha	Small but valuable wood.
66. ——— ?	Kaungo-kurro	A heavy but durable wood, used in boat-building: specific gravity 0·960.
67. ——— ?	Keahnaun	Strong crooked wood, used for gun-stocks.
68. ——— ?	Kuddeot-alain	A large tree, used in house and ship-building.

No. 19.—WOODS OF TAVOY (Dr. WALLICH)—*continued.*

	Burmese.	
69. ———— ?	Kuddoot-nu	Inferior wood, used in boat-building.
70. ———— ?	Kummi.	
71. ———— ?	Mainaban	Used for bows, lances, beams, rafters, &c.
72. ———— ?	May-klin	Used for rudders and anchors.
73. ———— ?	May-maka	Used in ship-building.
74. ———— ?	May-rang	Said to be very durable.
75. ———— ?	May-tobek	Used for the bottoms of ships; preferred to teak.
76. ———— ?	Megeonge	A large tree, used in building.
77. ———— ?	Penlay-peen	Used in building.
78. ———— ?	Pienmahne	Yields very strong knee-timber.
79. ———— ?	Pienmah-pue.	
80. ———— ?	Tantheya.	
81. ———— ?	Tauguet-nu.	
82. ———— ?	Teutha.	
83. ———— ?	Thauga-et-thittoo	Inferior wood.
84. ———— ?	Thau-baun-po	Inferior wood, used for common canoes.
85. ———— ?	Thau-baun-thau-lay	Very flexible wood.
86. ———— ?	Theyah	Inferior wood.
87. ———— ?	Thounmynga	Used in building.
88. ———— ?	Thymbro	Good strong durable wood, used in boat-building.
89. ———— ?	Town pine	Good wood, used in boat-building.

No. 20.—WOODS OF TAVOY (Mr. Commissioner BLUNDELL).

1. Aman	– –	A small tree; used for building.
2. Bep-than	– –	Used for building.
3. Bep-won	– –	,, ,,
4. Bhan-bhway	– –	Used for house-posts; like sissoo.
5. Bha-ta-ka	– –	Used for common carpentry.
6. Daup-yan	– –	Used for building.
7. Eng-beng	– –	Strong wood; used for common carpentry.
8. Kad-wot-nu	Cedrela ?	Used for house and ship-building; large lumber, 40 to 70 feet; specific gravity 1·060.
9. Kanna-tso	– –	A very tough close-grained wood.
10. Ka-nyeng-kyaung-khyay	– –	Used for boat, ship, and house-building; yields an oil; not attacked by insects.
11. ,, ,,	– –	,, ,, rather shaky.
12. Ka-nyeng-pyan	– –	A heavy, grey wood; used for hand-pikes.
13. Katso	– –	Like Toon; used in building, &c.
14. Kaung-thmoo-ysep-say	– –	A rough, strong wood; used for posts, &c.
15. Keng thep-guyung-ywept	– –	A light, inferior wood; used in building.
16. Kengthep-pheoot-kyay	– –	A sound small wood; used in building.
17. Khamoung-nee	– –	Heavy wood, not attacked by insects.
18. Khamoung-pyion	– –	Small-sized, compact, yellowish-grey wood.
19. Kharaway-nu	– –	Porous, heavy, strong wood, not attacked by insects.
20. Kouk-ko	– –	Employed for bottoms of boats.
21. Kyay-tsay-gyu-khyay	– –	A heavy, compact, dark wood; suitable for gun-stocks.
22. Kyay-tsay-bayoun	– –	,, ,, useful for common carpentry.
23. Kyep-yo	– –	A kind of teak.
24. Kywon-bo	– –	A soft wood like the nauclea.
25. Kywon-ma	– –	,, ,, a variety.
26. Lienman	– –	A small tree; heavy, close-grained, light-coloured wood, like terminalia.
27. Mala-ka	– –	Small-sized, strong wood; useful for handles.
28. Ma-yam	– –	An indestructible, strong, heavy, dark-red wood.
29. Mee-kyaung-kyay	– –	A heavy wood, not attacked by insects.
30. Meep-thun-ban	– –	A small-sized, compact, grey wood; used for handles, &c.
31. Miaup-bout	– –	Used for furniture, &c.
32. Mya-kamaun	– –	A valuable strong black wood; used for knife-handles.
33. Myeng-ta-bep	– –	A strong, bluelsh-grey wood; adapted for handles.
34. Ngoo-beng	– –	A strong wood; used for posts and planking.
35. Noalee-lyeng	– –	A close-grained, strong, heavy wood; useful for handles.
36. Pan-loun	– –	A close-grained red wood; used for building.
37. Pantheet-ya	– –	A good white rough wood; useful for boat-building.
38. Patseng-taway	– –	Small-sized strong wood.
39. Patseng-ngo	– –	A superior high-coloured aromatic wood, like mahogany.
40. Peng-lay-byun	– –	Small-sized tough wood.
41. Peng-lay-oun	– –	Strong, rough, red wood, like Mimosa seripa.
42. Peng-lay-kaboay	– –	A heavy small-sized wood; suitable for handspikes, handles, &c.
43. Pee-daup	Mimosa.	
44. Pinnay	Artocarpus	Strong, close-grained, yellow wood.
45. Pyaung-pyion	– –	A compact, heavy, yellow wood.
46. Pyeng-khado	– –	Small-sized, heavy, close-grained, red wood.
47. Tag-nyeng	– –	A useful furniture wood.
48. Takeep-nee	– –	A very strong, close-grained, heavy, light-coloured wood.
49. Tha-bhan	– –	Used for canoes.
50. Thabyay-nee	– –	A strong, close-grained, brownish-grey wood; used for house-posts.
51. Tha-byoo	– –	A heavy close-grained wood.
52. Theet-ta-gyee	– –	Suitable for common carpentry.
53. Theet-ya-han	– –	A close-grained teak; used for posts.
54. Theet-ya-nee	– –	A close-grained brown wood, rather shaky.
55. Theet-ya-pyion	– –	A heavy strong wood.

No. 20.—WOODS OF TAVOY (Mr. Commissioner BLUNDELL)—*continued.*

56. Thiem	– –	A serviceable timber.
57. Thingan-kyaup	– –	A close-grained, heavy, strong wood; used in ship and house-building, for carts, &c.
58. Thmeng-ba	– –	Like red jarrool; used for posts and cotton-rollers.
59. Thmeng-tshout	– –	A small, heavy, coarse, brown wood; used for door-frames and boat-beams.
60. Toung-bhaut	– –	Rough, knotty wood; used for knife and spear-handles.
61. Toung-bhien	– –	A light, porous wood; used for common carpentry.
62. Toung-byeng	– –	A kind of red saul.
63. Toung-byion	– –	A close-grained, brown, shaky wood.
64. Toung-kha-ray	– –	Red jarrool; used in boat-building.
65. Tseng byioun	– –	A compact greyish-brown wood; suitable for common carpentry.
66. Tsoay-dan	– –	Used for gun-stocks.
67. Wonthay-khyay	– –	A small, strong, compact, yellowish-white wood.
68. Yau-ma-lay	– –	A strong, heavy, rough, white wood; used for house-posts.
69. Zoo-iat	– –	A small, heavy, compact, yellowish-white wood.

No. 21.—WOODS OF AMHERST (Mr. Commissioner BLUNDELL).

1. Anan	– –	A yellowish-white, heavy, durable wood; used in constructing temples; specific gravity 1·312.
2. Ban-boay	Mimosa	A strong and useful wood; used for posts in building houses.
3. Ban-kha	– –	A grey-coloured wood; used for posts in building houses.
4. Bahai-bya	Lagerstrœmia	Used for house-posts.
5. Bep-than	– –	A good wood; used for making handles to spears and swords.
6. Bhyeng-tseng	– –	A close-grained, compact, grey wood, seems not to be attacked by insects.
7. Bijion	– –	A heavy, close-grained, compact, grey wood; used for house-posts, rafters, &c.
8. Daup-yat	– –	A beautiful yellowish-white, compact wood, but shaky; used for rafters.
9. Dien-neeang	– –	A strong, hard, close-grained, brown wood; used for rice mortars.
10. Eng	– –	A strong, heavy, grey wood; used in boat-building, for piles, beams, &c.
11. Eng-gyeng	– –	A useful wood, but shaky; used for posts.
12. Gan-gan	– –	A very tough, strong, hard, red wood; suitable for machinery.
13. Gyo	– –	A close-grained compact wood; used for ploughs, handspikes, posts, &c.
14. Ka-thut-nee	– –	A heavy, hard, grey wood; used for boats, posts, carts; liable to attacks of insects.
15. Kha-boung	– –	A small tree, but the wood is very strong.
16. Kiep-dep	Shorea (?)	Used for posts, &c.
17. Kiep-maup	– –	A superior wood; used for wheel-spokes.
18. Kiep-yo	– –	A small tree; heavy, good wood; used for rafters, posts, &c.
19. Koup-ha	Nauclea (?)	A light soft wood; used for carving images, &c.
20. Kya-nan	– –	A very hard, close-grained, dark-red wood; used for musket-stocks, spear-handles, &c.
21. Kya-zoo	– –	A very heavy wood.
22. Kyway-thoay	Acacia (?)	A strong solid wood; used for posts and rafters.
23. Kywon	– –	A kind of teak.
24. ,,	– –	,, used for posts, rafters, oars, &c.
25. Kywon-gaung-noay	– –	A compact, heavy, tough, yellowish-white wood; used for posts and rafters.
26. Lammay	– –	A light, red wood, not attacked by insects.
27. Laphyan	– –	A heavy, solid wood, soon destroyed by insects.
28. Lien	– –	A valuable, compact, heavy, homogeneous, deep-brown wood; not attacked by insects; used for house-posts and rafters.
29. Liep-yo	– –	Small, but compact and heavy; used for carpenters' tools.
30. Lip-dwat	Nauclea (?)	A fine-grained white wood; turns well; used for spear and sword-handles.
31. Magu-neng	– –	A close-grained wood; used for boats, carts, paddles, oars, posts, &c.
32. Mala-ka	– –	Small, but compact and heavy; used for carpenters' tools.
33. Ma-thioa	Artocarpus (?)	Used for house-posts.
34. Ming-ba	Shorea (?)	Used for house-posts, rafters, &c.
35. Morna-kha	– –	A close and compact, but softish, red wood; used for turning.
36. Moutha-ma	– –	A fine-grained, compact, red wood, but shaky.
37. Myaun-ngo	– –	Used for rafters.
38. Myaup-loaut	Cedrela	A kind of toon.
39. Mya-yu	– –	A hard, close-grained, durable wood; not attacked by insects.
40. Myeng-kha	Acacia.	
41. Na-kyeen	Heriteria	Very strong and tough; used inmaking carts, carriages, &c., and for fuel.
42. Naoo	– –	A brown solid wood, not attacked by insects; used in building houses.
43. Neet-gnyoo	Mimosa (?)	A useful, strong, heavy, red wood.
44. Nga-soay	– –	A very heavy, solid, red wood; used for posts and rafters.
45. Nyaung-lan	Shorea	Used in boat-building, and for posts and rafters.
46. Oun-thuay	– –	A white soft wood, of little value.
47. Pad-dan	– –	Used for musical instruments.
48. Pa-ngan	Gmelina	Compact white wood; used for boats and musical instruments.
49. Pa-ra-wa	– –	A hard red wood, not attacked by insects; used for spears and arrows.
50. Peng-lay-oun	– –	A very valuable, close, heavy, red wood; used for spear-handles.
51. Pinnai	Artocarpus (?)	A close, handsome, yellow wood.
52. Povin-gnyet	Lagerstrœmia	A good useful wood; used for posts and rafters.
53. Pyeen-ma	Shorea (?)	A capital wood; used for carts, boats, oars, posts, rafters, &c.; specific gravity 0·920.
54. Raung-thmoo	– –	Used for house-posts.
55. San-labet	– –	A good, heavy, white wood; not attacked by insects; used in building.

No. 21.—WOODS OF AMHERST (Mr. Commissioner BLUNDELL)—*continued*.

56. Seet-seen	– –	A valuable, heavy, compact, red wood; used in building temples.
57. Taup-sha	– –	Shaky wood; used in carpentry.
58. Teng-khat	– –	A heavy, white, compact wood; turns well; used for rice-mortars.
59. Thab-ban	– –	A heavy wood; used in boat-building; timber sometimes 70 feet long; specific gravity 0·814.
60. Tha-bwot-gyee	– –	A good, heavy, useful wood.
61. Tha-byion	Eugenia (?)	A useful timber tree.
62. Tha-khwot	– –	Used for sandals.
63. Thammai	– –	A strong handsome wood, like box.
64. Than-kya	– –	Wood like saul-wood.
65. Tha-nat	– –	A kind of grey teak.
66. ,,	– –	Resembles saul.
67. Than-that	– –	Resembles saul, a capital wood.
68. Thanna-dan	– –	A reddish-brown, heavy, strong wood, but somewhat shaky.
69. Theng-gan	– –	An excellent compact wood; used for carts, boats, house-building, &c., and considered superior to teak; specific gravity 0·911.
70. Thep-yeng	– –	A fine-grained wood.
71. Theet-phyion	Mimosa (?)	A fine white wood; used for fan-handles.
72. Theet-to	– –	A dark-coloured, hard, heavy wood; used in boat-building, &c.
73. Theet-ya	– –	A fine strong, tough, brown wood; used for rice-mortars, or pounders.
74. Thiem	– –	Used in house-building and carpentry.
75. Toung-bien	– –	A strong heavy wood; used for carts and boat-building.
76. Toung-thau-gyee	– –	A hard, compact, dark-brown wood.
77. Toung-tha-byion	Mimosa	A strong, red, heavy wood; used in building.
78. Tseet	– –	Used for house-posts, and in boat-building.
79. Tsekka-doun	– –	Used for houso-posts, and in boat-building, but very shaky.
80. Tshaup-yo	– –	A heavy, very strong, white wood, but liable to attacks of insects.
81. Tshan-tshay	– –	A useful wood, but shaky, and liable to attacks of insects.
82. Tshwai-lwai	– –	A hard red wood, suitable for cabinet-work; used for musket-stocks.
83. Tshiet-khyeen	– –	Used for house-posts.
84. Tsoay-dan	– –	Hard, heavy, tough wood; used for wheels, musket-stocks, &c.
85. Tswot-ba-lwot	– –	Like the wood of Lagerstrœmia.
86. Yammandy	– –	A good and valuable wood; used for carving images.
87. Yeng-taip	– –	A strong useful wood; used for common carpentry.
88. Yetha-byay	– –	,, ,, ,,
89. Yoga-theet	– –	Used for carved images; the bark used as soap.
90. Zee-byion	– –	A close compact wood, but rather shaky; not attacked by insects.
91. Zeng-bywom	– –	A useful wood; employed in building.

No. 22.—WOODS OF TENASSERIM.

1. Bauhinia, or mountain ebony.
2. Calophyllum, sp.
3. Careya arborea, C. sphærica, bambooce.
4. Cyrtophyllum fragrans. Anan.
5. Dalbergia latifolia, or lana wood.
6. Diospyros, sp.
7. Erythrina.
8. Fagræa fragrans.
9. Grewia, sp.
10. Hopea odorata, or thengan.
11. Heretiera minor, or soondra.
12. Inditte, or ebony.
13. Inga xylocarpa, pyangadian.
14. Kazaret.
15. Laurus, sp., sassafras wood.
16. Lagerstrœmia Reginæ; jarrool, or jamoung.
17. Lagerstrœmia macrocarpa; pyen ma, or jarrool.
18. Mergui, red wood.
19. Pinus Latteri.
20. Pterocarpus Wallichii, Pterocarpus Indica, podauck.
21. Rose-wood.
22. Sterculia fœtida.
23. Sandal-wood (wild).
24. Thanaka.
25. Tectona grandis.
26. Vitex arborea.

The "Soondra" is a very tough and elastic wood, commonly used for boat-building, &c.; it is, however, a very perishable wood, and shrinks a good deal in seasoning; specific gravity 1·002 to 1·086. From Major H. Campbell's valuable experiments on the strength of Indian timber, this is evidently a very strong wood; since out of 27 woods which he examined, he found the Soondra to be the strongest.

"Anan," a tree belonging to the nux vomica tribe, one of the hardest and most compact woods known.

"Podauck," a leguminous tree, commonly called "rose-wood," a very beautiful, compact, and hard timber, resembles the Andaman wood.

"Thengan," *Hopea odorata*, an enormous tree of the *Dipterocarpeæ*, or Saul tribe; a very strong but coarse-grained wood, used for making canoes;—immense quantities of good dammer, or resin, are obtained from this tree.

"Pyangadean," a tree belonging to the Acacia tribe, commonly called "iron-wood," in the Arracan provinces; a very hard, dense, and durable wood.

No. 23.—WOODS OF MARTABAN (Dr. WALLICH).

1. Calophyllum	Thurappe	A large tree; used for masts and spars.
2. Careya	Kaza	,, used for posts, &c.
3. Cynometra	Maingga	A small tree.
4. Diospyros (?)	Ryamucha	Used in house-building.
5. Elæocarpus	– –	Very large timber; used for masts and house-posts.
6. Fagræa fragrans	Annah-beng	Compact, hard, yellow, and very beautiful wood; little used.
7. Gordonia (?)	Kaza	Large common timber.
8. Hopea odorata	Tengaun	An immense tree.
9. Meenaban	– –	A durable pliant wood.
10. Pongamia atropurpurea	Lagun	A noble tree; used in boat and house-building.
11. Quercus Amherstiana	Tirbbac	A large tree; used in boat-building.
12. Tectona grandis	– –	Teak wood.
13. Terminalia bialata.		
14. Xanthophyllum	Saphew	A very large tree; used for posts and rafters.

No. 24.—WOODS OF ARRAKAN.

1. **Bhaman.**
2. **Kyandevel teing.**
3. **Moo-tso-ma.**
4. **Parawa.**
5. **Pyawa tulli.**
6. **Pyanany.**
7. **Pyaing.**
8. Therock.
9. Thekuddo.
10. Thorat-soing.
11. Thenganet.
12. Iswanbyee.
13. Inwroot.

No. 25.—WOODS OF CHITTAGONG (Capt. Marquart).

1. **Conocarpus**—Buthna.
2. **Diospyros** melanoxylon.
3. **Dypterocarpus**—sargetiah.
4. **Acacia**, sp.—koom koyre.
5. **Swietenia** chickrassia—Chuckrassee.

No. 26.—WOODS OF MIRZAPORE (Benares).

1. **Dipterocarpus**—Bigeedar.
2. **Diospyros**—Abnoos.
3. **Conocarpus**—Sickroa.
4. **Pentaptera** glabra—Asan.
5. **Phyllanthus** emblica—Amorah.
6. Terminalia Bellerica—Buheera.
7. ,, ,, safed mooslee.
9. ,, ,, hurrah.

Some fine planks of teak, from Rangoon, nearly 3½ feet wide, are exhibited by Mr. McDowell (p. 888); these were deemed deserving of Honourable Mention. Teak is a light-brown, porous, and quick-growing wood; it derives much of its value from the aromatic, oily substance with which it is more or less saturated in the fresh state. A very interesting series of examples of teak wood, formed by Mr. Seppings, of Calcutta, is contributed from the Naval Department of the Honourable East India Company. It consists of 72 specimens from various localities, and the weight of each, per cubic foot, has been carefully ascertained. From the experiments of Major H. Campbell, it appears that the density of teak wood varies from 0·594 to 0·876, according to its quality and the mode in which it is seasoned; whilst Captain Baker found it to vary from 0·631 to 0·792. It is evident, however, from the following table, which shows the results of Mr. Sepping's experiments, that the specific gravity of teak varies considerably more, not only between the wood of different forests, but even in different parts of the same beam.

No. 27.—SPECIMENS OF TEAK FROM THE WOODS OF MOULMEIN.

No.	Place in which the Tree was Cut.	Number of Years Cut.	Girth of the Tree when roughly Trimmed. Ft.	in.	Specific Gravity of two Samples.	
1	Kyoon Gyoung - - - - -	3	9	0	0·708	0·731
2	Kyat Gyoung - - - - - -	3	8	0	0·650	0·758
3	Maioa Gyong - - - - - -	4	8	0	0·678	0·750
4	Mote Somahmen - - - - -	2	9	0	0·785	0·777
5	Gwen Gyee - - - - - -	6	8	0	0·620	0·630
6	Shwaibo Hat - - - - - -	4	7	6	0·651	0·769
7	Kid Yai Tsuk - - - - - -	4	6	6	0·772	0·819
8	Mayan ben Tsuk - - - - -	5	7	6	0·742	0·743
9	Sakat Kyoung - - - - -	5	8	0	0·732	0·649
10	Dallee Kyoung Eastside - - -	5	9	0	0·757	0·822
11	Makarau Kyoung - - - - -	6	7	0	0·787	0·796
12	Ah, Tak Kia Yeen - - - - -	7	9	0	0·767	0·704
13	Nat Kyoung - - - - - -	4	7	0	0·800	0·686
14	Paidaree Kyoung - - - - -	3	6	0	0·649	0·739
15	Gwen Galai - - - - - -	3	6	6	0·742	0·706
16	Gwen Gyee Kya Yar Tsuk - - -	3	8	6	0·733	0·748
17	Mala Kyoung - - - - - -	4	8	0	0·594	0·595
18	Pra Gyee - - - - - - -	5	7	5	0·687	0·603
19	Kyoung Galai - - - - - -	3	7	6	0·602	0·765
20	Meetakeel - - - - - -	4	8	6	0·608	0·707
21	Paulow Kyoung - - - - -	3	6	0	0·600	0·827
22	Meeboring Kyoung - - - -	3	5	6	0·745	0·686
23	Mapa Kyoung - - - - -	3	6	6	0·625	0·775
24	Deedo Kyoung - - - - -	4	7	0	0·654	0·663
25	Pakan Kyoung - - - - -	4	6	0	0·756	0·745
26	Ouck Boweng - - - - - -	5	5	6	0·658	0·692
27	Thengyan Nee Kyoung - - -	4	7	0	0·766	0·583
28	Mee Byan Kyoung - - - -	5	8	0	0·610	0·739
29	Pah Biel - - - - - - -	4	7	6	0·748	0·597
30	Akau Onweng Toung - - - -	4	6	6	0·599	0·681
31	Meezoum Kyoung - - - - -	4	6	0	0·680	0·721
32	Swaiboung Kyoung - - - -	3	5	6	0·772	0·812
33	Pau Daw - - - - - - -	3	7	6	0·737	0·610
34	Karen Kyoung - - - - -	3	8	0	0·736	0·768
35	Thoung Keen Dauguent Seek - -	4	6	6	0·708	1·056
36	Kaulow - - - - - - -	–	7	0	0·761	0·652
	Maximum - - - - -	–	–		1·056	
	Average - - - - -	–	–		0·711	
	Minimum - - - - -	–	–		0·583	

No. 28.—WOODS OF MALAY.—From Singapore.

This collection consists of about one hundred specimens, many having no labels; those marked are as follows:—

1. Angsanah.
2. Bilong.
3. ,, Wangi.
4. Brus Bras.
5. Bitangor wood.
6. Changis.
7. Glam.
8. Jambu-ayer-utan.
9. Kayau Arang.
10. Kumuning.
11. Krautai.
12. Aranji.
13. ,, Klat.
14. Kayu Brombong.
15. Kledang.
16. Lakah wood.
17. Leban.
18. Meosbon.
19. Medansi Miniak.
20. ,, Buah Yeah.
21. ,, Tandoh.
22. Medansi Kitanahan.
23. ,, Konit.
24. Polai wood.
25. Peragah.
26. Ranggas.
27. Simpoh Ryah.
28. ,, brekit.
29. Slumar.
30. Tampang.
31. Tampinis.
32. Timbusu.

Of these the "Bintangor" wood is the most used, especially in ship-building, serving for planks, masts, spars, &c.; it grows in the greatest abundance round Singapore, and is largely exported to the Mauritius, California, &c. The "Glam" tree furnishes a paper-like bark, used in caulking the seams of vessels. The wood of the "Polai" tree, which is used to make floats for fishing-nets, is a very remarkable light white wood, and might probably be imported, and used with advantage as a substitute for cork, and some similar substances.

No. 29.—WOODS OF PRINCE OF WALES ISLAND.

These are all stated to be furniture woods:—

1. Angsena, or Senna Baymah.
2. Balah Bungah.
3. Balach.
4. Baloh.
5. Balon Bungah.
6. Betel-nut tree root.
7. Clove tree.
8. Cocoa-nut tree root.
9. Durium (wild).
10. Elsuch-tree root.
11. Ebony.
12. Guava wood.
13. Ibool wood.
14. Kamuning.
15. Mirlimoh.
16. Penang wood.
17. Ranggus.
18. Siam wood.
19. Timbusi.

No. 30.—WOODS OF PENANG (Col. FRITH).

NAME.	Colour.	Specific Gravity.	REMARKS.
1. Brantey	Light brown	–	An inferior weak wood; used for building.
2. Bunho	,,	–	A large tree; occasionally used for building.
3. Bintagon	,,	–	,, used for masts.
4. Curupas	Dark red	–	Used for beams of houses.
5. Cooran	Light brown	–	Used for planks for building.
6. Chiujeritt	Brown	1·165	A small tree; used for furniture.
7. Cumpas	Light brown	–	A large tree; used only for planks.
8. Cawa-Arang	Pale brown	–	A very large tree; used for furniture and ornamental work.
9. Canis	,,	–	,, ,, used for door-frames.
10. Chiuracy	Brown	1·081	Used for beams; does not work kindly.
11. Cawa-Arang	Light brown	–	Only used for furniture.
12. Cocoa-nut	Brown	–	Cut perpendicularly.
13. China red wood	Red	–	Only used for furniture.
14. Ceylon ebony	Black	–	Used for inlaying and ornamental furniture.
15. Dumarlout	Brown	–	Used for building and general purposes.
16. Dunorhung	,,	1·235	Used by the Chinese for carved images.
17. Drum	Light brown	–	A very small tree; used for ornamental furniture.
18. Hama Raja	,,	–	,, ,, little used.
19. Maddang Kamenhir	,,	–	Used by the Chinese for making boxes.
20. Miraban	Light red	–	Much used for ship-building, furniture, &c.
21. Maddang Tandack	Dark brown	–	Not used at all.
22. Maskaw	Light brown	1·016	Used for palankeens, carriages, furniture, &c.
23. Mankudu	Brown	–	A species of Damaslout; much used for beams.
24. Maliler	White	–	A small tree; used for work-boxes and ornamental work.
25. Maribot	Purple	0·939	A very large tree, difficult to work; used for furniture.
26. Mandara	Pale red	0·939	A small tree; used for ornamental furniture.
27. Nebong	Dark	–	A tall and thin, but straight tree; used for railings.
28. Papisrang	Pale brown	–	Six to nine feet in circumference, forty feet long; not good for beams; chiefly used for furniture.
29. Pasa Linja	Light brown	–	A large tree; used only for planks; soon decays.
30. Pala	,,	–	A tall thin tree; used for planks.
31. Pinang Back	Brown	–	A large tree; used for beams.
32. Pala Utan	Light brown	–	,, only used for planks.
33. Papisrang	Purple	–	A strong wood; used for beams.
34. Penang teak	Brown	–	A scarce tree now.
35. ,, Jack	Yellow	–	Used only for ornamental furniture.
36. Rangha-as	Light brown	–	Used for furniture.
37. Rokam	Light red	–	Used for boxes and furniture.
38. Red wood	Red	1·000	In general use for furniture.
39. Sankuang	Pale brown	–	Used only for ornamental work.
40. Satin wood	Straw	–	A beautiful wood for ornamental furniture, &c.
41. Siam ebony	Black	–	Used only for ornamental furniture, inlaying, &c.
42. Teak	Brown	–	In general use.
43. Tampinnis	Light red	–	A fruit-tree; used for ornamental furniture, billiard-cues, &c.
44. Tija	Light brown	–	Used for furniture, boxes, &c.
45. (No name)	Purple	–	Not durable; used for all sorts of rough work.

No. 31.—WOODS OF THE INDIAN ARCHIPELAGO.

Extensive collections of woods from Borneo, New Guinea, and several other of the Archipelago islands, are contributed; including sandal-wood from Timor, and Lingoa, or Amboyna wood, from Ceram, in the Moluccas. This wood, which is very durable, and takes a high polish, was imported from the Moluccas in considerable quantities at the time when the latter were British possessions; it is very abundant, and may be had in any quantity. Very large circular slabs are obtained from the lower part of the tree by taking advantage of the spurs, or lateral growths; they are sometimes as large as nine feet in diameter. A circular disk of wood thus obtained, nearly seven feet in diameter, as well as some other specimens, are exhibited by Messrs. ALMEIDA (p. 891), of Singapore, and were deemed deserving of a Prize Medal by the Jury. Specimens are also shown of the "Kayu-Buka," which is brought from Ceram, New Guinea, Arru, and the other islands of the Moluccas, to Singapore; it is a knotty excrescence, which forms on the stems of the Lingoa tree, and is much esteemed as a fancy wood for cabinet-work; of late years its estimation seems to have decreased in Europe, but it is still much valued by the Chinese. The following is a list of the woods from Labuan:—

NAME.	Height.	Diameter.	REMARKS.
	Feet.	Feet.	
1. Dadarru	30	2	
2. Gabar Buto	about 60	3	
3. Jati china	60	1½	
4. Kalim pupa tandok	12 to 15	1½	
5. Kayu Aru	about 60	3	
6. ,, Arang	–	–	Grows to a large size in Borneo.
7. ,, Arru	30	2	
8. ,, Benatore bukit	70	3	
9. ,, Bencoola	about 60	3	
10. ,, Badak utan	–	–	A fruit tree.
11. ,, Bidarru	30	1½	A scented tree.
12. ,, Impas	40	2½	
13. ,, Gading	25 to 30	1	
14. ,, Jamber	30	2	
15. ,, Kandis Dahan	30	2	A fruit tree.
16. ,, Kalum Puppa	30	2	
17. ,, Karye	20	1½	
18. ,, Kapur Rangin	90 to 100	4 to 5	
19. ,, Kuing	70	3	
20. ,, Kapur	90 to 120	5	
21. ,, Koningutan	40	2½	
22. ,, Kamuning	–	0½	
23. ,, Limau	–	0½	
24. ,, Laoh	–	–	Small tree.
25. ,, Leda Karbau	about 60	3	
26. ,, Malam	,,	3	
27. ,, Nasi Nasi	40	2	
28. ,, Oobah	40	1½	Bark used to dye red.
29. ,, Plye (root)	–	–	
30. ,, Palah palawan	30	1½	
31. ,, Petong	30	1½	
32. ,, Rsak	40	2½	
33. ,, Rangas	30	1½	Used for common furniture.
34. ,, Sampilou	60	1½	
35. ,, Senang annumbukit	90	4	The fruit yields an oil.
36. ,, Samuck	30	2	Used for dyeing.
37. ,, Senang Awan	90 to 120	5 to 6	
38. ,, Sarogan	25	1	
39. ,, Tampui pyah	–	–	A fruit free.
40. ,, Tioro	30 to 35	3	
41. ,, Tobah tobahutan	30	3	
42. ,, Taratang	20 to 30	2	
43. ,, Urat Mata	90 to 100	3 to 4	
44. Madang sisik	50	2½	
45. ,, lada	30	2	
46. Nibong binar	90	–	A species of palm.
47. ,, sabarani	90	–	,, ,,
48. Samala	50	2½	
49. Saryiah	50	3	

Although, in the preceding lists of woods exhibited by the Honourable East India Company, some of the woods are enumerated more than once, being contributed from different localities; yet, taken as a whole, the entire collection is of the highest interest and importance. As many of the specimens sent over are of a large size, means will be afforded of ascertaining the density, elasticity, strength, and other properties of the several woods, and thus much valuable practical information may be obtained.

A collection of forty-eight specimens of woods from Ceylon is exhibited in the Colonial Department, consisting of timbers used in house-building, and for purposes of construction, and of ornamental or furniture woods. The following is a list of these woods:—

WOODS OF CEYLON.

1. **Ahoo (19)**	A soft, though fine, but not very close-grained, light wood.
2. **Aloobon (39)**	A rather soft, coarse, open-grained, but not very light wood.
3. **Cahamilile (66)**	A very hard, fine, close, even-grained, heavy wood.
4. **Calamender (2)**	An exceedingly hard, fine, close-grained, heavy wood, of a pale-reddish hue; with the heart and isolated elongate patches of an intense black. This specimen is inscribed at the back "Hoamidina."
5. **Ceylon Teak (61)**	A rather hard, fine, close-grained, and somewhat heavy wood.
6. **Cochin Teak (70)**	A rather hard, though somewhat coarse and open-grained, moderately heavy wood, of a lighter hue, rather coarser texture, and considerably more ponderous than the Moulmein teak.
7. **Cocoa-nut (75).**	
8. **Dombe (63)**	A soft, coarse, open-grained, light wood, bearing a strong resemblance to inferior Honduras mahogany, takes a good polish, and presents a pretty curled pattern; but judging from this specimen, which is much worm-eaten, it cannot be a very durable wood, at all events in its native country.
9. **Drapore (31)**	A hard, fine, rather close-grained, somewhat heavy wood.
10. **Ebony**	A beautiful specimen of a well-known wood.
11. **Flower Batten (76)**	A very hard, fine, close-grained, heavy wood. Its polished surface shows a pleasing mottled pattern.
12. **Galmendora (68)**	A rather hard, very fine, but not close-grained, heavy wood.
13. **Godepere (25)**	A rather hard, fine, close-grained, heavy wood.
14. **Goorakieme (14)**	A soft, fine, but open-grained, light wood.
15. **Hadiwicke (26)**	A moderately hard, fine, close-grained, rather heavy wood.

WOODS OF CEYLON—*continued.*

16. Hall (28)	A very soft, coarse, open-grained, light wood, evidently adapted only for very inferior work, and where durability is not required.
17. Halmendora (67)	A hard, fine, close-grained, heavy wood.
18. Halmilile (43)	A rather soft, though fine, but not very close-grained, heavy wood.
19. Hampalede (36)	A rather soft, fine, though open-grained, heavy wood.
20. Hick (57)	A very hard, fine, close, very uniformly-grained, heavy wood, in colour resembling pencil-cedar.
21. Horre (74)	A hard, though coarse, open-grained, heavy wood.
22. Hounkieriler (15)	A soft, fine, but open-grained, rather heavy wood.
23. Kadoll (13)	A rather hard, fine, close-grained, heavy wood. Specimen much worm-eaten.
24. Kadombairia (3)	A rather hard, fine, close-grained, somewhat light wood; its surface curiously veined.
25. Kadoomba (42)	A soft, though fine, close-grained, and rather light wood.
26. Kattukende (27)	A hard, fine, rather close-grained, heavy wood.
27. Kirepalle (23)	A very soft, coarse, open-grained, light wood.
28. Koan (12)	A very hard fine, close-grained, heavy wood.
29. Koesor Jack (6)	A moderately hard, but rather coarse and open-grained, though heavy wood, of a beautiful saffron yellow colour; emits a peculiar, but by no means unpleasant odour.
30. Kuretia (29)	A hard, fine, close-grained, heavy wood.
31. Meeaumilile (60)	A very hard, fine, close-grained, heavy wood
32. Millele (5)	Probably specifically identical with Sapoomilile, with which it coincides in every respect. [*Vide* No. 43.]
33. Moolmein Teak (64).	
34. Naa (72)	A very hard, fine, close-grained, and very ponderous wood.
35. Namede (34)	A rather hard, very fine, close-grained, heavy wood.
36. Nendoon (48)	Hard, though coarse, open-grained, heavy wood.
37. Obbairla (55)	Hard, rather fine, generally close-grained, presenting, however, many open cells; heavy.
38. Palmira (71)	A species of palm.
39. Paloo (65)	A hard, fine, close-grained, heavy wood: heart-wood deep red-brown, recent layers reddish yellow; its compact, even structure, indicates that it is admirably adapted for turnery work.
40. Patta Dell (62)	A soft, coarse, open-grained, light wood.
41. Pelan (54)	A very hard, fine, close-grained, heavy wood.
42. Sapoo (53)	A soft, firm, but rather open, though even-grained, light wood.
43. Sapoomilile (77)	A soft, rather coarse, open-grained, light wood.
44. Sattin (69)	A hard, fine, close-grained, heavy wood.
45. Sooriye (73)	A hard, though somewhat coarse and open-grained, heavy wood, of a deep chesnut colour.
46. Tamarind (4)	An exceedingly hard, fine, close-grained, very heavy wood.
47. Tarine (35)	A hard, fine, close-grained, rather heavy wood, much resembling English birch.
48. Wanedile (37)	A rather hard, fine, close, even-grained, heavy wood.

WOODS OF CAPE OF GOOD HOPE, &c.

Several interesting specimens of timber and other woods are contributed from South Africa and the Cape of Good Hope. One specimen in particular deserves special notice; it is called Red Ebony, from Natal, and is contributed by C. J. Busk (60, p. 952). It is a hard, heavy, very close-grained, red wood, admirably adapted for turning and the finer sorts of cabinet work; approximating in fact, in character, somewhat to ivory. This wood appears to be new, and it is unquestionably a valuable addition to the hard ornamental woods already known; the Jury, accordingly, awarded a Prize Medal for it.

A valuable small collection of the woods of the Cape of Good Hope, is exhibited from the Moravian Mission at Gnathendal (44, p. 950); it consists of thirty specimens, and was deemed worthy of Honourable Mention. The annexed table contains a list of these woods, their sizes, and the uses to which they are applied in the colony.—(See Table I., p. 141.)

A second series of Cape woods, including a number not in the Gnathendal Collection, and valuable because the specimens are shown in the bark, is exhibited by H. Dumbleton of George District (47, p. 951); this was likewise deemed worthy of Honourable Mention. (For list of this series, see Table II., pp. 141, 142.)

A specimen of teak wood, from the Western Coast of Africa, a valuable timber, well known and valued by ship-builders, is shown by Warwick Weston (1, p. 952).

WOODS OF CANADA.

Very remarkable specimens of the chief varieties of Canadian timber are exhibited; especially the collection shown by the Central Commission of Montreal (80, p. 963), for which the Jury awarded a Prize Medal (see p. 7). It includes excellent specimens of the following woods:—

1. Ash, curled.
2. Birch, white.
3. Butter-nut.
4. Bass wood.
5. Cedar, pencil.
6. Elm.
7. Elm, red rock.
8. Iron wood.
9. Maple, soft.
10. Maple, hard.
11. ,, bird's-eye.
12. Oak, red.
13. Oak, white.
14. Pine, red.
15. ,, yellow.
16. ,, white.
17. Spruce.
18. Tamarack.
19. Walnut, black.

The butter-nut, and black walnut are excellent furniture woods, and hardly seem to be so well known or appreciated as they deserve. Very fine specimens of butter-nut, birch, pine, cherry, curled black walnut, and maple, both curled and bird's-eye, are exhibited by Messrs. Reed and Meakins of Montreal (75, p. 963) these were also judged worthy of a Prize Medal by the Jury.

Fine specimens are also shown of curled black walnut by — Fisher, of Simcoe (78, p. 963); of bird's-eye maple, by J. Egan, of Ottawa (74, p. 963); of black walnut, by J. Henson, of Dawn (79, p. 963); and of soft maple and chestnut, by J. and F. Parisault, of St. Martin (76 and 77, p. 963). The Jury deemed each of these deserving of Honourable Mention.

Small samples of a few woods from New Brunswick are exhibited: namely, bird's-eye and curly maple, black birch, and the candleberry myrtle.

A few woods are contributed from Nova Scotia; including curled and bird's-eye maple, birch, and white and grey oak.

WOODS OF BRITISH GUIANA.

A valuable and very interesting collection of timber and other woods from British Guiana, is contributed by several independent exhibitors. The Jury awarded Prize Medals to J. Outridge (84, 84A, 85, 85B, 85C, 87, 88, 89, 91, 92, 97, 98, 104 to 115, 117D, E, F, G, H, &c., pp. 982, 983, 984, 985); and to J. S. Stutchbury (85A, 116, 117B, &c., pp. 982 and 985), for their collections of woods; and they deemed the specimens shown by A. Buchanan (86, 90, 95, 96, pp. 982, 983); T. B. Duggin (90B, 99, 100, 101, 102, p. 984); T. Faucet (93, 94, p. 983); G. Pontifex (102B, p. 984); and J. F. Bee (103, 105, 116, 117, &c., pp. 984, 985), severally deserving of Honourable Mention.

Mr. Bee also exhibits a numerous series of small samples of the chief woods of Guiana (156, p. 987).—See List, pp. 143-146.

TABLE I.—LIST of 30 SPECIMENS of WOODS from the MORAVIAN MISSION, CAPE of GOOD HOPE.

NAMES.		BOTANICAL NAMES.	General Height without Branches.	Diameter.	QUALITY.	USES.
			Feet.			
1. Alder, red	Roode els	Cunonia capensis	15 to 25	2 to 3 ft.	Hard and tough	Waggon work.
2. Alder, white	Witte els	Weinmannia trifoliata	10 12	2 3	Tough and soft	Planks.
3. Ash	Essen hout	Ekebergia capensis	20	1 2	Tough	,,
4. Assagay wood	Hassagai hout	Curtisia faginea	20 40	3	Very tough	Waggon work.
5. Beech	Beuken hout	Myrsine melanaphloeos	15 25	2	Tough	Waggon wheels.
6. Black bark	Zwart bast	Royena villosa	12	1	Hard and very tough	For poles: excellent for wooden screws.
7. Black wood	Zwart hout	Gardenia Rothmannia (?)	20	1 2½	Hard and tough	Waggon work.
8. Candle wood	Kaars hout	Kiggelaria Africana	12	1	Close	General work.
9. Gomassie	Kamassie hout	Gonioma Kamassi, E. M.	12 15	1 ft. 9 in.	Hard and close	Veneering and tools.
10. Iron wood	Zwarte yzer hout	Olea undulata	25 45	4 ft	Very hard	Ploughs and axles.
11. Keur		Virgilia capensis	20	1 to 1½ ft.	Light and soft	Spars and rafters.
12. Olive wood	Olyf hout	Olea verrucosa	6 10	1	Very hard	For furniture.
13. Pear, red	Rood peer		20 30	3	Hard and tough	Axles and waggon poles.
14. Pear, white	Wit peer	Imbricaria obovata (?) N. ab E.	15 20	2 3	,, ,,	Principally for felloes
15. Pear, hard	Hard peer	Olinia cymosa, Th.	15 20	2 3	,, ,,	Axles and waggon poles.
16. Red wood	Rood hout	Diporidium arboreum	12 15	1 2	,, ,,	Not much used.
17. Saddle wood	Lepel hout	Mystroxylon	10 15	1 2	Close and tough	Waggon work.
18. Sabree			12	1	Light and soft	Coopers' work.
19. Saffron	Saffraan hout	Crocoxylon excelsum	10 15	1 2	Close	Felloes and general work; bark for tanning.
20. Silk bark	Zyde bast	Celastrus	10 12	7 to 9 in.	Tough and close; the bark tough like silk.	Carriage poles.
21. Smal blad		Hartogia capensis	10	7 in.	Tough	Not much used, firewood.
22. Sneeze wood	Nieshout	Ptaeroxylon utile, E. and Z.	15	1 to 2 ft.	Very hard	Very handsome for furniture.
23. Spek wood			10 15	2 3	Tough and soft	Planks.
24.						
25. Stink wood	Stink hout	Oreodaphne bullata	20 35	3 5	Hard and tough	Furniture and waggon work.
26.						
27. Thorn	Doorn boom	Acacia horrida	8 10	1 3	,, ,,	Gum, bark for tanning, firewood.
28. Vlier		Chilianthus arboreus. Scoparia arborea	10	7 in.	,, ,,	Chairs, table-feet.
29. White wood	Whit hout	Virgilia capensis	15 20	1 to 2 ft.	Light and soft	Spars, rafters, &c.
30. Yellow wood	Geel hout	Taxus elongata	20 50	2 7	Not unlike deal	Balks, beams, planks.

TABLE II.—LIST of 43 SPECIMENS of WOODS from GEORGE DISTRICT, CAPE of GOOD HOPE.

NAMES.		BOTANICAL NAMES.	General Height without Branches.	Diameter.	QUALITY.	USES.	LOCALITY.
			Feet.				
1. Alder klip	Klip els	Plectronia	10 to 15	1 to 2 ft.	Hard and close	Waggon-work.	
2. Alder, red	Roode els	Cunonia capensis	15 20	2 3	Hard and tough	Planks and felloes of wheels	Ravines and water-courses throughout Cape Colony.
3. Alder, white	Witte els	Weinmannia trifoliata	10 12	2 3	Tough and soft	Planks, furniture	Moist ravines in eastern parts.
4. Ash	Essen hout	Ekebergia capensis	10 20	1 3	,, ,,	Planks for furniture	Forests of the eastern provinces.
5. Assagay	Hassagay hout	Curtisia faginea	20 30	2 3	Hard and very tough	Much preferred for waggons	Moist stony places in forests throughout South Africa.
6. Bastard safran	Bastard S. hout	Mystroxylon	–	–	Hard	Waggon-work.	

TABLE II.—LIST OF WOODS from GEORGE DISTRICT, CAPE of GOOD HOPE—*continued.*

NAMES.		BOTANICAL NAMES.	General Height without Branches. Feet.	Diameter.	QUALITY.	USES.	LOCALITY.
7. Beech	Beuken hout	– –	15 to 20	6 ft. 4 in.	Soft and tough	Very useful for waggon-work	Forests throughout Cape Colony.
8. – –	Blaauw bosch	Royena lucida (?)	5 12	8 8	Hard and tough	Furniture and tools	Shady places in ravines in Cape Colony.
9. Black bark	Zwart bast	Royena villosa	10 12	6 12	Hard and very tough	Waggon-poles, tools, &c.	Moist shady parts in the forests of Cape Colony.
10. Black wood	Zwart hout	Royena	–	–	Tough and hard	Furniture and tools.	
11. Cedar	Sapru hout	Callitris Ecklonii	10 25	1 to 4 ft.	Light, short, and resinous	Coopers'-work, water-wheels, and roofing-planks, &c.	High rocky places in the Cedar mountains.
12. Chestnut, wild	Wilde kastanje	Calodendron capense	15 30	3 4	Soft and light	Beams, planks, &c.	Ravines in forests of the eastern part of Cape Colony, and Magalisberg.
13. Cross thorn	Kruis doorn	Plectronia ventosa	5 8	3 ft. 9 in.	Hard and tough	Waggon-poles, spars, &c.	Ravines in forests of Cape Colony.
14. – –	Dany bosch	Rhus tomentosa	5 10	1 8	Very tough	Waggon-work; bark used by tanners.	Forests in the Cape Colony.
15. Elder, wild	Wilde vlier	Chilianthus arboreus	8	7	Hard and tough	Furniture	Edges of rivers in the Cape Colony.
16. – –	Gnutsam	– –	–	–	Tough.		
17. Gornasie	Kornassie hout	Gonioma Kamassi	12 15	1 9	Hard and close	For veneers, tools, &c.	Forests of the Neisna river, and others of the eastern districts.
18. Granate, wild	Buffel hoorn	Burchellia capensis	5 10	2 5	Fine-grained, hard, and tough.	Very good for cabinet-work	Grootvaders bosh, and eastern forests.
19. Horsepis	Paarde pis	Hippobromus alatus	5 10	12	Hard and tough	Waggon-work	Eastern parts of Cape Colony.
20. Iron wood, white	Witte yzer hout	Asaphes undulata	20 30	2 to 3 ft.	Very hard and tough	,,	Makalisberg. Krakkakammer.
21. Iron wood, black	Zwart yzer hout	Olea undulata	15 20	2 3	,, ,,	,,	Forests in the east of Cape Colony.
22. Kooboo	Koeboe	Myotroxylon Kuba	5 8	1 2	Hard and short-grained	,,	,, ,, ,,
23. – –	Kuurboom	Virgilia capensis	10 15	1 ft. 7 in.	Soft and light	Building roofs	Rivulets in the eastern parts.
24. Milk wood	Melk hout	Sideroxylon inerme	5 10	1 to 3 ft.	Hard, white, very tough	Waggon-work; boat-building	Stony places throughout the Colony.
25. – –	Ningroe	– –	–	–	Hard and heavy.		
26. Noentigara	– –	Euclea	–	–	Hard and close.		
27. Olive, black	Zwarte olyven hout	Olea verrucosa	6 10	18 in.	Very hard and tough	Waggon-work, furniture	Rocky places all over South Africa.
28. Olive, white	Witte olyven hout	– –	15 20	2 to 3 ft.	Hard and tough	Waggon-work, poles, &c.	
29. – –	Onderbosch	Trichocladus orinitus	5 10	1 3	Very tough and durable	Waggon-work, roofs, &c.	Under high trees, all over South Africa.
30. Pandle wood	Kaars hout	Celastrus rostratus	10 15	12 in.	Very hard and heavy	Waggon-work, &c.	Water-courses and ravines.
31. Pear, hard	Hard peer	Olinia cymosa	15 20	2 to 3 ft.	Hard and tough	Waggon-work	Stony and moist places of Cape Colony.
32. Pear, white	Witte peer	Imbricaria olovata	15 20	2 3	,, ,,	,,	Olifant's hock; Zizikamma.
33. Quarry bush	Bosch quarry	Euclea undulata	6 8	6ft. 10 in.	Hard and short	Waggon-work; berries eatable	Eastern parts of Cape Colony.
34. Redwood	Roode hout	Diporidium arboreum	12 15	1 to 2 ft.	,, ,,	Furniture, tools, &c.	,, ,,
35. Sage, wild	Wilde saly	Tarchonanthus camphoratus.	6 10	3 ft. 5 in.	Hard and heavy	Cabinet-work	Ravines throughout the Cape Colony.
36. Safran	Safraan hout	Crocoxylon excelsum	10 15	1 to 2 ft.	Hard and close	Waggon-work; bark used for tanning.	Eastern parts of Cape Colony.
37. Silk bark	Sey bast	Celastrus mucronatus	7 12	7 ft. 9 in.	Tough and close	Spars and poles	Woody ravines, all over Cape Colony.
38. Stink wood	Stink hout	Oreodaphne bullata	26 30	3 to 5 ft.	Hard and tough	Much used for furniture, gun-stocks, &c.	Many parts of Cape Colony.
39. Tamboukie wood	– –	– –	–	–	Hard and heavy	Used as an emetic	Port Natal.
40. White wood	Witte hout	Virgilia	10 12	1 ft. 8 in.	Light and soft	Rafters, &c., in house-building	
41. – –	Wolve doon	Celastrus (?)	7 12	3 10	Hard and tough	Waggon-work, tools	Shady moist ravines in Cape Colony.
42. Yellow wood	Gul hout	Podocarpus taxus latifolia.	20 50	2 to 5 ft.	Light and short-grained	Much used in house-building	Eastern parts of Cape Colony.
43. ,,	,,	Podocarpus taxus elongatus.	15 20	2 4	Soft and light	,, ,, ,,	Forests of George District.

WOODS OF BRITISH GUIANA.

1. **Black greenheart.** [85*b*, 85*c*.]	Shows a diameter of 11½ inches. In bark. A very hard, fine, close-grained, heavy wood. Duramen deep brown; recent layers narrow, pale-ochre yellow. The timber of this tree is used for ship-building, planks, &c., and is considered more durable than the common green-heart. The specimens sent are from a tree supposed to be about 50 years old.
2. **Blackheart.** [111, 111*a*.]	Shows a diameter of 4 inches. In bark. A soft, light wood; from the River Demerara. This is a good wood for house frames, and for making furniture. It will square from 6 to 7 inches, from 20 to 30 feet long.
3. **Bully-tree,** (***Mimusops sp.?***) [91, 91*a*.]	Shows a diameter of 12 inches. In bark. A fine close-grained, moderately hard, and rather heavy wood; from the River Demerara. The tree yielding this wood is supposed to be a species of *Mimusops*. It is found throughout the colony, but most abundantly in the county of Berbice. It is of great size, and squares from 20 to 30 inches, and may be obtained from 20 to 30 feet long. The weather has little effect upon it, and it is employed for house-frames, posts, floors, &c. The upper portion of the trunk and branches are manufactured into shingles, wheel-spokes, palings, &c.
4. **Cabacalli.** [112, 112*a*.]	Shows a diameter of 4½ inches. In bark. A fine close-grained, moderately hard, and rather heavy wood; from the River Demerara. This wood is impregnated with a bitter principle, which defends it against worms; it lasts well under water, and is much used for planking colony craft. It must, however, be fastened with copper nails. It will square from 12 to 16 inches, or even more, from 40 to 45 feet long.
5. **Camara, or tonkin-bean** (***Dipteryx odorata,*** **Willd**). [95, 95*a*.]	Shows a diameter of 20 inches. In bark. A fine close-grained, hard, and very heavy wood; from the River Essequibo. This wood is obtained from *Dipteryx odorata*, Willd.: the tree which produces the well-known tonkin bean. It is hard, tough, and durable in an eminent degree, and it is said that a portion of its timber, 1 inch square, and of a given length, bears 100 lbs. more weight than any other timber in Guiana of the same dimensions. It is therefore peculiarly well adapted for any purpose, where resistance to great pressure is the object, and for shafts, mill-wheels, or cogs. It will square from 18 to 20 inches, from 40 to 50 feet long. This tree is, however, not very plentiful in this colony.
6. **Coffee tree** (***Coffea Arabica***). [116, 116*a*.]	Shows a diameter of 3 inches. A fine, close-grained, hard, heavy wood, of a beautiful cream white throughout, and having the appearance of box, both in structure and growth; from Canal No. 2, River Demerara.
7. **Cork-wood** (***Pterocarpus Draco,*** **Linn.;** ***P. suberosus,*** **Pers.**) [102, 102*a*.]	Shows a diameter of 5 inches. In bark. An exceedingly light and soft, though fine even-grained wood; from the River Berbice.
8. **Cork-wood.** [102*b*.]	A curious excrescence, styled in the label "an abutment of the foregoing." In form, very like rough cork; about an inch in thickness throughout, enveloped in a thin hard bark. The wood is much softer than in 102 and 102*a*, and would doubtless afford an excellent substitute for cork, for entomological purposes. From Troolie Island in the River Essequibo. An abutment from near the root of the tree. This wood is supposed to be obtained from *Pterocarpus Draco*, Linn., or *P. suberosus*, Pers., and is chiefly used as floats for fishing-nets.
9. **Courida** (***Avicennia nitida,*** **Jac.**) [103, 103*a*.]	Shows a diameter of 5½ inches. In bark. An open-grained, moderately soft, and rather light wood; from Plantation Woodlands, River Mahaica. This wood is obtained from *Avicennia nitida*, Jacq., a tree of surprising rapidity of growth. These specimens are from a tree five years old. The wood is perishable when exposed to the atmosphere, but is very durable under ground, and is, therefore, used in foundations for buildings.
10. **Coutaballi.** [110, 110*a*.]	Shows a diameter of 5 inches. In bark. A very fine, close-grained, hard, heavy wood; from the River Demerara. The tree which yields this timber grows upon sand-hills; the wood is very hard and durable, if not exposed to the weather; it is plentiful, and principally used for house-frames, and will square 12 inches, from 30 to 40 feet long.
11. **Crab-wood** (***Xylocarpus carapa,*** **Spreng.;** ***Carapa Guianensis,*** **Aubl.**) [108, 108*a*.]	Shows a diameter of 7½ inches. In bark. A tolerably hard, even-grained rather light wood. In great repute, and largely used in the colony for interior work; from the River Demerara. This wood is obtained from *Xylocarpus carapa*, Spreng., or *Carapa Guianensis*, Aubl., the seeds of which yield the crab-oil. It is a light wood, and takes a high polish, and is used for masts and spars, flooring, partitions, and doors of houses. There are two varieties, the red and white. These specimens are the white. It squares from 14 to 16 inches, from 40 to 60 feet long.
12. **Determa.** [107, 107*a*.]	Shows a diameter of 6 inches. In bark. A rather hard, but not very close or even-grained wood. The most valuable of the British Guiana woods for ship-building purposes, where it is used chiefly for the bottoms of vessels; grows to a much larger size than represented in the present specimen; from the River Demerara. This wood is used for masts, booms, and planking for colonial craft; and as insects do not infest it, it is well adapted for chests, wardrobes, &c. It will square from 14 to 16 inches, from 40 to 60 feet in length
13. **Greenheart** (***Nectandra Rodiæi,*** **Benth.**) [85, 85*a*.]	Shows a diameter of 12 inches. In bark. A very hard, heavy, fine, but not even-grained wood. Duramen deep brown, recent layers broad pale yellow; from the River Demerara. The Greenheart tree is very abundant, and its timbers, squaring from 18 to 24 inches, can be procured from 60 to 70 feet long. It is a fine-grained hard wood, well adapted for the planking of vessels, house-frames, wharves, bridges, and other purposes where great strength and durability are required. Mr. Manifold, engineer of the Demerara Railway, states, that this is the best timber for resisting tensile and compressive strains, and is therefore well adapted for kelsons for ships, and beams.
14. **Hackia, or Lignum vitæ** (***Guaiacum officinale,*** **Linn.?**) [98, 98*a*.]	Diameter 15 inches; from the River Demerara. This wood, known in the colony as *lignum vitæ*, is said to be obtained from *Guaiacum officinale*, Linn.; but this seems doubtful, as the tree producing the wood attains a height of from 50 to 60 feet, and squares 16 to 18 inches, whilst the *Guaiacum officinale* is described as a comparatively small tree, about 4 or 5 inches in diameter. It is used

WOODS OF BRITISH GUIANA—*continued.*

	for mill-cogs, and shafts. The specimens sent are from a tree supposed to be about 40 years old.
15. Hooboballi. [89, 89*a.*] –	Shows a diameter of 15 inches. In bark. A fine close-grained, hard, heavy wood. Duramen deep-red chestnut; alburnum nut brown; from the River Demerara. This wood is very close and fine-grained, is easily worked, takes a high polish, and is much used in the colony for furniture. It may be had from 15 to 20 inches square, 40 to 70 feet long. The specimens sent are from a tree supposed to be about 20 years old.
16. Hyawaballi. [117*j*, 117*k.*]	Shows a diameter of 8 inches. In bark. A fine, close-grained, hard, heavy wood; from the River Demerara. This tree is scarce. This wood, known as zebra wood, is used for furniture. The specimens sent are from a tree supposed to be about 25 years old.
17. Hyawa (*Icica heptaphylla,* Aubl.) [101, 101*a.*]	Shows a diameter of 5 inches. In bark. A light, though rather fine close-grained white wood; from the River Berbice. This wood is obtained from the *Icica heptaphylla,* Aubl., or Incense tree, yielding the gum hyawa.
18. Itaballi (*Vochysia Guianensis,* Aubl.) [117*f*, 117*g.*]	Shows a diameter of 11 inches. In bark. An open-grained, light, and rather soft wood; from the River Demerara. The tree which produces this wood is *Vochysia Guianensis,* Aubl., and is used by the Indians for making corials.
19. Itikiribouraballi. (*Macharium Schomburgkii,* Benth.?) [104, 104*a.*]	Shows a diameter of 12 inches. In bark. A close-grained, hard, heavy wood; duramen bright chestnut; alburnum broad, white; from River Demerara. This wood is supposed to be obtained from *Machærium Schomburgkii,* Benth. The trunk grows to the length of from 30 to 40 feet, and squares from 12 to 16 inches. It is used chiefly for cabinet-work.
20. Kakar Ally. [87, 87*a.*]	Shows a diameter of 10 inches. In bark. A fine, close, even-grained wood, hard and heavy. Duramen deep red brown; alburnum broad, pale, dirty yellow; from the River Demerara. This wood is very plentiful, and it has been proved that it is more durable than greenheart in salt water, as it possesses the quality of resisting the depredations of the sea-worm and barnacle. It may be had from 6 to 14 inches square. The specimens sent are supposed to be about 20 years old.
21. Lana (*Genipa Americana,* Linn.) [99, 99*a.*]	Shows a diameter of 6 inches. Centre traversed by a longitudinal cylindrical furrow, containing in tranverse section a hard granulated pith. Wood fine, close-grained, moderately hard, rather heavy. Bark bearing a strong resemblance to that of the common birch; from the River Berbice. This wood is obtained from *Genipa Americana,* Linn.: the fruit of which yields the Indian pigment known as Lana dye. The tree is very high, and the trunk will frequently square from 14 to 18 inches. The wood is close-grained, and is not liable to split.
21*. Koquerettaballi. [103, 103*a.*]	Shows a diameter of 4½ inches. In bark. A very close-grained, hard, heavy wood; from the River Demerara. This wood forms excellent rafters, and beams for cottages. It grows from 20 to 30 feet long, and is from 4 to 6 inches in diameter.
22. Letter-wood (*Brosimum Aubletii,* Poep., *Piratinera Guianensis* Aubl.)	Called by the Indians, "Bourra Courra." 20 inches × 4 × 1½. Fine, close-grained, hard, and rather heavy; a beautiful wood, of a bright-red chestnut colour, with small rhomboidal black patches, mostly isolated, though occasionally concurrent. Used for ornamental purposes, especially for picture-frames; several walking-sticks of this wood, from the colony, are exhibited, *vide* No. 148; unfortunately, it never attains a large size; from the River Corentyne. This is obtained from *Brosimum Aubletii,* Poep., or *Piratinera Guianensis,* Aubl., and is one of the costliest woods which Guiana possesses. It is of a beautiful brown colour, with black spots, which have been compared to hieroglyphics; the spotted part being peculiar to the heart, which is seldom more than 12 to 15 inches in circumference. It is adapted for cabinet-work of small size, and for veneering only. From its extreme hardness it is difficult to work, and is therefore little used.
23. Marisiballi. [117*r*, 117*s.*]	Shows a diameter of 8 inches. In bark. An exceedingly close-grained, hard, heavy wood; from the River Demerara. This tree is plentiful, and is used chiefly for spars. It will square from 13 to 14 inches, from 30 to 40 feet in length. The specimens sent are from a tree supposed to be about 20 years old.
24. Mammee apple-tree (*Mammea Americana,* Linn.) [100, 100*a.*]	Shows a diameter of 7 inches. A wood very like that of the English pear tree. In bark; from the River Berbice. This wood is obtained from the *Mammea Americana,* Linn., which produces a Mammee apple, or wild apricot of South America.
25. Mora (*Mora excelza,* Benth.) [84, 84*a.*]	Shows a diameter of 12 inches. In bark. A hard, heavy, close, but not even-grained wood; from the River Demerara. The tree producing this wood frequently reaches a height of upwards of 100 feet. It grows abundantly on barren sand-reefs. It is tough, close, and cross-grained, and is peculiarly adapted for ships' timbers and planks, for which purpose it is extensively used. The trunk of this tree, when of the height of from 40 to 50 feet, will square from 18 to 20 inches, but when grown to that size, it is generally faulty. The specimens sent are from a tree supposed to be from 30 to 40 years old.
26. Purpleheart (*Copaifera pubiflora* or *bracteata*). [86, 86*a.*]	Shows a diameter of 14 inches. In bark. A hard and ponderous, though open-grained wood. Duramen, in longitudinal section, bright claret; in transverse section, deep brown purple; recent layers narrow, pale yellow; from the River Essequibo. The purpleheart yields a timber possessing great strength, durability, and elasticity, and is described by Dr. Lindley as "invaluable for resisting the shock of artillery discharges," on which account it is employed for mortar beds. It is used for windmill shafts, rollers, and machinery.
27. Saka, or Bastard Purpleheart. [117*d*, 117*e.*]	Shows a diameter of 11 inches. In bark. A fine, close-grained, hard, heavy wood. Heart-wood bright purple, recent layers narrow, dirty white; in brightness of colour, it excels the real Purpleheart; from the River Demerara. Used for furniture.
28. Saouari (*Caryocar tomentosum,* Dec.; *Pekea tuberculosa,* Aubl.) [96, 96*a.*]	Not in bark, diameter doubtful, certainly exceeding 18 inches. A coarse, open-grained, hard, heavy wood; from the River Essequibo. This wood is obtained from *Caryocar tomentosum,* Dec., or *Pekea tuberculosa,* Aubl., the tree which yields the delicious nut, known as the Saouari, or Sewarri nut. It greatly

WOODS OF BRITISH GUIANA—*continued.*

resembles in its properties the Mora, being excellent for ship-building, mill-timbers, and plank, and may be had from 16 to 20 inches square, from 20 to 40 feet long.

29. Silverballi, Yellow (*Nectandra sp. ?*) [92, 92*a*.] A rather soft, open-grained, light wood; from the River Demerara.

This wood is supposed to be derived from a species of *Nectandra*. It is light, and floats, and contains a bitter principle, which protects it from the attacks of worms. Hence it is much used for the outside planking of colony craft: it is also used for booms and masts. It grows to a great size, but then it is often hollow. It will, however, square sound from 10 to 14 inches, from 40 to 50 feet long.

30. Silverballi, Brown. [93.] – A fine, close-grained, moderately hard, and rather heavy wood.

Portion of the planking of a drogher. This specimen formed part of the outside planking of a drogher, employed in the conveyance of produce in this colony, and is known to have been exposed to the action of salt water during a period of 20 years.

31. Silverballi, Brown. [94.] – Although bearing a similar label to the foregoing, its specific identity therewith is doubtful; it differs in colour, is more open-grained, and much lighter. It is, however, possible that this specimen may represent the alburnum, and 93 the duramen of the same tree; if so, it must attain a very large size.

Portion of the planking of a punt. This specimen formed part of the bottom of a punt, known to have been used in the Demerara River for a period of 30 years and upwards.

31.* Silbadani. [117*l*, 117*m*.] Shows a diameter of 7 inches. In bark. A fine, close-grained, moderately hard, and rather heavy wood; bark smooth, much resembling that of common beach; from the River Demerara.

This wood is used for furniture. The specimens sent are from a tree supposed to be about 20 years old.

32. Simiri, or Locust tree (*Hymenæa Courbaril*, L.) [117*n*, 117*o*.] Shows a diameter of 19½ inches. In bark. A rather open-grained, though hard, heavy wood; from the River Demerara.

The tree producing this wood is *Hymenæa Courbaril*, Linn., and is plentiful in various parts of the colony. It often attains a height of from 60 to 80 feet, with a trunk from 7 to 8 feet in diameter. The wood is hard and compact, and its durability recommends it for mill-rollers and similar purposes. The Indians make "woodskins" out of the bark. The specimens sent are from a tree supposed to be about 100 years old.

33. Suradanni. [106, 106*a*.] – Shows a diameter of 9 inches. In bark. A moderately hard, rather heavy, but not even-grained wood. Alburnum not perceptibly lighter in colour than the duramen; from the River Demerara.

It is much used for timbers, rails, and covering boards for colony craft, and for naves and felloes of wheels; it is also made into canoes by the Indians. It will square from 14 to 18 inches, from 30 to 40 feet long.

34. Tacouba, or Heart of Wallaba. [90*b*.] From the River Berbice. This wood is the heart of the upper portion of the trunks of Wallaba trees which have been felled in the forests, and from which the sapwood has decayed. These are much used as paling-posts, and for other out-door purposes, being found to be so durable as to be almost imperishable. They are about to be used as sleepers on the Demerara Railway, for which purpose it is supposed they will prove to be peculiarly well adapted. The defect of Wallaba and of its Tacouba, is its inability to bear great lateral strain; it should not, therefore, be used for beams longer than 12 feet.

35. Tiger-wood. [117, 117*a*.] 8½ inch × 5 inch × 2 inch. Shows heart-wood only. A fine, close, even-grained, very hard, and ponderous wood, of a bright red chestnut colour, remarkable for its isolated lunate black spots, which, however, sometimes assume an irregular form; susceptible of a high polish; from the River Demerara.

In the printed Catalogue accompanying the collection, this wood is stated to be the "heart-wood of the Itikiribouraballi;" on comparing it with the specimens of the latter, Nos. 104, and 104*a*, it is manifest that the two woods are totally distinct. Mr. Bee, to whom the circumstance was pointed out, confirmed this fact, observing that the specimens of Tiger-wood now under consideration were cut from a tree undoubtedly specifically distinct from that which yields the Itikiribouraballi.

36. Too Roo. [115, 115*a*.] A species of palm; from the River Demerara.

It grows to the height of from 50 to 70 feet. Its woody outside is used by the cabinet-makers for inlaid work, walking-sticks, billiard-cues, &c.

37. Torch-wood. [114.] – Supposed to be obtained from a species of *Amyris*, or *Icica*. When beaten so as to separate the fibres, the branches are used as torches by the Indians.

38. Towraneroo, or Bastard Bully tree. [117*p*, 117*q*.] Shows a diameter of 10 inches. In bark. A fine, close, even-grained, hard, heavy wood; from the River Demerara.

It is very plentiful, and is used for framing-timber, spokes, &c. It will square 25 inches, from 40 to 50 feet long. The specimens sent are from a tree supposed to be about 50 years old.

39. Wadaduri, or Monkey-pot tree (*Lecythis grandiflora*, Aubl.) [117*h*, 117*i*.] Shows a diameter of 10 inches. In bark. A close-grained, tolerably hard, and heavy wood, presenting, however, numerous open cells; heart-wood bright amber yellow, recent layers narrow, white; from the River Demerara.

The tree which produces this timber, is the *Lecythis grandiflora*, Aubl., and is plentiful. The wood is used for furniture, staves, &c. The specimens sent are from a tree supposed to be about 25 years old.

40. Wamara, or brown ebony. [88, 88*a*.] Shows a diameter of 12 inches. In bark. A remarkably fine, close-grained, hard, heavy wood. Heart-wood of a beautiful deep Vandyke brown; recent layers broad (3 inches), dirty yellow. From the River Demerara.

This wood is hard and cross-grained, consequently not apt to split; it would, therefore, answer various purposes in naval architecture. It may be had from 6 to 12 inches square, and from 40 to 60 feet long. The Indians make war-clubs of it. The specimens sent are from a tree supposed to be about 20 years old.

41. Wallaba (*Eperua falcata*, Aubl.) [90, 90*a*.] Shows a diameter of 9 inches. In bark. Wood hard and heavy, though rather open-grained. Duramen bright red-brown; recent layers narrow, pale reddish-yellow. From the River Essequibo.

This wood is produced from a tree very abundant throughout the colony. It is hard, splits freely, and is very durable from being impregnated with a resinous oil. It is used for house-frames, palings, shingles, staves, &c. It has been ascertained that a roof well shingled with this wood will last upwards of 40 years. It may be had from 15 to 20 inches square, from 30 to 40 feet long.

WOODS OF BRITISH GUIANA—*continued.*

42. **Warracoeri, or white cedar** (*Icica altissima*, Aubl.) [105, 105*a*, 105*b*, 105*c*.]	Shows a diameter of 7 inches. In bark. An open-grained, soft, light, white wood; from River Demerara, and from River Mahaica, east sea cost, Demerara. This wood is obtained from *Icica altissima*, Aubl. It is light, easily worked, and very aromatic. Sir Robert Schomburgk states that one of his canoes, 42 feet long and 5½ feet wide, was made from a tree of this species. It is used for oars and paddles, and for boards for inside work of houses. During the American war it was used for staves of sugar hogsheads.
43. **Yaruri, or paddle-wood** (*Aspidosperma excelsum*, Benth.) [97, 97*a*, 97*b*.]	In bark. A very hard, close-grained, light wood, of eccentric growth; from the River Demerara. This wood is obtained from *Aspidosperma excelsum*, Benth. The whole tree, from 5 to 6 feet in diameter, and to the first branches, about 50 feet in height, has the appearance of being fluted, or as if it consisted of a faciculus of numerous slender trees. The fluted projections of the trunk are used by the Indians for the construction of their paddles. The wood is light, elastic, and very strong, and preferred to any other for cotton gin-rollers.
44. **Yarri-yarri, or Lance-wood** (*Duguetia quitarensis*, Lindl.) [113, 113*a*.]	Specimen affording no clue to diameter. A light, yet fine, close-grained, and tolerably hard wood; from the River Demerara. This tree is stated by Schomburgk, to be *Duguetia quitarensis*, Lindl., a slender tree found in tolerable abundance in the interior of the colony. The wood possesses much toughness and elasticity, and is used for gig-shafts, and when small, for whip-handles and fishing-rods. The Indians make their arrow-points of it. It grows from 4 to 6 inches diameter at the lower end, and from 15 to 20 feet long.

A table made of the ornamental woods of Guiana, and containing 82 different woods, is also exhibited; the specimens being of course small, and covered with varnish, it is not possible to identify more than a very few of them; the following is a list of them, and contains a large number not mentioned in the preceding list of larger specimens:—

1. Armiosi.
2. Assepoca.
3. Akarnki.
4. Arawica.
5. Acourib root.
6. Brown silverballi.
7. Bannia.
8. Bartaballi.
9. Bangro, or ebony.
10. Bully tree.
11. Crab wood.
12. Contaballi.
13. Caraharri.
14. Ceffre.
15. Canuballi.
16. Cabacalli.
17. Curbacalli.
18. Calabash.
19. Cabbage tree.
20. Canella.
21. Ducalaballi.
22. Determa.
23. Ducalli.
24. Gomarrow.
25. Guava.
26. Greenheart.
27. Huwassi.
28. Hymakusi.
29. Hooboballi.
30. Hyawaballi.
31. Hiaballi.
32. Hya hya.
33. Hackia.
34. Itikiribouraballi.
35. Kretti, or bastard silverballi.
36. Kurara.
37. Kakaralli.
38. Kartaballi.
39. Kamacusack.
40. Keria.
41. Kamakasa.
42. Kucahara.
43. Kimaasamasa.
44. Kurahara.
45. Kuracurara.
46. Kopassa.
47. Lana.
48. Locust.
49. Logwood.
50. Letter wood.
51. Light silverballi.
52. Masaranuni.
53. Murwaana.
54. Mora.
55. Purpleheart.
56. Pritti.
57. Red cedar.
58. Rosewood.
59. Sand Mora.
60. Saouri.
61. Simaruba.
62. Suradanni.
63. Saka.
64. Siridani.
65. Silberdani.
66. Turiballi.
67. Tatabo.
68. Tabiecushi.
69. Towraneroo.
70. White cedar.
71. Waiki.
72. Wamara.
73. Wadaduri.
74. Wild orange.
75. Washiba.
76. Wara couri.
77. Wallaba.
78. Waremia.
79. Yellow silverballi.
80. Youraballi.
81. Yerara.
82. Yarri yarri.

WOODS OF BAHAMA.

A fine series of the woods of Bahama is included in the collection of raw produce from that colony. The specimens contributed by Messrs. BAINES (p. 976) were deemed worthy of Honourable Mention.

1. **Cedar** - - - - -	Is used principally in house-building, for door and window frames, piazza-posts, sills, girders, &c. It grows on several of the Bahama islands, but is found in greatest abundance on Andros Island; and its size, when full-grown, is from 16 to 20 feet in length, and 1 foot in diameter; it is generally cut 10 to 16 feet in length, and from 5 to 8 inches square: the branches are used for boats' timbers. This is one of the most durable of the Bahamian wood. A soft, fine, close-grained, rather light wood, possessing the pink hue, and emitting the fragrant odour of the common pencil cedar.
2. **Cedar** - - - - -	This wood is used principally for picture-frames and other ornamented articles of cabinet-work; there is no difference between it and No. 1, except its curled and shaded appearance, which is said to be obtained by its growth in a very rocky soil.
3. **Horseflesh mahogany** -	Is principally used in house-building, the branches and crooked trees for ships' timbers; it is a very durable wood, and grows on several of the Bahama islands, but is found of large size, and in greater quantities at Andros Island, where it grows to about 20 feet in length and 2 feet in diameter; it is, however, seldom brought out of the woods of that size, from the want of proper means of conveyance. A hard, fine-grained wood, heavy, and exhibiting numerous open cells.
4. **Dogwood** - - - -	The principal uses made of this wood are for felloes of wheels and ships' timbers; from its toughness and other properties, it is better adapted to the former purpose than any other of the Bahamian woods. The tree does not attain any considerable size, and is generally crooked. A rather soft, open-grained, light, but evidently very tough wood.
5. **Stopper wood** - - -	Used principally for piles to wharfs, and for wheel-spokes; it is a very strong and durable wood; it grows from 12 to 16 feet long, and from 6 to 8 inches in diameter; it is found on all the Bahamian islands. An exceedingly hard, fine, close-grained, very heavy wood.
6. **Lignum** - - - -	This wood grows on several of the Bahama islands, and is generally exported to Europe and America, where it is used for sheaves to blocks, &c. The principal use made of it in the Bahamas is for hinges and fastenings for houses situated by the sea-shore, or in the vicinity of salt-ponds on the out-islands, where, from the quick corrosion of iron, hinges, &c., of that metal are seldom used.
7. **Bahama Satin wood** - -	This wood, commonly called yellow wood, grows abundantly on Andros Island, and others of the Bahamian group: it grows to a large size. A hard, fine, close-grained wood, showing on its polished surface a beautifully rippled pattern.

WOODS OF BAHAMA—*continued.*

8. Bahama Satin wood	Specimen of a deeper colour, showing a pretty mottled pattern.
9. Bahama mahogany	This wood, commonly called "Madeira," grows abundantly on Andros Island, and others of the Bahamas group, is not exceeded in durability by any of the Bahamas woods: it grows of a large size, but is generally cut of small dimensions, owing to the want of proper roads, and other means of conveyance; it is principally used for bedsteads, &c., and the crooked trees and branches for ships' timbers. A hard, fine, and rather close-grained, moderately heavy wood, of a fine rich colour, equal to that of Spanish mahogany, although probably too hard to be well adapted for the purposes to which this latter is usually applied.
10. Crab wood	Mostly used for picture-frames, walking-sticks, and small ornamented cabinet-work: it seldom grows larger than from 3 to 4 inches in diameter. A rather hard, fine, close-grained, moderately heavy wood; heart-wood of a beautiful veined Vandyke-brown, its external edge bright black, alburnum of a pure white.

A small collection of the woods of South America is exhibited by — DEACON. The specimens are very small, and amount to 39 in number; they include the calabash, ramwood, ebony, mahogany, sanden, green heart, box, fustic, rosewood, Brazillette, and various palms, &c.

WOODS OF TRINIDAD.

Some very beautiful specimens of ornamental and other woods are shown in the excellent collection of the raw produce of Trinidad, contributed by His Excellency Lord HARRIS, the Governor (see p. 71). They are as follows:—

1. Achras balata, L. (balata or valata).	A timber extensively used and much esteemed; diameter from 2 to 6 feet.
2. Achras (zapotilla or zapodilla).	
3. Achras, sp. (acoma or mastic).	A timber held in high estimation, as indeed are all the woods derived from the present family of trees. It varies in diameter from 2 to 4 feet.
4. Acrocomia sclerocarpa (gru gru).	Yields beautiful veneers. A palm.
5. Astrocaryum aculeatum (gri gri).	Also appertaining to the order "Palmæ," and affording excellent veneers for ornamental purposes.
6. Brosimum guianense (letter-wood).	The tree which yields this beautiful wood never attains a large size; its recent layers are of an uniform yellowish-white colour. The heart-wood only is used.
7. Bucida Buceras (olivia)	A coarse-grained strong wood, principally employed for making shingles; its diameter ranges from 2 to 4 feet.
8. Carapa guianensis (carapa).	Bears a considerable resemblance to cedar, and is extensively used and much esteemed; diameter from 2 to 3 feet.
9. Cedrela odorata (West India cedar).	A very useful and ornamental timber, from 3 to 12 feet in diameter.
10. Cocos nucifera (cocoa-nut).	The cocoa-nut palm.
11. Copaifera officinalis (copai).	A beautiful and durable wood.
12. Cordia, sp. (sepe)	A light wood, resembling English elm, impregnated with a bitter principle, which preserves it from the attack of insects: it is much valued; diameter from 1 to 2 feet.
13. Crescentia Cujete (calabash).	A very strong tough wood; used in boat-building, and for various other purposes, where these qualities are required; is very abundant, and ranges in diameter from 1 to 2 feet.
14. Dalbergia, sp. (roble).	
15. Geoffroya inermis (l'angeline).	A strong hard wood, extensively used for naves of wheels, &c.
16. Grey mangrove.	
17. Guiacum officinale (guiacan).	Bois lizard.
18. Hæmatoxylon campechianum (log-wood).	
19. Hymenæa courbaril (courbaril).	West India locust: an abundant and valuable timber; diameter 2 to 6 feet.
20. Lecythis Idatimon (aguatagaro).	
21. Mimosa juliflora (yoke savan).	A very hard and useful wood.
22. Morus tinctoria (fustic, or bois d'orange).	
23. Paltivia.	
24. Purple-heart	An abundant and useful timber, 2 to 4 feet in diameter.
25. Rhopala montana (aguatapana)	A very durable and curious wood, suceptible of a fine polish, 18 inches to 3 feet in diameter.
26. Sideroxylon (sp. ?) (iron-wood, or bois gri).	
27. Swietenia mahogani (mahogany).	
28. Tapana	A very strong and tough wood, esteemed for felloes of wheels.
29. Tecoma poui (green poui)	These trees, belonging to the natural order "Bignoniaceæ," furnish the hardest and most durable of woods; their timber takes a fine polish, and has a peculiar colour; they furnish the favourite timbers of the colony, are very abundant, 3 to 4 feet diameter, and proportionably lofty.
30. Tecoma serratifolia (grey poui).	
31. Tecoma sp. (black poui).	
32. Yoke	A handsome wood, resembling mahogany, usually 2 to 3 feet diameter.

A very fine large specimen of "cedrela wood," or West Indian cedar (*Cedrela odorata*), from Trinidad, is exhibited by T. Y. C. BURNETT; this was deemed worthy of Honourable Mention.

The collection of Australian and Van Diemen's Land woods is extensive and very interesting, many of the woods being new, and some of them of remarkable beauty.

Amongst the specimens from New South Wales, must be mentioned the samples of Briggalo or Bricklow, probably a variety of *Acacia*, exhibited by J. G. BIDWELL (1A, p. 989); and two small collections, contributed by Messrs. DAY (2, p. 989), and by W. FRANCIS; the latter being intended as samples of woods suitable for railway sleepers, and similar engineering purposes. Messrs. DAY's series consists of

1. Black butt.
2. Box.
3. Beef-oak (Casuarina).
4. Cedar.
5. Colonial ash.
6. Iron bark.
7. Myrtle, white.
8. Sycamore.

Mr. W. FRANCIS's collection and that of Messrs. DAY were deemed worthy of Honourable Mention. It contains:

1. Australian box.
2. ,, turf-wood.
3. ,, mahogany (Eucalyptus, sp.)
4. Blue gum.
5. Black butt.
6. Forest-oak (Casuarina, sp.)
7. Flooded gum (Eucalyptus, sp.)
8. Iron bark, grey.
9. ,, red.
10. Swamp oak (Casuarina, sp.)
11. Stringy bark (Eucalyptus, sp.)

WOODS OF WESTERN AUSTRALIA.

In the interesting and valuable collection of the Colonization Assurance Company, already alluded to (see p. 8), are some fine specimens of the woods of the country, including some remarkable pieces of Eucalyptus wood. It is however stated, that owing to the period of the year when they were collected, the short time which could be devoted to their preparation, and the want of proper saws, &c., the specimens sent are not to be considered as fairly representing the woods of this part of the country. The woods sent are—

1. Banksia, sp. – – –	Abundant throughout the colony; a very ornamental wood; the specimen sent is from Guildford.
2. Cypress – – – –	Abundant on Garden Island, Rottnest, and also in some places on the mainland.
3. Jam-wood – – – –	A species of Acacia, commonly called "raspberry-jam wood," in consequence of its peculiar odour, resembling raspberries. It grows abundantly throughout the settled districts; it is well adapted for turning, and as it takes a very high polish, is suitable for all sorts of cabinet-work.
4. Jarrah (Eucalyptus, sp.)	This excellent wood, considered to be admirably adapted for ship-building, and indeed for all other purposes, as it withstands the attacks of the white ant and the teredo, &c., can be obtained in any quantity; it may be had in planks, 8 feet wide. The plank exhibited was cut by W. P. Clifton, and is more than 4 feet wide.
5. Morrell (Eucalyptus, sp.)	Said to be a most excellent wood, both for cabinet-work and for treenails. It is abundant in some parts, about 60 miles from the sea-shore; grows to a great height, and attains a diameter of more than 3 feet. For the manufacture of spokes and other wheelwrights' work it is excellent.
6. Red ebony (?) – – –	Said to be very abundant at Sharks' Bay, and along the sea-coast; this wood is very different from the red ebony exhibited from Port Natal.
7. Red gum (Eucalyptus resinifera).	The tree is very abundant throughout the colony, and the wood is admirably adapted for wheelwrights' work.
8. Salmon bark (Eucalyptus sp.).	A good durable wood, much used for farming implements. It is tolerably abundant in York district, and grows to a considerable size.
9. Sandal-wood – – –	Abundant in the settled districts beyond the Darling range, at a distance of about 50 miles from the sea-coast. It has lately been discovered, of a very superior quality, on the coast at Sharks' Bay.
10. Satin-wood – – –	Occurs in the island of Rottnest.
11. She-oak (Casuarina) –	Very abundant.
12. Tuart (Eucalyptus, sp.) –	A noble timber; tolerably abundant on the coast, and said to be well adapted for ship-building and general purposes. The plank exhibited is more than 3 feet wide, and is contributed by W. P. Clifton, of Bunbury. Planks, some 10 feet wide, may be obtained.
13. York gum (Eucalyptus, sp.)	Excresences formed on the stem of this and also of some other Eucalypti, similar to the "Kaya boku" of the Lingoa wood, and like it, well adapted for fancy cabinet-work. It is stated that the exhibitors had hoped to have procured and sent a plank of the Blue gum (Eucalyptus globulus) from the Deep river, 14 feet in width, but were unable to do so, for want of saws of sufficient size.

A very remarkable and interesting collection of the woods of Van Diemen's Land, is formed by the contributions of His Excellency Sir W. T. DENISON, Messrs. FOWLER, WHITESIDES, MCNAUGHTEN, HADDEN, BROWNRIGG, and HOOD. To each of these the Jury severally awarded a Prize Medal The specimens shown are as follows:—

BROWNRIGG.—Musk-wood (107, 108, p. 994).

Sir W. T. DENISON.—Blue gum, stringy bark, black wood, sassafras, myrtle, musk-wood, cedar, celery-pine, rose-wood, dog-wood, Norfolk Island pine, white oak, iron-wood, and maple (1, p. 992).

FOWLER, of Maria Island.—Dog-wood, musk-wood, he-oak, and Tasmanian iron-wood (82-89, p. 994).

Capt. W. C. HADDEN.—Musk-wood (103, 104, p. 994).

R. V. HOOD.—Silver wattle, musk-wood, black-wood, Huon pine, and myrtle (111-120, p. 994).

MCNAUGHTEN, of Hobart Town.—Musk-wood (209, p. 996).

J. MILLIGAN.—Richea-wood, pink-wood, and Oyster-bay pine (341, 342, p. 999).

WHITESIDES, of Hobart Town.—Black-wood, myrtle-wood, and musk-wood (91-93, p. 994).

A remarkably large section of iron-wood is exhibited by EUSTON and MILLIGAN (105, p. 994); specimens of the Tolosa tree, honeysuckle, and she-oak, by H. HULL (208, p. 996); of oak, myrtle, cherry, and honeysuckle, by the Rev. E. FREEMAN, of Brown's River (210, p. 996); of blue gum and maple by — QUIN, of Hobart Town (94, 95, p. 994); and of Norfolk Island pine, by Lieut. AKERS, R.E. (328, p. 998). Each of these was deemed worthy of Honourable Mention.

These various woods are arranged in the following table. One of the most remarkable of the specimens shown is the blue gum exhibited by Sir W. DENISON; it consists of two pieces, one a section of the tree just above the surface of the ground, and about 6 feet in diameter; the second a section of the same tree, 134 feet from the preceding one, and which measures about 2½ feet across.

WOODS OF VAN DIEMEN'S LAND.

1. Black-wood (Acacia melanoxylon).	A very hard, close-grained, dark, and richly-veined wood; it is well adapted for cabinet-work of all sorts, and may be had in any quantity, and of large size. The beauty of this fine wood is admirably shown in some of the articles of furniture exhibited, in which its dark hue is well contrasted with the equally beautiful light wood of the Huon pine.

WOODS OF VAN DIEMEN'S LAND—*continued.*

2. Blue gum (Eucalyptus globulus).	An enormous tree: it is said to be equal to oak for ship-building, and may be obtained in beams of any dimension up to 200 feet in length. It appears somewhat premature to speak very decidedly of the value of this comparatively new wood, but, from the practical results already obtained, it certainly promises to be a most important material for the ship-builder. A blue gum tree near Tobosa, on the northern aspect of Mount Wellington range, measured upwards of 30 feet in diameter at the base; and this is by no means unusually large for the trees of this species. According to the Rev. Mr. Ewing, a swamp gun-tree has been measured 102 feet in circumference, at 3 feet from the ground.
3. Cedar, or Pencil pine (Arthrotaxis selaginoides?).	It grows in the mountain ravines and gorges, and in the high table-land about 4000 feet above the level of the sea.
4. Celery pine (Phyllocladus aspleniifolia).	A handsome tree, which grows in the cold and moist parts of Van Diemen's Land, and attains a height of 150 feet. The wood is close-grained, and beautifully white; it is well adapted for household purposes.
5. Cherry (Exocarpus cupressiformis).	A small graceful tree with lively green foliage: thinly scattered on the eastern side of the colony. It is useful as a cabinet wood, and forms good ornamental veneers.
6. Dog-wood (Bedfordia, sp.)	This tree attains to considerable size in Maria Island; the wood is very richly and beautifully marked, it is consequently an excellent cabinet wood, and well adapted for all sorts of ornamental work.
7. Honeysuckle (Banksia australis).	A low shrubby tree; the wood is handsome, and useful for cabinet work and for veneering. The bark is employed in tanning.
8. Huon Pine (Dacrydium Franklinii).	A most remarkably beautiful light-coloured wood, singularly marked with dark spots, especially towards the lower part of the stem: admirable for ornamental furniture.
9. He-oak (Casuarina stricta).	A low tree, of no great beauty or value, which grows upon the open grounds.
10. Iron-wood (Notilia ligustrina).	A tree which rarely attains a greater diameter than 12 to 14 inches; the specimen exhibited, however, is nearly 2 feet. The wood is very hard and dense, and has been consequently made into sheaves for ships' blocks.
11. Iron-wood of Norfolk Island (Olea apetala).	Said to be the most durable of all the Norfolk Island woods.
12. Maple of Norfolk Island.	
13. Musk-wood (Eurybia argophylla).	A comparatively small tree, which grows only in dense forests and close, damp situations. The wood is close-grained, very beautifully marked, especially at the lower part of the butt, and takes a fine polish. It is most admirably adapted for veneering and other cabinet-work.
14. Myrtle (Fagus Cunninghamii).	This tree forms dense forests in parts which extend for many miles; the tree sometimes attains a girth of 30, or even 40 feet, and a proportionate height. The wood is hard, very close-grained, and has a fresh pink or red colour. The lower part of the stem is often very beautifully veined, rendering it excellent for cabinet-work; it takes a beautiful polish.
15. Pine, Oyster-bay (Callitris australis).	Grows only on the eastern coast. The wood is used for internal fittings in houses, and for agricultural implements.
16. Pine, Norfolk Island (Araucaria excelsa).	Very transparent in thin pieces; a good wood for turning.
17 Pink-wood (Carpodontos lucida).	Grows chiefly on the western side of the island, in the dense myrtle forests. It attains a height of 100 to 150 feet, with a clear straight stem. The wood is fine-grained, and very hard; it has been used for the sheaves of ship blocks.
18. Richea-wood (Richea pandanifolia).	Grows only in the dense moist forests on the western side of the island; attains a height of 30 or 40 feet, and a diameter of 10 inches.
19. Rose-wood, or Zebra-wood (Acacia, sp.)	Said to be plentiful in Lake country, and about Marlborough.
20. Sassafras-wood (Atherosperma moschatum).	A moderate-sized tree; very abundant. The wood is soft, even, and close-grained; well adapted for internal building, flooring-boards, cabin-fittings, &c.; it turns well.
21. She-Oak, or Beef-wood (Casuarina quadrivalvis).	A hard and beautifully-marked cabinet-wood; it takes a high polish.
22. Silver wattle (Acacia dealbata).	
23. Stringy-bark (Eucalyptus robusta).	An enormous tree; very abundant. A stringy-bark tree, near the Cam river, on the north-west coast, measures 200 feet to the first limb, and has been calculated to contain in the trunk alone 225 tons of timber. The wood is rather coarser than that of the blue gum, and is chiefly used for house and ship-building, and for fencing; it is especially esteemed for treenails.
24. White-wood (Pittosporum bicolor).	Seldom acquires a greater diameter than a foot. The wood has a remarkably close even grain, and might therefore, perhaps, be employed by wood-engravers. It is used by the natives for their "waddies," or war-clubs.
25. White Oak of Norfolk Island (Hibiscus Patersonii).	

A valuable little collection of the woods of New Zealand is contributed by TAO NUI, a native chief (44). For these the Jury awarded a Prize Medal.

Two small collections of the woods of New Zealand are exhibited by J. JOHNSON (21, p. 1001), and by W. FOX. These were deemed worthy of Honourable Mention.

WOODS OF AMERICA.

The collection of American woods is by no means numerous. It consists of two separate series, and a few isolated specimens; the series contributed by R. J. PELL, of New York (115, p. 1440), consists of 167 specimens; unfortunately, however, many of these are cut from small branches or young trees, and do not therefore well show the characters of the wood; it was, nevertheless, deemed worthy of Honourable Mention.

1. Acer striatum	Moose wood.
2. Acer	Bird's-eye maple.
3. Abies canadensis	Hemlock spruce.
4. Acer eriocarpum	White maple.
5. Acer saccharinum	Sugar maple.
6. Boxwood.	
7. Blue dogwood.	
8. Betula populifolia	White birch.
9. Cupressus juniperus	Cypress cedar.
10. Castanea vesca	American chestnut.
11. Cerasus virginiana	Wild cherry.
12. Carya tomentosa	Common hickory.
13. Diospyros	Persimon

WOODS OF AMERICA—*continued.*

14.	Fagus ferruginea	Red beech.
15.	Gleditsia triacanthus	Sweet locust
16.	Horseflesh-wood.	
17.	Ilex opaca	Holly.
18.	Juniperus Sabina	Cedar.
19.	Juglans nigra	Black walnut.
20.	Juglans squamosa	Shell-bark hickory.
21.	Juniperus virginiana	Red cedar.
22.	Laurus sassafras	Sassafras.
23.	Liquidambar styracifluar	Gum tree.
24.	Liriodendron tulipifera	Tulip tree.
25.	Ornus rotundifolia	Manna ash.
26.	Pinus mitis	Yellow pine.
27.	Pinus Strobus.	
28.	Pinus rubra	Red pine.
29.	Platanus occidentalis	Plane tree.
30.	Quercus palustris	Pine oak.
31.	Quercus alba	White oak.
32.	Quercus Prinos monticolo	Rock chestnut oak.
33.	Quercus Prinos acuminata	Yellow oak.
34.	Quercus virens	Live oak.
35.	Swietenia.	
36	Thuia occidentalis	White cedar.
37.	Tilia americana	Bass wood.
38.	Ulmus rubra	Red elm.

Specimens in Bark.

1.	Ailanthus.	
2.	Acer saccharinum	Sugar maple.
3.	Acer rubrum	Scarlet maple.
4.	Alnus serrulata	Common alder.
5.	Acer Negundo	Box elder.
6.	Amygdalus Persica	Peach.
7.	Acer grandidentatum	Mountain maple.
8.	Acer rubrum	Scarlet maple.
9.	Æsculus rubicunda	Red flowering chestnut.
10.	Alnus serrulata	Hazel-leaved alder.
11.	Abies	Hemlock.
12.	Acer eriocarpum	White maple.
13.	Alnus glauca	Black alder.
14.	Abies nigra	Black spruce.
15.	Acacia.	
16.	Betula lenta	Black birch.
17.	Betula papyracea	Canoe birch.
18.	Betula rubra	Red birch.
19.	Betula populifolia	White birch.
20.	Blue dogwood.	
21.	Carya microcarpa	Nutmeg hickory.
22.	Castanea vesca	American chestnut.
23.	Cerasus virginiana	Wild cherry.
24.	Cornus alba	White dogwood.
25.	Carya pecan	Pecan-nut hickory.
26.	Carya porcina	Bitter-nut hickory.
27.	Carpinus	Hornbeam.
28.	Castanea alnifolia	Dwarf chestnut.
29.	Corylus avellana	Hazle.
30.	Carya pecan	Pecan-nut hickory.
31.	Cratægus coccinea	Scarlet thorn.
32.	Castanea alnifolia	Red flowering chestnut.
33.	Cratægus populifolia	Washington thorn.
34.	Carya microcarpa	Small-fruited hickory.
35.	Carpinus Ostyra	Iron wood.
36.	Carya porcina	Pig-nut hickory.
37.	Cytisus	Laburnum.
38.	Cerasus borealis	Red cherry.
39.	Carya amara	Butter-nut hickory.
40.	Carpinus	Hornbeam.
41.	Celtis crassifolia	Hackberry.
42.	Cercis	Judas tree.
43.	Fraxinus	White ash.
44.	Fraxinus sambucifolia	Black ash.
45.	Fagus ferruginea	Red beech.
46.	Fraxinus	Common ash.
47.	Fagus sylvestris	White beech.
48.	Fraxinus viridis	Green ash.
49.	Fraxinus acuminata	Witch elm.
50.	Fraxinus	White ash.
51.	Hibiscus syriacus	Althæa frutex.
52.	Imperialis.	
53.	Juniperus occidentalis	Juniper.
54.	Juniperus rubra	Red cedar.
55.	Juglans castanea	Butter nut.
56.	Juglans nigra	Black walnut.
57.	Laurus benzoin	Spice-wood.
58.	Laurus sassafras	Sassafras.
59.	Lady apple..	
60.	Larix americana	Black larch.
61.	Larix rubra	Red larch.
62.	Liquidambar styraciflua	Gum tree.
63.	Liriodendron tulipifera	Tulip tree.
64.	Morus alba	White mulberry.
65.	Morus nigra	Black mulberry.
66.	Morus rubra	Red mulberry.
67.	Morus	Mulberry.
68.	Maclura aurantiaca	Osage orange.
69.	Magnolia glauca.	
70.	Magnolia grandiflora.	
71.	Magnolia acuminata	Cucumber magnolia.
72.	Malus	Apple.
73.	Nyssa biflora	Pepperidge.
74.	Nyssa capitata	Sour tupelo.
75.	Ornus rotundifolia	Manna ash.
76.	Punica granatum	Pomegranate.
77.	Populus argentea	Cotton tree.
78.	Populus tremuloides	Aspen poplar.
79.	Populus angulata	Common poplar.
80.	Populus alba	White poplar.
81.	Populus balsamifera	Balsam poplar.
82.	Platanus occidentalis	Plane tree.
83.	Pearmain apple.	
84.	Pinus mitis	Yellow pine.
85.	Pinus Strobus	White pine.
86.	Pinus ruspestus	Grey pine.
87.	Pinus australis	Long-leaved pine.
88.	Prunus americana	Wild plum.
89.	Prunus domestica	Plum.
90.	Prunus Armeniaca	Apricot.
91.	Prunus cerasus	Cherry plum.
92.	Pyrus vivulans	Crab apple.
93.	Pyrus communis	Pear.
94.	Pyrus Cydonia	Quince.
95.	Philadelphus syringa	Lilac.
96.	Quercus ferruginea	Black oak.
97.	Quercus Prinos monticola	Rock-chestnut oak.
98.	Quercus olivæformis	Mossy-cup oak.
99.	Quercus Phellos	Willow oak.
100.	Quercus Prinos acuminata	Yellow oak.
101.	Quercus Prinos discolor	Swamp white oak.
102.	Quercus palustris	Pine oak.
103.	Quercus rubra	Red oak.
104.	Quercus Phellos	Willow oak.
105.	Quercus ambigua	Grey oak.
106.	Quercus Banisteri	Bean oak.
107.	Quercus alba	White oak.
108.	Quercus heterophylla	Bartram oak.
109.	Rhus	Sumach.
110.	Rhamnus maritima	Buckthorn.
111.	Rhus rubra	Red sumach.
112.	Robinia Pseudacacia	Yellow locust.
113.	Salix alba	White willow.
114.	Salix lucida	Shining willow.
115.	Salix lutea	Yellow willow.
116.	Salix triandra	Basket willow.
117.	Salix nigra	Black willow.
118.	Sorbus Aucuparia	Mountain ash.
119.	Salix vitellina	Common willow.
120.	Summer queen apple.	
121.	Silver abeille.	
122.	Spitzenburgh apple.	
123.	Sambucus	Elder.
124.	Tilia alba	White lime tree.
125.	Thuia occidentalis	White cedar.
126.	Ulmus rubra	Red elm.
127.	Ulmus alba	White elm.
128	Vitis vinifera	Grape vine.
129.	Viburnum.	

The second collection, that exhibited by the Rev. Z. Thompson, of Burlington (241, p. 1451), consists of better-selected specimens of the woods of Vermont, and is accompanied by a good series of descriptive labels, reprinted from his own useful work on the "Natural History of Vermont," conveying a good deal of valuable local as well as scientific information: for this collection the Jury awarded a Prize Medal.

Woods of Vermont.

1.	Acer rubrum	Red maple.
2.	Acer saccharinum	Sugar maple.
3.	Betula excelsa	Yellow birch.
4.	Carya squamosa	Shell-bark hickory.
5.	Cerasus serotina	Black cherry.
6.	Fagus ferruginea	Red beech.

WOODS OF AMERICA—*continued.*

7. **Fraxinus acuminata**	White ash.
8. **Fraxinus pubescens**	Red ash.
9. **Fraxinus sambucifolia**	Black ash.
10. **Juglans cinerea**	Butter-nut.
11. **Juniperus virginiana**	Red cedar.
12. **Ostrya virginica**	Iron-wood.
13. **Pinus balsamea**	Silver or balsam fir.
14. **Pinus canadensis**	Hemlock.
15. **Pinus nigra**	Double spruce.
16. **Pinus resinosa**	Norway pine.
17. **Pinus Strobus**	White pine.
18. **Platanus occidentalis**	Button wood, or sycamore.
19. **Robinia pseudacacia**	Locust wood.
20. **Thuja occidentalis**	White cedar, or arbor vitæ.
21. **Tilia americana**	Bass-wood, or lime-tree.
22. **Ulmus americana**	White elm.
23. **Ulmus fulva**	Red or slippery elm.

A few good specimens of the chief woods of Maryland are also exhibited by the MARYLAND COMMITTEE (371, p. 1459), consisting of ash, beech, cedar, cherry, hickory, holly, locust, maple, mulberry, oak, pine, poplar, and walnut; these were deemed worthy of Honourable Mention. (See p. 71.)

Specimens of Palmetto cedar, live oak, and a few other woods, are exhibited by E. B. BELL, of Charleston, South Carolina (176, p. 1448*); these also were deemed worthy of Honourable Mention. It is hardly necessary to advert to the importance of the wood of the live oak, *Quercus virens*, its value as a ship timber being universally known and recognised.

1. Acer eriocarpum	White maple.
2. Acer saccharinum	Sugar maple.
3. Carya tomentosa	Common hickory.
4. Diospyros, sp.	Persimon.
5. Fagus ferruginea	Red beech.
6. Gleditschia triacanthos	Sweet locust.
7. Horse-flesh.	
8. Ilex opaca.	
9. Juglans nigra	Black walnut.
10. Juniperus Sabina	Cedar.
11. Juniperus virginiana	Red cedar.
12. Pinus Strobus	White pine.
13. Quercus alba	White oak.
14. Quercus Prinos acuminata	Yellow oak.
15. Quercus Prinos monticola	Rock chestnut oak.
16. Quercus virens	Live oak.

A sample of sweet gum-wood is contributed by J. B. DE SAUSSURE, of Charleston (176A. p. 1448).

The only specimens of wood exhibited in the Austrian Collection are a series of pine planks, *Abies taxifolia*, as prepared for the uses of musical-instrument makers, chiefly for sounding-boards, shown by D. BIENERT and SONS, of Maderhaüsen (143, p. 1015.) The wood of this tree is remarkably homogeneous, and when fairly grown, is peculiarly free from knots, or irregularities of any kind; it possesses in an eminent degree those qualities which are essential for sounding-boards. A section of a tree more than 3 feet in diameter is shown, in which upwards of 470 concentric rings, or circles, can be counted; from this it is presumed that the tree must have been nearly five centuries old. These specimens were deemed worthy of Honourable Mention.

WOODS OF CHINA.

A numerous collection of the woods of China is exhibited by the Rev. Dr. PARKER (12, p. 1422). It is much to be regretted that these specimens are so small as scarcely to show the characters of the woods; many of the specimens have no labels, and of those which have, a considerable number are evidently incorrectly named; the following is a list of the labels:—

1. Canton rosewood.		
2. Chan muh	Pine-wood.	
3. Chang muh	Camphor-wood.	
4. Chau muh		
5. Chung tu	– –	An inferior kind of pine.
6. Ebony.		
7. Hwang jung muh	Yellow Dryandra.	
8. „ muh	Yellow-wood.	
9. Hwa Nien	Averrhoa Carambola.	
10. Isz King muh	Thorn-wood.	
11. Kan muh	– –	Wood of the Coolie orange.
12. Kau muh.		
13. Kuin tien kuh	– –	A fine wood for cabinet-work.
14. Kih now muh.		
15. Kung muh	Tallow tree (?)	
16. Kwang lang	Dryandra, sp.	Used for rhills of sedans.
17. Lew muh	Willow.	
18. Lung yen muh	Dimocarpus jungyen.	
19. Lan muh	Canarium Pimela	Wood of the Chinese olive.
20. Ma me muh	– –	A resinous pine.
21. Mango-tree wood.		
22. Mei muh	Apricot-wood.	
23. Muh mien	Bombax Ceiba	Wood of the cotton-wood tree.
24. Nan-chi-muh	– –	A fine wood from Cochin China.
25. Oil-wood.		
26. Pah-muh	Cedar (?)	
27. Plum-wood	– –	Used for cutting blocks for books. (rather coarse.)
28. Pride of India	Melia Azaderachta.	
29. Red-wood.		
30. Rose-wood	– –	From Siam.
31. Sandal-wood.		
32. Sang muh	Mulberry.	
33. Satin-wood.		
34. Shan cha	Wild tea	A lofty tree.
35. „ che.		
36. „ muh	Pride of India.	
37. Sha tea muh	– –	A kind of willow.
38. Shui sha muh	– –	Used for coffins.
39. Siang iz muh	Maple.	
40. Sung muh	Fir.	
41. Tan hiang muh	Sandal-wood.	
42. Tau kwa san	Peach flower. Pride of India	Called "China mahogany," at Canton.

WOODS OF CHINA—*continued.*

43. Tsung muh	Fir	Used for fuel and boxes.
44. Tu muh	Pine	Used for furniture.
45. Varnish-wood	Cannaium alba.	
46. Woo tung	Dryandra cordifolia	Wood used for musical instruments.
47. Wu tung muh	,, ,,	
48. Ying muh	Knot-wood, or Amboyna-wood.	
49. Ying	– –	Sapwood of a kind of beech.
50. Yung muh	– –	Wood of the bastard banian.

WOODS OF EGYPT.

Fine specimens of the chief woods of Egypt are shown in the collection of Egyptian raw produce; the specimens are very good, and their interest is still further increased by their being accompanied by some of the agricultural and other implements made from them. The "Bois de Nabh," a hard, dark-coloured wood, resembling ebony, appears likely to be useful. The Acacia wood also seems to be a useful durable wood. The woods shown are:—

1. Acacia.
2. Alizier wood.
3. Azaderak.
4. Date.
5. Doum palm. Cucifera Thebaica.
6. Ebony of Sennar.
7. Sweet palm.
8. Sycamore. Ficus Sycamorus.

WOODS OF ALGERIA.

A highly-valuable collection of the woods of Algeria is shown in the Algerian Department of the French Collections. These specimens are remarkable for their beauty, and for the skilful and instructive manner in which they are exhibited. Some of them are rather small, but in all cases they are characteristic and well selected. Some of the woods are comparatively new to this country. They are as follows:—

1. Thuya-articulé; an evergreen tree	Thuja articulata, Desf.? 6 × 5 × 2. Close grain, hard, heart-wood (duramen) bright chestnut-coloured, resinous; recent layers (alburnum) cream-yellow. This wood is supposed by some to be the "sandal-wood" of the ancients.
2. Pin pinier; an evergreen tree	Pinus Pinea, 6 × 2½ × 1½. Specimen from a young tree, in bark; a resinous wood.
3. Grand cyprès d'Italie; an evergreen tree.	Cupressus, sp. (?) 6 × 3½ × 2½; in bark; a resinous wood.
4. Ricin; a deciduous tree	Paliurus, (?) 6 × 4 × 2½; an exceedingly soft, light, weak wood; in bark. (Palma Christi, or Christ's thorn).
5. Jujubier sative	Ziziphus, sp. 6 × 5 × 2. An exceedingly close, fine-grained wood, heavy; heart bright-red chestnut, recent layers, pale ochreous; in bark.
6. Aune; a deciduous tree	Alnus, 6 × 9 × 2; a light, though fine, and close-grained, soft weak wood, of an uniform reddish-yellow throughout; in bark.
7. Pin maritime; an evergreen tree	Pinus maritima, (?) 6 × 8 × 2, in bark; a resinous wood.
8. Saule fragile; a deciduous tree	Salix fragilis, (?) 6 × 1½ × 1½, in bark; a soft and weak wood.
9. Génevrier Phénicien	Juniperus Phœnicea, (?) 8 × 5 × 2. This specimen was cut from a portion of a tree having a diameter of about 9 inches only; in bark; from Zeralda.
10. Grand cyprès	Cupressus, sp., 9½ × 4 × 2, from a tree 1 metre in diameter; from the environs of Bledah.
11. Sumac Therèza	Rhus, sp., 9½ × 4 × 2. Wood heavy; its longitudinal section exhibits numerous open cells; in bark.
12. Jujubier des lotophages; a deciduous tree.	Ziziphus, sp., 6 × 1 × 1; in bark; a hard wood.
13. Phillyréa; a deciduous tree	Phillyrea, sp., 6 × 5½ × 2; a close-grained, hard, and heavy wood.
14. Lentisque commun	Pistacia, sp., 8 × 5 × 2½; a hard, heavy wood.
15. Chêne-zeen	——— 8 × 5½ × 2; a tree, a metre in diameter, from Edough.
16. Grand bruyère arborescente, evergreen tree.	——— 6½ × 2 × 2. Wood fine, close-grained, hard. (Tree-like heath.)
17. Cédre; an evergreen tree	Cupressus, sp., 6 × 6 × 2; in bark; resinous wood.
18. Figuier sauvage,—bois tendre à feuilles caduques; a deciduous tree.	Ficus Carica, 6 × 6 × 2; a soft and weak wood.
19. Pistachier-térebinthe; a deciduous tree.	Pistacia terebinthus, 8 × 6½ × 2. Wood close-grained, hard, heavy, and resinous.
20. Cytise	Cytisus, sp., 9 × 2½ × 1½. Wood fine and close-grained, hard, heavy; heart chestnut; recent layers narrowly white.
21. Tamaris; evergreen tree	Tamarix, 6 × 6½ × 2½, in bark; a resinous wood.
22. Saule-marceau; a deciduous tree	Salix., sp., 6 × 6 × 2; a fine-grained, soft, and weak wood; light wood, in bark.
23. Térébinthe, ou le faux pistachier	——— a large tree, 1·3 metre in diameter.
24. Caroubier	Cercis siliquastrum, 8 × 7 × 1, in bark; a tree, 9 in. in diameter, from Mouzaia.
25. Olivier sauvage	Olea, sp., 6 × 6 × 2, in bark; a tree, 10 inches in diameter, from Mouzaia.
26. Sorbier cormier; a deciduous tree.	Sorbus torminalis, 6 × 6½ × 2½; shows a diameter of about 11 inches; in bark; a hard wood.
27. Arbousier; an evergreen tree	Arbutus, sp., 6 × 7 × 2; shows a diameter of about 12 inches; in bark; a hard wood.
28. Arbousier	Arbutus, sp., 13 × 8½ × 1; bark on both longitudinal edges; a tree, 10 inches in diameter, from Mouzaia.
29. Cerisier sauvage; a deciduous tree	Prunus, sp, 6 × 6 × 2, in bark.
30. Erable Napolitain; a deciduous tree.	Acer, sp., 6 × 4 × 2, in bark; shows a diameter of about 5 inches only; a hard wood.
31. Laurier-rose; a deciduous tree	Nerium Oleander, 8 × 3½ × 2; fine and close grain, hard, though light; shows a diameter of about 6 inches; in bark.
32. Lierre; evergreen tree	Hedera, sp., showing diameter of about 3½ inches; a very light, soft, weak, open-grained wood.
33. Pin d'Alep; evergreen tree	Pinus, sp., 6 × 5 × 2½; shows a diameter of about 8 inches; in bark; a resinous wood.
34. Myrthe; evergreen tree	Myrtus, sp., 6 × 3 × 2; a fine, close, even-grained wood, hard and ponderous; in bark.
35. Prunelier sauvage; a deciduous tree.	Prunus, sp., 6 × 3 × 1¼; a fine, close-grained, hard, and rather heavy wood; in bark.

WOODS OF ALGERIA—*continued.*

37. Genèvrier-à-feuilles de cèdre; an evergreen tree.	Juniperus, 6 × 3½ × 2; shows a diameter of about 4 inches. Alburnum pure white, duramen dark chestnut; in bark; a resinous wood.
38. Houx; an evergreen tree – –	Ilex, sp., 6 × 3 × 2, in bark; shows a diameter of about 4 inches; a hard wood.
39. Laurier-sauce; an evergreen tree	Laurus, sp., 6 × 5 × 2; a light, soft, weak, open-grained wood; in bark.
40. Sumac des corroyeurs; an evergreen tree.	——— 6 × 2 × 1½; moderately hard, though light, weak, and open-grained; in bark.
41. Aubépine; a deciduous tree – –	Cratægus, sp., 6 × 6 × 2; a fine, close-grained, hard, and rather heavy wood; in bark.
42. Nerprun alaterne; an evergreen tree.	Rhamnus Alaternus, 6 × 5 × 2. A hard, and heavy, though open-grained wood; alburnum fine citron-yellow; duramen dark red-brown; in bark; shows a diameter of about 6 inches.
43. Citronnier; an evergreen tree –	Citrus Limonium, 6 × 2½ × 1½; shows a diameter of about 3½ inches; in bark; a hard wood.
44 Oranger; an evergreen tree – –	Citrus Aurantium, 6 × 5 × 2; shows a diameter of about 10 inches; in bark; a hard wood.
45. Blanc d'Hollande, a deciduous tree	——— 6 × 7 × 2½; a light, soft, weak, and open-grained wood; shows a diameter of about 11 inches; in bark.
46. Chêne à gland doux – – – –	Quercus, sp.
47. Chêne liege – – – – – –	Quercus Suber.
48. Chêne vert – – – – – –	Quercus Ilex.
49. Micocoulier – – – – –	Celtis.
50. Frêne – – – – – – –	Fraxinus.
51. Orme – – – – – – –	Ulmus.
52. Mûrier blanc – – – – –	Morus alba.
53. Jujubier domestique – – –	Ziziphus.

A numerous series of small specimens of the woods of the Upper Pyrenees, suitable for cabinet-work, is also exhibited (St. UBERY, 1495, p. 1248). They are valuable chiefly as showing the grain and character of the different woods, when polished and varnished, and as employed by cabinet-makers. The Jury awarded a Prize Medal for this collection.

Specimens of acacia wood, as employed for machinery, are exhibited by MOUSSILLAC-AMAND, of La Réole (933, p. 1224); these were deemed worthy of Honourable Mention.

Some very interesting specimens of preserved wood are shown by I. A. BOUCHERIE (1104, p. 1230), in illustration of his process of protecting timber from decay, dry-rot, and the attacks of insects.

The remarkable experiments of Dr. Boucherie, on the absorption of saline and other solutions by trees, are well known, and excited very general interest about ten years since. He has, for a long time, been engaged in an extended and minute series of experiments on wood, the object of which was to ascertain the substance best fitted to preserve timber from decay, and to discover the most economical mode of practically applying it on the large scale. The peculiar feature of Dr. Boucherie's original process consisted in the mode in which he availed himself of the vital power of the tree; for, following up the suggestions of Hales, Duhamel, and others, he arrived at the conclusion that it is far easier to impregnate wood with any desired solution when the plant is still full of its own natural juices, and when freshly cut down, than it is when the vessels have begun to contract, and a considerable portion of the natural humidity of the wood has evaporated. In the first instance, indeed, he endeavoured to impregnate the wood of the tree whilst still in a growing state, causing it to suck up various solutions, by means of the absorbing power of the leaves themselves; a process which, however, for various practical reasons, he subsequently abandoned: and, at the present time he adopts a cheap, simple, and effective process for impregnating the felled timber with the preserving liquid, designated in France, "trait de scie, et la cuisse foulante." The trunk of the newly-felled tree is cut into a length suitable for two railway sleepers; it is then very nearly divided across, just in the centre, by means of a saw, so as to form a channel, or small reservoir, in the very centre of the log, by means of which the preserving liquid may pass, right and left, towards either end; the opening of the saw-cut is then carefully closed all round, and a small flexible tube being introduced into the upper part, serves to convey into the cut the preserving liquid, which, as it is laid on through the flexible tubes, under the pressure of a column of some feet in height, is rapidly disseminated throughout the entire substance of the wood. The preserving liquid which Dr. Boucherie employs, and which from his numerous experiments he considers the best, is a solution of sulphate of copper. When he desires to increase the hardness of the wood, he uses a solution of pyrolignite of iron; and when his object is to render it flexible, elastic, and at the same time incombustible, he employs a solution of chloride of calcium. By the above-mentioned process, Dr. Boucherie has prepared many thousands of railway sleepers with sulphate of copper, and some which have been down on the Great Northern Railway of France, for five years, are at the present time perfectly sound; whilst similar ones, not prepared, which have been on the same line, are completely destroyed. The Jury, appreciating the very long and laborious series of experiments made by Dr. Boucherie, and satisfied with the successful issue to which he has now brought them, awarded him a Prize Medal for the process.

Specimens of wood for sounding-boards of musical instruments are exhibited by J. HENSTEH, of Lindberg, near Linsel, in Bavaria (76, p. 1101); these were deemed worthy of Honourable Mention.

A collection of woods, extremely well-selected and arranged, is exhibited by Professor NÖRDLINGER, of Hohenheim, Stuttgard (4, 11, pp. 114, 115). These specimens are exceedingly well prepared, so as to show all the chief characters of each wood; though small, each sample is left in the bark, and good microscopic sections accompany each wood. As a small collection, it is admirable, and the Jury accordingly awarded a Prize Medal for it.

A comparatively small number only of Portuguese woods are exhibited; and with one exception, none of them are of very great importance. The Marquis de LOULÉ (553—578, p. 1314), contributes a small collection of 24 specimens, consisting of pine, plum, filbert, wild olive, chestnut, wild pine, elm, mulberry, olive, beech, ash, cherry, cypress, carib-wood, cork-tree, holm, poplar, oak, plantain, white acacia, walnut, orange, box, and cratægus. For these the Jury awarded a Prize Medal.

Other specimens of the ordinary woods are contributed from the Royal Arsenal, from the Ceira Forests, by A. P. F. VAZ (580, p. 1314), and by the Marquis of FICALHO (552, p. 1314).

Three specimens of wood from Angola and Goa are shown, namely, Tacula-wood from Angola, and teak-wood and sico-wood from Goa. The former, exhibited by the GOVERNOR of ANGOLA (590, 1850, p. 1340), is a very remarkably beautiful wood, and which may fairly be called one of the most handsome cabinet-woods known. The Jury accordingly awarded a Prize Medal for this specimen.

A very small number only of Russian woods are shown; a good series of the chief timber trees of the Governments of Grodno, Minsk, and Volhynia are exhibited by A. KAUFMANN (117, p. 1370). For these the Jury awarded a Prize Medal.

Specimens of Rhododendron-wood, and plane-tree wood are shown from Ozoorget by the GOVERNMENT of COOTAIS (118, p. 1370), and of walnut and beech-wood, from Djarobelocan by the GOVERNMENT of TIFLIS (119, p. 1370). These were each deemed worthy of Honourable Mention.

No Spanish woods are exhibited; but in the Spanish Department there are two interesting and extensive collections of the woods of Cuba and the Philippine Islands. The series of the woods of Cuba, used for building, furniture, &c., is 225 in number, and is exhibited by the CABINET BOTANICAL GARDEN of MADRID (186, pp. 1340, 1341); the specimens are all cut into the form of books, so as to show the structure of the wood in different sections, and varnished so as to bring out the colour and grain; the latter circumstance, however, though useful in showing the beauty of the wood, renders it rather more difficult to judge of the characters. This collection was formed by D. Ramon de la Sagra, and the woods are described in his large work on Cuba; the following list contains only those woods the botanical names of which have been made out. For this collection the Jury awarded a Prize Medal.

WOODS OF CUBA.

1. Abey macho	Jacaranda Sagræna. D. C.	A hard wood, the leaves eaten by cattle.
2. Abey hembra	Pœppigia excelsa. Rich.	A hard wood, the leaves eaten by cattle.
3. Acana	Sideroxylum pallidum. Spr.	Very dense wood, the fruit eaten by animals, especially by pigs.
4. Agracejo	Ardisia cubana. Alph. D. C.	Hard wood.
5. Agracejo carbonero	Excœcaria (?)	Hard wood.
6. Aguedita	Picramnia pentandra. Sw.	Hard wood.
7. Almendro	Laplacea Curtyana. Rich.	Hard wood.
8. Almendro silvestre	Dipholis salicifolia. Alph. D. C.	Hard wood.
9. Arara	Bucida Buceras. Lin.	
10. Arbol del cuerno	Acacia cornigera. Lin.	
11. Ateje hembra	Cordia Valenzuelana. Rich.	A hard wood; the fruit eaten by animals, especially by pigs.
12. Ayua amarilla	Zanthoxylum bombacifolium. Rich.	
13. Ayua macho	Z. lanceolatum. Poiret	Yields gum or resin.
14. Ayua hembra	Z. juglandifolium. D. C.	Yields gum or resin.
15. Azucarero de montaña	Icica Edwigia. Rich.	Yields gum or resin.
16. Bagà	Anona palustris. Lin	Fruit eaten by animals, especially by pigs.
17. Baria	Cordia gerascanthoides. Kunth.	Hard wood.
18. Bijaguara	Colubrina ferruginea. Brong.	Hard wood.
19. Boniato amarillo	Nectandra boniato. Rich.	Both leaves and fruit eaten by cattle.
20. Boniato blanco	Oreodaphne? alba. Rich.	Both leaves and fruit eaten by cattle.
21. Brasil	Cæsalpinia bijuga. Sw. C. horrida. Rich	A dye-wood.
22. Brasilete colorado	Cæsalpinia crista. Lin.	A dye-wood.
23. Bucare	Erythrina umbrosa. Kunth.	Leaves eaten by cattle.
24. Cabo de hacha	Trichilia spondioides. Jacq.	Hard wood.
25. Caja	Schmidelia nervosa. Rich	Hard wood.
26. Caimito	Chrysophyllum Cainito. Lin.	Very dense wood; fruit eatable.
27. Caimitillo	C. microphyllum. D. C.	Very dense wood; fruit eatable.
28. Canela blanca	Canella alba. Murray.	
29. Caoba	Swietenia mahogani. Lin.	Hard wood.
30. Carne de doncella	Byrsonima lucida. Kunth.	Very dense wood.
31. Cedro	Cedrela odorata. Lin.	
32. Ceiba	Eriodendron anfractuosum. D. C.	
33. Ceibon de arrogo	Pachira emarginata. Rich.	
34. Chicharron	Chicharronia intermedia. Rich.	Very dense wood.
35. Cigua	Nectandra cigua. Rich.	Fruit eaten by animals.
36. Ciguaraya	Trichilia havanensis. Jacq.	Hard wood.
37. Ciruelo	Spondias purpurea. Lin.	Yields a gum or resin; fruit eaten by animals.
38. Cocuyo	Bumelia nigra. Sw.	Very dense wood.
39. Copal	Icica copal. Rich.	Yields a gum or resin.
40. Copey	Clusia rosea. Lin.	A dye wood.
41. Cordoban	Miconia pyramidalis. D. C.	
42. Cuaba amarilla	Amyris maritima. Jacq.	
43. Cuaba blanca	A. sylvatica. Jacq.	
44. Cuajani	Cerasus occidentalis. Loiseleur	Very dense wood.
Curbana, V. Canella blanca		
45. Dagame	Calycophyllum candidissimum	Very dense wood.
46. Daguilla	Lagetta lintearia. Juss. L. Valenzuelana. Rich.	Bark yields a fibre.
47. Ebano	Diospyros (?)	Very dense wood.
48. Encina	Quercus (?)	Hard wood; fruit eaten by animals.
49. Frijolillo	Lonchocarpus latifolius. Kunth	Very dense wood; fruit eatable.
50. Fustete	Broussonetia tinctoria. Kunth.	Dye wood.
51. Gia blanca	Casearia alba. Rich.	
52. Gia brava	C. ramiflora. Vahl.	
53. Goao	Commocladia dentata. Jacq.	Very dense wood.
54. Goao de costa	Rhus Metopium. Lin.	Very dense wood.
55. Granadillo	Brya Ebenus. D. C.	Very dense wood.
56. Guacima amarilla	Luhea platypetala. Rich.	Hard wood.
57. Guacima baria	Xylopia Cubensis. Rich.	Dense wood; fruit eaten by animals.
58. Guacimilla	Celtis macrophylla. Kunth. C. lævigata. Wild	Fruit eaten by animals, especially by pigs.
59. Guacimilla de costa	Prockia Crucis. Lin.	
60. Guaguacl	Lætia apetala. Jacq. L. longifolia. Rich. L. crenata. Rich.	Hard wood: yields a gum or resin.
61. Guamà	Lonchocarpus sericeus. Kunth.	Bark used for tanning.
62. Guamà de costa	Malvaceæ (?)	Bark used for tanning.
63. Guana	Malvaceæ (?)	

WOODS OF CUBA—*continued.*

64. Guara	Cupania glabra. Sw. C. tomentosa. Sw. C. crenata. C. triquetra. Rich.	Hard wood; fruit eaten by animals.
65. Guara colorada	Cupania macrophylla. Rich.	Hard wood; fruit eaten by animals.
66. Guavico	Xylopia obtusifolia. Rich.	Very dense wood.
67. Guayabo agrio Guayabo silvestre Guayabo cotorrero	Psidium pomiferum. Lin.	Hard wood; bark used for tanning; fruit eaten by animals.
68. Guayabillo	Eugenia guavabillo. Rich.	
69. Guayacan	Guaiacum officinale. Lin.	Very dense wood.
70. Guayacancillo	Guaiacum verticale. Ortega	Very dense wood.
71. Guimbà, V. Guavico	– –	Very dense wood.
72. Guira cimarrona	Crescentia acuminata. Kunth.	
73. Guira criolla	Crescentia cujete. Lin.	
74. Hueso	Drypetes alba. Poit	Very dense wood; leaves eaten by animals.
75. Jaboncillo	Sapindus saponaria. Lin.	
76. Jagua	Genipa americana. Lin.	Fruit eaten by animals.
77. Jaguey hembra	Ficus (?)	Bark used for tanning.
78. Jaguey macho	Ficus populnea. Wild	Bark used for tanning.
79. Jibà	Erythroxylom brevipes D. C. E. obtusum. D. C. E. havanense. Jacq. E. alaternifolium. E. rufum. Rich.	
79*. Jiqui, V. Cocuyo	– –	Very dense wood.
80. Jobo	Spondias lutea. Lin.	Yields a gum or resin.
81. Jocuma	Dipholis salicifolia. Alph. D. C.	Very dense wood; fruit eaten by animals.
82. Jucaro	Bucida capitata. Vahl.	Very dense wood.
83. Laurel amarillo. V. Boniato amarillo.		
84. Laurel blanco	Oreodaphne (?) alba. Rich.	Hard wood.
85. Laurel de cuabal	Anona bullata Rich.	Fruit eaten by animals.
86. Lengua de vaca	Ægiphyla martinicensis. Lin.	
Leviza, V. Laurel blanco	– –	Hard wood.
87. Lloron	Malanea lucida. Rich.	
88. Maboa	Cameraria latifolia. Jacq.	Very dense wood.
89. Macurige	Cupania oppositifolia. Rich.	Hard wood; fruit eaten by animals.
90. Maco	Drypetes glauca. Vahl.	Hard wood.
91. Majagua	Paritium elatum. Rich.	Hard wood; bark used for tanning.
Majagua de Cuba. V. Guamà.	– –	Bark used for tanning.
92. Majagua macho	Belotia grewiæfolia. Rich.	Bark used for tanning.
93. Malagueta	Eugenia pimenta. D. C. E. valenzuelana. Rich.	
94. Manajù	Malpighia (?)	Hard wood; yields a coloured resin.
95. Mangle blanco	Avicennia tomentosa. Jacq.	Bark used for tanning.
96. Mangle colorado	Rhizophora Mangle. Lin.	
97. Moruro	Acacia arborea. Wild	Very dense wood; leaves eaten by cattle.
98. Moruro de costa	Acacia litoralis. Rich.	Very dense wood; bark used for tanning.
99. Mora	Morus celtidifolia (?). Kunth.	
100. Nogal	Juglans cinerea. Lin.	Hard wood; fruit eaten by animals.
101. Ocuje	Calophyllum Càlaba. Jacq.	Hard wood; yields a gum or resin; fruit eatable.
102. Palo blanco	Simaruba glauca. D. C.	
Palo cachimba. V. Vibona.		
Palo de Caja. V. Caja.		
Palo carbonero. V. Agracejo carbonero.		
Palo santo. V. Guayacan		
103. Peralejo	Malpighia (?)	Hard wood; bark used for tanning; fruit eaten by animals.
104. Pico de gallo	Cynometra cubensis. Rich.	Very dense wood.
Pimienta. V. Malagueta.		
105. Pino	Pinus occidentalis. Sw.	Fruit eaten by animals.
106. Quiebra hacha	Copaifera hymenæfolia. Moric.	Very dense wood; fruit eaten by animals.
107. Ramon	Trophis americana. Lin.	Leaves eaten by animals.
108. Raspa lengua	Cæsearia hirsuta. Sw.	Hard wood; both leaves and fruit eaten by animals.
109. Roble amarillo	Cytharexylum caudatum. Lin.	Hard wood.
110. Roble blanco	Tecoma leucoxylon. Mart.	Hard wood; leaves eaten by animals.
111. Roble guayo	Ehretia bourreria. Lin.	Hard wood; leaves eaten by animals.
112. Roble negro 113. Roble prieto	Ehretia tinifolia. Lin.	Hard wood.
114. Sabicu	Acacia formosa. Kunth.	Very dense wood; leaves eaten by animals.
Sangre de doncella. V. Carne de doncella.		
115. Sapote	Sapota Achras. Mill	Very dense wood; fruit eaten by animals.
116. Sapote de culebra	Lucuma serpentaria. Kunth.	Very dense wood; fruit eaten by animals.
117. Sapote negro	Diospyros laurifolia. Rich.	Very dense wood; fruit eaten by animals.
118. Torcido	Mouriria Valenzuela. Rich.	
Tengue. V. Moruro	– –	The leaves eaten by animals.
119. Obero de playa	Coccoloba uvifera. Jacq.	
120. Vaca-buey	Curatella americana. Lin.	
121. Vibona	Erithalis pentagonia. D. C.	The leaves eaten by animals.
122. Vigueta de Naranjo	Ilex Cassine. Aiton	Hard wood.
123. Viriji	Eugenia ferruginea. Rich.	Hard wood.
124. Yaba	Andira inermis. Kunth.	Fruit eaten by animals, especially by pigs.

WOODS OF CUBA—*continued.*

125. Yagruma macho	Panax undulata. Aub.	Both leaves and fruit eaten by animals.
126. Yaimiqui. V. Carne de doncella.		
127. Yaicuage	Hypelate paniculata. Cambes.	Hard wood.
128. Yaiti	Excæcaria lucida. Sw.	Very dense wood.
129. Yamao	Guarea trichiloides. Lin.	Hard wood; both leaves and fruit eatable.
130. Yana	Ximenia americana. Lin. Conocarpus erecta. Kunth.	
131. Yanilla	Schmidelia Cominia. Sw.	Hard wood; leaves eaten by animals.
132. Yaya	Uvaria neglecta. Rich. Oxandra virgata. Rich.	Hard wood.
133. Yaya cimarrona	Mouriria myrtiloides. Poiret.	
134. Yaynjabico	Columbrina reclinata. Brong. Erithalis fruticosa. Lin.	Hard wood.

The series of woods of the Philippine Islands, exhibited by the Economical Society of Manilla (187, p. 1341), consists of 213 specimens. It is very much to be regretted that this collection is unaccompanied by any list, or catalogue, which would have very greatly increased its value. It was, however, deemed worthy of Honourable Mention.

Specimens of St. Domingo mahogany and satin-wood are contributed by Sir R. Schomburgk (1429), H. M. Consul to the Dominican Republic; these form part of the series of raw produce of that country, for which the Jury awarded a Prize Medal (see p. 71).

A few specimens of timber from Tabarca are shown in the collection of Tunis raw produce.

WOODS OF TURKEY.

A valuable series of some of the chief woods of Turkey are exhibited; the specimens are large and capital, but they are shown in the rough, so that the nature and characters of each wood can scarcely be distinguished the following are the chief woods shown:—

1. Ardij aradji	Fagus sylvatica	Used for ship-building and for wheels.
2. Armood aradji	Pyrus communis	Common furniture wood.
3. Baaz guurgang	Carpinus betulus	Fire-wood; rough work.
4. Djinnak aradji	Acer pseudo-platanus	Furniture wood.
5. Djinnar aradji	Fraxinus excelsior	Furniture and house-work.
6. Djumaar aradji	Acer, sp.	Used for furniture.
7. Ehklael aradji	Sorbus domestica	Used for grafting.
8. Guurgang aradji	Fagus, sp.	Fire-wood only.
9. Hklamoorg aradji	Tilia vulgaris	Used for carving and fine work.
10. Jeeviz aradji	Juglans regia	Furniture wood.
11. Kawak aradji	Populus nigra	Used for house-building.
12. Karrar aradji	Ulmus excelsa	Used for common carpentry.
13. Keerasje	Prunus cerasus	Furniture wood.
14. Maatsché aradji	Quercus rubra	Useful timber.
15. Pfundook aradji	Corylus Avellana	Used for pipe-stems.
16. Taphzoos	Taxus baccata.	
17. Tozham aradji	Pinus Picea	Timber for general purposes.
18. Zugunt	Salix alba	Used for light house-work.

Besides these, specimens of Pinus orientalis, from Damascus; Quercus ægilops, from Litekofteha and Wallachia; Juniperus communis, from Smyrna; Juglans regia, from Damascus; Quercus coccinea, from Rhodes, Morus alba, from Damascus, &c., are also exhibited.

WOODS OF TUSCANY.

A valuable and excellent collection of Italian woods is exhibited by the Royal Technological Institute of Tuscany (47, p. 1294), forming part of the series of Tuscan raw produce, for which the Jury awarded a Prize Medal (see p. 71). The collection consists of two series; the one being of furniture or ornamental woods, the other of timber trees, or woods of construction so cut as to show the character of the wood in the best and most instructive manner; several of the woods are scarce and highly interesting. The collection comprises panel and block specimens.

Panel specimens 2 feet long, varying from 15 inches to 20 inches in width, quarter-inch thick, consisting, in most cases, of pieces joined together longitudinally to display to the best advantage the colour and markings of the woods, and affording satisfactory evidence of their fitness for ornamental purposes:—

1. Acacia Julibrissin	Gaggia alborea.
2. Acer negundo	Negundo.
3. Æsculus hippocastanum	Castagno d'India.
4. Ailanthus glandulosus	Ailanto.
5. Alnus cordifolia	Ontano Napoletano.
6. Betula alba	Betula.
7. Broussonetia papyrifera	Moro papirifero.
8. Cercis canadensis	Siliquastro del Canada.
9. Cercis siliquastrum	Siliquastro.
10. Cotisus laburnum	Maggio ciondolo.
11. Diospyrus lotus	Loto.
12. Eleagnus hortensis	Olivo di Boemia.
13. Fraxinus americanus	Frassino Americano.
14. Fraxinus sambucifolia.	
15. Gymnocladus canadensis	Albero morto.
16. Juglans nigra	Noce nero.
17. Kœlreuteria paniculata.	
18. Melia Azedirachta	Albero di Zaccheo.
19. Olea europæa	Olivo.
20. Pinus cedrus	Cedro del Libano.
21. Platanus orientalis	Platano orientale.
22. Prunus lauro-cerasus	Lauroceraso.
23. Prunus mahaleb	Albero di Santa Lucia.
24. Rhamnus alaternus	Alaterno.
25. Rhus typhina	Somacco.
26. Robinia pseudacacia	Acacia, or Cascia.

Block specimens, consisting of branches and trunks, cut in half, showing bark, longitudinal section, and oblique transverse section:—

27. Acacia lophantha.	
28. Acer campestre	Loppo.
29. Acer negundo	Negundo.
30. Acer pseudo-platanus	Acero fico.
31. Ailanthus glandulosus	Ailanto.
32. Amyris polygama.	
33. Betula alba	Betula.
34. Buxus sempervirens	Bossolo.
35. Carpinus betulus	Carpine.
36. Castanea vesca	Castagno.

WOODS OF TUSCANY—*continued.*

37.	Celtis australis	Giracolo.
38.	Citrus aurantium	Arancio.
39.	Corylus avellana	Nocciolo.
40.	Cratægus coccinea	
41.	Cupressus pyramidalis	Cipresso.
42.	Elæagnus hortensis	Olivo di Boemia.
43.	Eucalyptus populifolia.	
44.	Fagus sylvatica	Faggio.
45.	Fraxinus excelsior	Frassino.
46.	Gleditschia triacanthos	Gledischia.
47.	Gymnocladus canadensis	Albero morto.
48.	Ilex aquifolium	Agrifoglio.
49.	Juglans nigra	Noce nero.
50.	Juglans regia	Noce.
51.	Juniperus virginiana	Ginebro di Virginia.
52.	Kœlreuteria paniculata.	
53.	Laurus camphora	Albero della confora.
54.	Laurus nobilis	Alloro.
55.	Melia Azedirachta	Albero di Zaccheo.
56.	Morus alba	Moro.
57.	Olea europæa	Olivo.
58.	Pinus Abies	Abeto.
59.	Pinus Cedrus	Cedro del Libano.
60.	Pinus halepensis	Pino d'Aleppo.
61.	Pinus Pinea	Pino domestico.
62.	Pistacia Lentiscus	Sondro.
63.	Platanus occidentalis	Platano d'Occidente.
64.	Populus alba	Gallice.
65.	Populus nigra	Albero.
66.	Prunus canadensis	Ciliegio del Canada.
67.	Prunus cerasus	Ciliegio.
68.	Punica granatum	Melagrano.
69.	Pyrus Malus	Melo.
70.	Quercus Cerris	Cerro.
71.	Quercus crinita	Cerro.
72.	Quercus Ilex	Leccio.
73.	Quercus pedunculata	Querce.
74.	Quercus racemosa	Quercia farnia.
75.	Quercus Robur	Quercia Ischia.
76.	Quercus Suber	Sughera.
77.	Rhamnus alternus	Alaterno.
78.	Rhus Cotinus	Scotano.
79.	Rhus typhina	Somacco.
80.	Salix babylonica	Salcio piagente.
81.	Salix vitellina	Salcio.
82.	Sterculia platanifolia	Sterculia.
83.	Styrax officinalis	Storace.
84.	Tamarix africana	Tamarigio.
85.	Taxus baccata	Tasso.
86.	Ulmus campestris	Olmo.
87.	Vitex agnus castus	Agno casto.

Some very excellent veneers of walnut wood, cut in a peculiar manner, invented by the exhibitor, are shown by A. Ducci, of Florence (99, p. 1298). The Jury awarded a Prize Medal for these.

VIII. Miscellaneous Substances.

Under this head are classed those vegetable substances not properly coming under any of the preceding divisions. It would have been easy to have included in it a very large number of new and little-known products, and of substances chiefly interesting as curiosities; the Jury, however, considered that in so doing they would merely increase the length of their Report, without leading to any practical result; they have therefore entirely omitted all mention of these substances, and simply here refer to one or two articles especially deserving of notice.

A very beautiful collection of anatomised plants, flowers, and leaves, is exhibited by E. King (2, p. 195). In these remarkable dissections, the whole of the soft and pulpy matter of the plants is removed, and only the woody or fibrous part is left, forming a perfect net-work of woody tissue. This effect is produced by steeping the plants in rain-water, in which they are suffered to remain until the whole of the soft parts are decomposed; they are then placed in fresh water and the decomposed matter carefully removed with a brush; after this the remaining fibrous part is bleached in a weak solution of chloride of lime and then dried. The time required for this operation varies from a few weeks to several months, and its success essentially depends on the minute and patient care bestowed on the brushing away of the decomposed pulpy matter. The specimens exhibited by E. King are remarkable for their beauty and the very perfect manner in which the whole of the woody skeleton of the plants has been preserved; the Jury accordingly awarded a Prize Medal for them.

Some excellent specimens of similar anatomised plants are likewise contributed by Lieut. Tilley (5a, p. 195*). These were deemed deserving of Honourable Mention.

Various small collections of dried or preserved plants and flowers are shown by different exhibitors; namely, preserved flowers intended as botanical illustrations, by W. Stevens (3, p. 195*): preserved pitcher plants, by E. W. Cooke (2a, p. 195*); dried mosses, by M. Rock (5, p. 195*); and dried mosses and sea-weeds by E. Holt (123, p. 205*).

A series of well-prepared and carefully-dried ferns from Madeira is contributed by Genoveva Gonsalves (21b, p. 1319); this was deemed worthy of Honourable Mention.

Finally, the Jury would specify in this department, as deserving of Honourable Mention, the specimen of selected teazles for the use of wool-dressers, exhibited by Rotsch and Reichel, in the Austrian Department (98, p. 1012).

EDWARD SOLLY, Reporter.

London, February 1852.

Part II.—ANIMAL KINGDOM.

A.—*FOR TEXTILE FABRICS AND CLOTHING.*

Wool.

The raw material of most importance and in most general use for the above purposes is Wool. This is a peculiar modification of hair, presenting, when viewed under the microscope, fine transverse or oblique lines, from 2,000 to 4,000 in the extent of an inch, indicative of an imbricated scaly surface, on which, and on its curved or twisted form, depends its remarkable felting property and its consequent value in manufactures.

Most quadrupeds possess the woolly variety of hair as an under-clothing, but in a small proportion, and hidden by the smooth, exterior, coarser, and straighter kind of hair. In the wild sheep (*Ovis ammon* and *Ovis musimon*) the woolly variety of hair is developed in excess; and in the domesticated breeds the fleece has been modified and improved, in various degrees, by crossing the breeds, choice of climate and pasture, and careful attention and defence during its growth, until not only has the original coarse character of the product disappeared, but qualities of wool of different kinds and of different degrees of superiority have been obtained, which are generally divisible into two classes—the one better adapted for "carding," the other for "combing," and both available for a great variety of useful and elegant textile fabrics.

In judging of these qualities in the wools exhibited, the Jury have tested the fineness and elasticity of the fibre; the degrees of imbrication of the scaled surface of the fibre as shown by the microscope; the quantity of fibre developed in a given space of the fleece; the comparative freedom of the fleece from extraneous matters; and the skill and care employed in preparatory processes; such, for example, as that termed "scouring" the fleece, upon which depends its liability, or otherwise, to mat at the bottom of the staple.

In these examinations the Jury have to acknowledge the valuable aid of well-versed English and Foreign Experts.

After the comparison of the wools exhibited by the growers of different nations, the Jury are unanimous in making the first mention of those transmitted from Germany, as being pre-eminent in the qualities of highest value.

Under "German Wools" are included those from Austria and Austrian Silesia, Hungary, Prussia, Saxony, and Polish Silesia.

Austria.

Figdor and Sons (90, p. 1012).—The fleeces exhibited by this firm present, in a high degree, the desired qualities of substance in the staple, and of fineness and elasticity of the component fibres, the spiral curves of which are close and regular, and are immediately resumed after being obliterated by stretching the fibre,—the length of which is also considerable for wool of this "carding" quality, the most valuable for the finest descriptions of cloth. One of the Experts in wool characterises the specimens, exhibited by Messrs. Figdor and Sons "as a superior and high-bred wool—the finest and most legitimate specimen in the whole Exhibition." The degree of superiority over some of the wools in the same department, which was contested by another Expert, was admitted by the first to be slight; whilst opinions were unanimous as to the superior character of the wools, generally, from Austrian Silesia and Hungary. The Jury, therefore, appreciating the difficulty of arriving at a correct judgment of the degrees of individual merit, especially from samples giving an uncertain indication of the average value of the produce of flocks, came to the conclusion of recommending the award of the Council Medal, as notified in the Second Section of the Report, so as to signify their appreciation of the highest class of wools; and to distinguish the manifestly superior qualities of the wools exhibited by individuals by the award of the Prize Medal; and they place first on the list the firm of MM. Isaac Figdor and Sons, of Vienna.

Count H. Larisch Moennich (92, p. 1012).—The product of a fine and well-known flock, from Silesia, is exhibited by four fleeces, which present similar excellent qualities to those of No. 90, the difference, on the whole, being so slight that the Jury also award the Prize Medal to Count H. Larisch Moennich, of Silesia.

Count Anton von Mittrowsky (91, p. 1012).—These fine and high-bred fleeces of a pure merino flock, from Silesia, exhibit the valuable qualities of fineness and elasticity of fibre in so eminent a degree that the Jury award the Prize Medal to their exhibitor.

Count Joseph Hunyady von Ketheley (89, p. 1012).—The fleece, from a flock in Hungary, is an unwashed specimen, but of a very fine quality of fibre; it is a little inferior to the best Silesian examples only in being somewhat thinner or poorer in substance. The fine imbrication and elastic properties of the fibre are, however, so remarkably characteristic of this fleece, that the Jury award to its exhibitor the Prize Medal.

The washed and unwashed wools exhibited by Count O. von Wallis (93, p. 1012) (Bohemia), and by Messrs. Panna and Alexis, (94, p. 1012) (Transylvania), present qualities which entitle them to Honourable Mention.

Zollverein.

W. Graff (803, p. 1094).—The fleece of wool exhibited on a stuffed sheep from the merino flock of this exhibitor, at Münchenhoff, merits, from the fineness and closeness of the fibre and its excellent "carding" qualities, the award of the Prize Medal.

Legations-Rath Kuepfer (29, p. 1049).—The merino fleeces of two-year old ewes, from Bromberg, here exhibited, are remarkable for the fineness and regularity of the staple, and illustrate favourably the advance of the improvement of wool in the Prussian districts of the Middle Vistula: the Jury deem them to merit the award of the Prize Medal.

E. Lubbert (24, p. 1049).—The fleeces transmitted by this exhibitor from Zweybrodt, near Breslau, are very remarkable for those qualities which, like the Austrian-Silesian wools, adapt them for the fabrication of the finest cloths, and the Jury award to Mr. Lubbert the Prize Medal.

G. L. Nordmann (30, p. 1049).—The fleeces from Liszkowy, near Mowraclaw, are also fine specimens of Prussian wools, remarkable for the great regularity in the staple, and meriting the award of the Prize Medal to M. Nordmann.

Oberburggraf von Brunneck (45 and 46, p. 1050).—The fleeces of a ram and a ewe from a merino flock at Bellschwitz, and the specimens of wool indiscriminately taken from a merino flock at Rosenberg, though rather inferior in quality to the finest Silesian wools, manifest a fineness, softness, and elasticity of fibre and a regularity of staple which, in the opinion of the Jury, merit an award to the exhibitor of the Prize Medal. The Bellschwitz flock was procured by the Oberburggraf in Spain in 1814, and afterwards improved by additions of the finest Saxon and Silesian races in 1820 and 1824.

M. Ockel, for the Royal Administration of Frankenfelde (27, p. 1049).—The fleeces of a ram and of ewes shorn in the spring of 1850, and the samples of wools from the flocks kept at Wrietzen on the Oder, under the above Administration, manifest qualities which the Jury have considered to entitle the Administration to the award of the Prize Medal.

Of other exhibitors of wools in the Zollverein, Baron Eckardstein (32, p. 1049), on account of the regularity of the staple in two examples of wool in fleeces; Count von Schwerin (33, p. 1049), for the fleeces of a ram and ewe of the Saxon breed, remarkable for their fine qualities as "combing wool;" Flockenhaus and Co. (335, p. 1070); Baron von Luttwitz (42, p. 1050); R. Lehmann (47, p. 1050), for fleeces of fine raw wool; A. P. Thaer (23, p. 1049), for the richness of the staple and fineness of the hair; MM. Peill & Co., of Düren* (369, p. 1071); M. A. von Saucken (433, p. 1075); Baron S. von Rothschild (280, p. 1049), for four fleeces of fine merino wool, from a flock of 15,000 head at Schillersdorf; J. von Lipski (25, p. 1049), for a ram's fleece from the owner's flock at Ludomy; — Hey (26, p. 1049), for the fleeces of wool from the flock of the Electoral race, under the personal superintendence of the exhibitor at the Royal Domain of Hainsburg, Saxony; and the fleeces exhibited by the Royal Remounting Horse-Depôt (22, p. 1049), on account of the weight of the wool and the length and resistance of the fibre, which adapt it for combing; are severally deemed by the Jury to be worthy of Honourable Mention.

United States of America.

Mr. Cockerill.—The wool transmitted by this exhibitor from Northville is well got up, and exhibits, like the preceding specimens, a quality of fibre, indicative of care and skill in the development and improvement of the fleece, which calls for the award of the Prize Medal.

Mr. J. H. Ewing (188, p. 1449).—The wool, transmitted from Washington, Pennsylvania, by this exhibitor, is remarkable for the good substance of the fleece, as well as for the quality of the fibre, and the Jury award to him the Prize Medal.

Messrs. Kimber and Co. (500, p. 1466).—The specimens of fine clothing wool, exhibited by this firm, also develop qualities which merit, in the opinion of the Jury, an award of the Prize Medal.

Messrs. Perkins and Brown (201, p. 1449).—The samples of fine combing wool transmitted from Ohio exhibit qualities which merit the award of the Prize Medal.

Among the samples of American wools deserving Honourable Mention the Jury include—Mr. J. Blakeslee, of North Castle, New York (131, p. 1441), samples of merino wools;—Mr. P. A. Brown, of Philadelphia, Pennsylvania (40, p. 1435);—Messrs. Parker and Brown (235, p. 1451), bale of fine wool;—Mr. T. C. Peters, of Darien, New York (106, p. 1440), specimens of wool of the Saxony breed;—Mr. S. Sibley, of Hopkington, New Hampshire (197, p. 1449), sample of wool from a flock of the Saxony breed. One of the able Experts, whose valuable aid the Jury have already acknowledged in their examinations of the wools, reports "those shown by America as most approximating to the character of the German wools."

Russia.

N. N. Schloss-Trikaten (128, p. 1370).—The specimens of wool from Livonia here exhibited appear to be derived from a flock of Silesian origin, and manifest all those characters of the fibre which adapt it for good clothing purposes; and the Jury award to the exhibitor an Honourable Mention.

Among other examples of wool of a good and valuable

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* This Firm's name is inserted in the Award List of Class XII.

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quality in the Russian Department, the Jury select, as deserving Honourable Mention—T. Gamaley, of Bessarabia, district of Ackerman (123, p. 1370), samples of the merino breed;—Vassal, of Tauride, district of the Dnieper (122, p. 1370), specimens of merino wool;—L. & F. Philibert, Tauride, district of Melitopol (124, p. 1370). specimens of merino wool;—A. Akhoondoff shah Mirza, of Stavropol, district of Piatigorsk (126, p. 1370), specimens of white and black wool, unwashed; —S. Gigolo, of Gork (130, p. 1370), for specimens of black wool, unwashed;—The Farm of Gorigoretzk, of Mohileff (121, p. 1370), for specimens of merino wool; —Mahomet Khan Youzbash, of Derbent, in the Khanate of Kiurin (129, p. 1370), for specimens of white wool, unwashed;—J. Abramoff, of Ekaterinoslaff (131, p. 1370), for his examples of fine unwashed Cashmere goats' hair; —and L. K. Narishkin, Saratoff, district of Balasheflsk.

France.

J. L. Graux (245, p. 1188).—Council Medal. The specimens of the new variety of wool exhibited by M. Graux, and which have been deemed worthy of the recommendation of the Council Medal, have already been noticed in the Second Section of the Report.

Le Général Girod (de l'Ain) (1249, p. 1237).—The fleeces of merino wool, from the exhibitor's flock at Nuz, although of a thin staple, and apparently not full-grown, display the qualities adapting it for the finer descriptions of cloth in so excellent a degree, that the Jury award to Général Girod (de l'Ain) the Prize Medal.

National Sheep-fold of Rambouillet (1080, p. 1230).—The qualities of the four fleeces of the true merinos, exhibited by this valuable institution, have also been considered such as to merit the award of the Prize Medal.

E. Lefèvre (345, p. 1239).—The specimens of wool in tufts transmitted by this exhibitor from Gevrolles (Coté d'Or) are long in the staple and very sound, forming a very superior description of combing wool, and, as such, deserve the award of a Prize Medal.

F. Richer (354, p. 1194).—The two fleeces of rams, of pure merino breed, two years old, transmitted from Gonvix, Calvados, have also appeared to the Jury to merit, in the comparison of the wools from France, the award to M. Richer of the Prize Medal.

The exhibitors of wools in the French Department whom the Jury would distinguish by Honourable Mention are—Eelatre and Son (142, p. 1178); Maporte and Son (900, p. 1223); MM. Bruneaua and Son (38, p. 1173); for the specimens of combed wool, spun by an apparatus of the exhibitor's construction, M. Malingie (322, p. 11 92), for the fine combed wool, the produce of a flock reared at the Agricultural School of La Charmoise, Pont Leroy (Loire et Cher); MM. Laroque and Jaquemet (901, p. 1223), for their assortment of spun wool for knitting blankets; G. Rivaue, of Petit Rochefort (987, p. 1226), for his good fleeces of merino wool; V. E. Warmont (1048, p. 1229), for his specimens of wool in skeins; MM. Paturle-Lupin Seydoux, Seiber, and Co. (1381, p. 1242), for their samples of cleansed wools; J. A. Lerasson de Montleau (1498, p. 1248), for his fleeces of merino wool; and MM. Bernoville, Larsonnier, and Chenest (1548, p. 1250), for their examples of combed wool and woollen yarn.

Spain.

D. Justo Hernandez (230, p. 1344).—Of black and white wool from Salamanca four samples have been transmitted by this exhibitor:—1. Unwashed wool for clothing purposes; 2. Unwashed wool for worsted; 3. Wool washed before shearing, in the Saxon manner; 4. Wool sheared in February, 1851. M. Justo Hernandez has introduced into Spain the custom of clothing the sheep from the beginning of December to the end of May; and amongst the specimens transmitted to the Exhibition is a fleece which has been so defended, and one that has been exposed to the direct influence of the atmospheric agencies. The difference in the quality is remarkable, and speaks decidedly in favour of a temporary protection of the fleece. The good qualities of most of these specimens of Spanish wool have appeared to the Jury to merit for D. Hernandez the award of the Prize Medal.

Of other samples of wool transmitted from Spain the Jury select as deserving Honourable Mention—(225, (p. 1343), S. Monlero, of Seville, for his samples of fine unwashed merino wool; and (226, p. 1343), the Province of Huela, for the good quality of wool exhibited from the flocks fed on the Sierra de Audevalo.

United Kingdom of Great Britain and Ireland.

C. Dorrien (11, p. 201*).—The samples of wool transmitted from Chichester, by this exhibitor, give evidence of a very high-bred flock, and manifest qualities of fibre, for which the Jury award the Prize Medal.

R. Millner (85, p. 201*).—The fleeces, showing a long staple, grown in the counties of Meath and Galway, and the long and short wool fleeces of the mountain sheep, county of Wicklow, exhibit qualities of fibre for which the Jury award the Prize Medal.

J. G. Redow (84, p. 201*).—The specimens of wool from the Southdown breed also exhibit qualities of such excellence as to call for the award of the Prize Medal.

The fleeces of Cheviot wool, grown at an elevation of 2,600 feet above the level of the sea, exhibited by Mr. Henderson, of Wooler, Northumberland (80, p. 201*), are remarkable for the fine silky quality of the fibre, which is well adapted for the blanket manufactory. The Jury regard these specimens as deserving Honourable Mention. The Jury also desire to record Honourable Mention of the fleeces of fine German wools, exhibited by Mr. C. Lippert, of Leeds, under 97, (p. 201*); and the series of wools shown by Mr. Cheeseborough, of Bradford, under 179, (p. 493) Class XII.

An object of curiosity is shown in the English Department, being a Southdown ewe, stuffed, seven years old, which had never been shorn. The weight of the accumulated annual fleeces was 36 lbs. This specimen is exhibited by Mr. J. Moore, of Littlecott Farm, Pewsey, Wilts (78, p. 201).

Australia.

Lieut.-Col. E. Macarthur (13, p. 989, 990).—The case, containing 132 specimens of merino wool, exhibits very favourable examples of the condition of the fleeces of that valuable variety of the sheep in New South Wales. The Jury regret that the quantities transmitted are too small to afford the requisite means of judging of the average qualities of the flocks; but, taking into consideration the important services rendered by Lieut.-Col. Macarthur to the colony by his persevering and successful endeavours to develop a source of wealth from the merino breed of sheep, the Jury award to him the Prize Medal.

The first importation of wool from New South Wales into England in 1807 was 245 lbs. In the year 1848 the quantity from New South Wales, alone, amounted to 23,000,000 lbs., valued at more than 1,200,000*l*.

The Jury desire to express, by Honourable Mention, their opinion of the good qualities of the wools exhibited by Mr. T. Learmonth (6, p. 989), marked T. L.; by Messrs. Stevens and Thomson (347, p. 999) S.T; and by Mr. Grant, of Tasmania.

Cape of Good Hope.

With regard to the wools exhibited from this colony, Nos. 31 and 32 are fine samples, but are too small in quantity to support a judgment as to the average value of the fleece from the flock. The Jury, however, regard the samples transmitted by Reitz, Breda, and Co. (30, p. 950), and by D. G. Van Breda (32, p. 950), as deserving Honourable Mention.

The specimens of wool, the production of Cachemere goats kept by His Royal Highness Prince Albert, at Windsor, and exhibited by His Royal Highness, are examples of an additional staple new to England, and give encouragement by their quality to the repetition of similar efforts to multiply and preserve that remarkable variety of the genus *Capra*. This staple includes, besides the closer and finer hairs answering to the wool of sheep and the fur of other quadrupeds, a coarser or stronger kind of white hairs. Both kinds are of value in manufactures—the stronger hairs, which require to be picked out prior to attempting to manufacture; the finer portions being afterwards used in the fabrication of coarse woollen cloths. This example of European Cachemere wool would have received a Medal from Jury IV. had not one been already awarded to it by the Jury of Class XII.

HAIR AND BRISTLES.

Russia.

The best developed and most valuable examples of these productions are exhibited in the Russian Department, in which the Jury select—

BASILE KOUDRIAFFZEFF JADENOFFSKY (340, p. 1382), for the award of the Prize Medal, merited by the superior qualities of the horse-hair exhibited by him under that number. In the sample of white hair from the tail, the hairs are 40 inches in length, and of the first quality for evenness, elasticity, and shining surface. In the sample of black tails, the hairs are 42 inches in length. Fine specimens of white hair from the mane, of from 28 to 30 inches in length, both transparent and opaque, and good samples of horse-hair for furniture, both drawn and curled, black, grey, and white, are also shown by the above Exhibitor.

Of the samples of bristles exhibited in the Russian Department, the Jury select—

SEMENOFF and **FALEYEFF** (135, p. 1370), as deserving, from the superiority of the combined qualities of strength, elasticity, and fineness of surface, the Prize Medal. These qualities are particularly shown in the packets of the sorted variety called "okátka."

The Jury regard as deserving Honourable Mention the fine-textured and well-formed bristles shown by the peasants **KORIAKIN** and **MOUGIKOFF**, of Vologda, under (134, p. 1370); and the selected bristles, of different qualities, shown by J. **ZOLOTOREFF**, of Kalonga, under 136 (p. 1370); the prepared horse-hair for mattresses, shown by A. **BEZNOUKAVNIKOFF-SOKOLOFF**, under 248, (p. 1374); and the plumes of horse-tails, and black buffalo tails, exhibited by P. **IVANOFF**, of St. Petersburgh, under 159, (p. 1375).

Belgium.

Among the examples of hair and bristles transmitted from Belgium, the Jury deem worthy of Honourable Mention samples of hogs' bristles, prepared and bleached for painting-brushes, exhibited by B. **HAUSSENS-HAP**,* of Villoorde (257, p. 1159); and the samples of horse-hair, horse-tails and manes, and pigs' bristles, shown by H. **SOMZE-MAHEY**, of Liége* (265, p. 1159).

Netherlands.

MM. **CATZ** and Co. (30, p. 1144).—Specimens of drawn horse-hair for fiddle-sticks, and horse-hair for stuffing furniture, show qualities deserving Honourable Mention.

Zollverein.

H. **FUDIKAR**, of Elberfeld (596, p. 1083). Specimens of horse-hair for upholstery purposes, deserve, for their fine and equal texture and elastic qualities, Honourable Mention; and the Jury also award the same distinction to **GOTTLIEB FOESE**† (813, p. 1095) for his well-selected series of hogs' bristles and picked hogs' hair from Halle.

Spain.

D. D. **DELGADO**, of Saragossa (231, p. 1344).—This exhibitor has transmitted some interesting examples of the hair of the rabbit and hare, shaved off the skin by a mechanical process. The vast numbers of those prolific rodents in Spain would afford a large supply of this kind of hair; and the Jury desire to signify their encouragement and approbation of D. Delgado's industry by making Honourable Mention of these specimens.

WHALEBONE.

The substance so called is closely analogous, in its chemical and physical properties and mode of growth, to hair and bristles, but is developed in compact plates which resolve into stiff bristles, at their free margin, from the thick gum at the circumference and palatal surface of the upper jaw of the animals of the whale tribe. The most valuable kind of whalebone is obtained from the great Arctic whale (*Balæna mysticetus*), in which the plates or 'blades' are arranged in several rows, the outermost consisting of the longest plates, attaining, in a full grown whale, the length of from 8 to 12 feet.

England.

Mr. **HENRY HORAN** (103, p. 201, 202).*—This exhibitor shows well-selected examples of whalebone plates from the Arctic whale (*Balæna mysticetus*), which yields the largest and best kind; from the Antarctic whale (*Balæna australis*), which affords the second best kind; and from the great finner whale (*Balænoptera Boops*), which affords the shortest and coarsest plates. With these examples of the raw material, Mr. Horan exhibits specimens in various states of preparation, and numerous and ingenious applications of the prepared whalebone, of different colours, as, *e.g.*, for covering whip-handles, walking-sticks, and telescopes, and in the form of shavings for plaiting, like straw, in the construction of light hats and bonnets. The Jury, taking into consideration the illustrative collection of this raw material in connexion with its various applications, adjudge to Mr. Horan the Prize Medal

WESTALL and Co.* (104, p. 202*).—The same grounds which are specified in relation to No. 103, sustain the award of the Prize Medal to Mr. Westall, in whose collection the Jury have to specify more especially the great variety of filamentary modifications of the whalebone material for numerous useful applications.

The fine blades of whalebone from the *Balæna mysticetus*, exhibited in the United States Department, under 537, (pp. 1467, 1468), by Mr. L. **GODDARD**, deserve Honourable Mention, as do likewise the specimens of Baleen plates from the *Balæna australis*, exhibited by Mr. S. **MOSES**, under No. 237 (p. 997), from Van Diemen's Land.

SILK.

The most valuable kind of Silk, and that which is the subject of the most extensive and pains-taking culture, is a secretion of the larva of a species of moth, indigenous to China, called, *par excellence*, the "silk moth," and by entomologists, *Bombyx mori*, from its native and favourite food, the leaves of the mulberry tree. The species was first introduced into Europe in the reign of the Emperor Justinian, by two Nestorian monks who had travelled in China, and who succeeded in bringing a quantity of eggs, secured in a hollow cane, to Constantinople, where they were hatched, and the larvæ fed and reared on the leaves of the white mulberry. The breeding of silkworms in Europe was confined for six centuries to the Greeks of the Lower Empire. In the twelfth century the rearing of silkworms and the manufacture of silk were introduced into Sicily; in the thirteenth century into Italy; whence this important branch of industry has been successively established in Spain, France, England, and most of the colonies with a suitable climate.

Silk is a secretion of a pair of long glandular tubes which terminate in a prominent pore or spinnaret on the under lip. Before their termination they receive the secretion of a smaller gland, which serves to glue together the fine filaments from the two 'sericteria,' the apparently single thread being in reality double, and its quality being affected by the quality or difference between the secreting power of the two sericteria. The silkworm commences spinning when it is full grown, in some convenient spot affording points of attachment for the first-formed thread, which is drawn from one part to the other until the body of the larva becomes loosely enclosed by the thread. The work is then continued from one thread to another, the silkworm moving its head and spinning in a zigzag way, in all directions within reach, and shifting the body only to cover the part which was beneath it. During the period of spinning the cocoon, which usually takes five days for its completion, the silkworm decreases in size and length considerably; then casts its skin, becomes torpid, and assumes the form of the chrysalis.

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* These exhibitors receive Medals in Classes XVI. and XXVIII., in whose Award Lists their names appear.

† This exhibitor receives a Prize Medal in Class XXVIII., in whose Award List his name appears.

* These exhibitors receive their Medals in Class XXVIII., in whose Award List their names appear.

The main object of the silkworm breeder is to obtain cocoons of a large size, composed of a long, strong, very fine, even, and lustrous thread. These properties of the silk have been realised in the highest degree in the specimens transmitted from France, in which country the development of the silkworm has for a long period exercised the care and pains of many able breeders, and of late years has been the object of systematic advancement by the Central Society of Sericiculture of France.

The ***Bombyx mori***, having been bred and reared under the special care and management of man during a long succession of ages, may be regarded as a domesticated species of insect; and it has become the subject, as in the higher domesticated races of varieties—of which those called 'Sina,' 'Syrie,' and 'Novi,' in France, are examples.

The 'Sina' variety of the silkworm is known and esteemed for the pure whiteness of its silk, the thread of which is fine, but weak, and not very lustrous. The 'Syrie' variety is of large size, produces a cocoon abundant in silk, but the thread is rather coarse, and inclines to a greenish tint. The 'Novi' race is small, but the cocoons are firm and well made, and the silk is lustrous, but has a yellowish tint.

France.

The specimens of silk exhibited in the French Department are numerous, and the degrees of excellence hardly to be discriminated in the finest examples selected for the award of the Prize Medal. In specifying the names of the exhibitors so distinguished, the Jury propose, therefore, to limit themselves to the mention of the more remarkable circumstances which they have found to be associated with certain examples. The Jury select, as the first in order of merit—

Major Count de Bronno Bronski (782, p. 1218), exhibitor of unbleached silk and silk cocoons from the Château de St. Selves, near Bordeaux, Department de la Gironde. The cocoons are remarkable for their large size and regularity of form, and the silk for the unusual length of the thread, its natural pure white colour, its fineness and lustre. The circumstances under which this superior quality of silk is obtained are certified—in a Report by a 'Committee of the Agricultural Society of the Gironde,' signed *Philippar*, and dated 28th April 1847—to be as follows:—

In 1836, Major Bronski reared separately the eggs of the three varieties, 'Sina,' 'Syrie,' and 'Novi.' In 1837 he set apart the cocoons of the varieties 'Syrie' and 'Novi;' and on the exclusion of the imago, or perfect insect, he associated the males of the 'Novi' with the females of the 'Syrie; and the hybrid ova were hatched at the ordinary period in 1838, the same operations being repeated in 1839 and 1840. With regard to the race 'Sina,' M. Bronski, in 1837, separated the white from the black worms as soon as they were hatched. He then selected the largest and best-shaped cocoons, and made a special collection of the eggs from the moths excluded from those cocoons. This procedure was repeated in 1838 and 1839; but in 1840 he associated the males excluded from the large cocoons of the black worms with the females excluded from the largest cocoons of the white worms. In 1841 he associated the males of the 'Sina' race with the hybrid females obtained from the above-described crossings of the 'Novi' and 'Syrie' breeds.

By these and similar experiments M. Bronski at length appears to have succeeded in obtaining a race of silkworms not subject to disease, producing a large and equal sized cocoons of a pure white colour, the silk of which is equal in all its length, strong and lustrous, and which is certified to present an average length of thread of 1057 metres (1154 yards English).

The Jury, in awarding the Prize Medal to Major Count Bronski, desire, at the same time, to give expression to their unanimous opinion as to the importance of the resumption, by the highest administrative and scientific authorities in France, of those investigations which had been entered upon with a view to determine the stability and commercial value of the results of M. Bronski's experiments and discoveries in the amelioration of the breed of silkworms.

The French exhibitors of silks of fine qualities are numerous; and amongst these the Jury award the Prize Medal to—

MM. Alcan and Limet (1050, p. 1229); in regard to whom the Jury desire to express their approval of the new mode of 'filature à froid,' and of the mode of dividing the silk of the grey cocoons of the Indian silkworm (Tussar), both of which improvements are due to MM. Alcan and Limet.

MM. Arduin and Chancel (8, p. 1170).

C. Beauvais (1076, p. 1229), to whom the silk-manufacture in France owes much, for his establishment of a school of sericiculture, for diffusing the true principles on which the development, breeding, and improvement of the silkworm should be carried on.

L. Boudon (1105, p. 1230).

C. Chamdon* (113, p. 1196).

J. Champanhet Sargeas (114, pp. 1176, 1177).

MM. Couderc and Soucaret* (96, p. 1176).

MM. Drouin and Brossier (169, 1181).

Gibelin and Son (846, 1220).

Jame, Bianchi, and Duseigneur (1273, p. 1238). With this series of cocoons and of raw and thrown silks are associated twenty-five ingenious daguerreotype figures, of the silk-thread as viewed by the solar microscope, in illustration of a valuable memoir by M. Duseigneur, in course of publication at the charge of the Chamber of Commerce and of the Agricultural Society of Lyons.

E. De Tillancourt (697, p. 1212).

A. Duval (189, p. 1183).

Guérin, Méneville, and Robert (784, p. 1218).

Lapeyre and Dolbeau (1292, p. 1238).

J. Menet* (1657, p. 1256).

L. Molines (647, p. 1209).

MM. Regard Brothers (1426, p. 1244).

MM. Ruas and Co. (1464, p. 1246).

L. Soubeyrand* (1490, p. 1248).

Teissier du Cros, L. and E. (1031, p. 1223).

The Jury, in testimony of their admiration of the qualities of the silk exhibited in the French Department, unanimously voted a recommendation of the award of a Council Medal to the Central Society of Sericiculture of France (see page 69).

The Jury desire also to express their estimation of the highly promising qualities of the silk exhibited by the colonists in Algeria; and to specify as deserving Honourable Mention the following exhibitors of raw silk in the French Department:—

M. A. Bahuet (17, p. 1172).

M. Morin (Algeria) (39, p. 1261).

M. G. L. Affourtit (749, p. 1216).

M. C. Barral (410, p. 1197).

MM. Barrès Brothers (41, p 1173).

L. De Barthelats (757, p. 1216.)

Madame Bénouville (760, p. 1216.)

MM. V. Bonnal and Co. (429, p. 1199).

M. Bonneton† (771, p. 1270).

MM. Cabrit and Roux (81, p. 1175).

M. F. Carrière (1136, p. 1232).

MM. Causse and Garion* (1137, p. 1232).

M. N. Champoiseau (794, p. 1218).

MM. Chartron and Sons† (796, p. 1218).

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* These exhibitors' names are inserted in the Award List of Class XIII.—W.

† These exhibitors receive Medals in Class XIII.

M. P. Darras (470, p. 1200).
MM. Darvieu, Valmale, and Co. (1169, p. 1233).
M. V. Delarbre* (1176, p. 1234).
M. A. Delouze (1178, p. 1234).
M. X. Dumaine† (175, p. 1181).
M. Dussol (150, p. 1178).
MM. Eymieu and Son* (831, p. 1220).
MM. Fabrique-Nourry, Barnoum, and Co.* (832, p. 1220).
M. H. Farion (1217, p. 1236).
M. Herme† (537, p. 1204).
M. Lavernhe and Mathieu, dit Verger* (1298, p. 1239).
M. Méjean* (1353, p. 1241).
MM. Mourgue and Bousquet (1363, p. 1241).
M. J. L. Nogarede (937, p. 1225).
M. J. Pradier (1406, p. 1243).
M. E. Reidon (1430, p. 1244).
M. L. Roeck (1446, p. 1245).
M. P. Sambuc, (1470, p. 1246).
M. Verdet and Co. (1519, p. 1246).
M. J. Vincent (1526, p. 1250).

Spain.

Good examples of Silk, commendable for their length, elasticity, strength, and brilliancy of the thread, are shown in the Spanish Department; amongst which the Jury select the following as deserving the award of the Prize Medal:—

The Agricultural Board, Valencia (209, p. 1342).

MM. Dotres and Co. (215, pp. 1342, 1343).

M. F. Monfort (202, p. 1342), who exhibits cocoons from the variety of Spanish silkworm called 'Trevoltino,' from that called 'Raicho,' and from the Turkey silkworm.

M. Rey and Co. (207, p. 1342).

The Jury also award the Prize Medal to the Province of Murcia (199, p. 1342), for the excellence of the specimens of 'Sanza,' or silkworm gut.

The Jury have selected for Honourable Mention from the Spanish exhibitors of Raw Silk,—T. Trenor, of Valencia (210, p. 1342); J. Calderon, of Granada (220, p. 1343); and the specimens exhibited by Rodriguez Leal (220).

Belgium.

From the Raw Silks exhibited in Belgium the Jury select for Honourable Mention:—

A. De Coninck (112, p. 1154). C. De Mevius (86, p. 1154). A. De Potter (111, p. 1154).

Tuscany.

Among the Italian Silks the first mention is due to those exhibited in Tuscany, which show well the desirable qualities of the cocoons and thread. From these the Jury select for the award of the Prize Medal,—

G. Franceschini (56, p. 1295).
T. Lepori (60, p. 1295).
N. Poidebard* (51, p. 1295).
P. Ravagli (61, p. 1295).
Scoti Brothers (49, p. 1294).
P. Zavagli (62, p. 1295).

And as deserving Honourable Mention:—

C. F. Casuccini (63, p. 1295).
L. Davitti (59, p. 1295).
L. Della Ripa (50, p. 1295).
R. Lambruschini (48, p. 1294).
C. G. Mordini (58, p. 1295).
C. Petrucci (52, 1295).
Count G. Pieri (53, p. 1295).

Prof. Savi (64, p. 1295), for the specimens of raw silk from silkworms fed upon leaves of the Philippine mulberry.

Switzerland.

The specimens of Raw Silk exhibited by T. B. Fogliardi, of Milano (54, p. 1270), are considered by the Jury as deserving of Honourable Mention.

Sardinia.

In the Department of Sardinia, the Jury have selected as deserving, for their excellent qualities, the Prize Medal, the silks exhibited by,—

Casissa and Sons (27, p. 1303); H. Jacquet and Co. (26, p. 1308); Rignon and Co.* (30, p. 1303). And the Jury regard as deserving 'Honourable Mention' the examples shown by:—

Borzone, J. (45, p. 1304).
Michael Bravo* (24, p. 1303).
Imperatori Brothers (38, 1303).
Sinigaglia Brothers (25, p. 1303).

Austria.

In the Department of Austria are exhibited some fine examples of Italian silks, from which the Jury select for the award of the Prize Medal:—

G. Querini, Venice (84, p. 1012).
Scheibler and Co.,* of Milan (80, pp. 1011, 1012).
Verza Brothers, of Milan (87a, p. 1012).

From Austria Proper the Jury also consider the 'Silkworm Breeding Association of Gratz,' Styria, as highly deserving the Prize Medal, for the specimens exhibited by them under No. 73, p. 1011.

The exhibitors of raw silk deserving Honourable Mention are:—

Bozzoni Brothers, of Riva.
G. B. Mattiuzzi, of Varmo, Friuli (77, p. 1011).
A. Scola, of Upper Austria (72, pp. 1010, 1011).
F. Secchi, of Milan (81, p. 1012).
Senigaglia and Carminati, of Parma, Friuli (78, p. 1011).
G. Steiner and Sons, of Bergamo (87, p. 1012).

Prussia.

The Jury wish to distinguish by 'Honourable Mention' the specimens of raw, white, and spinning-silk, produced in Berlin, by means of a hanging spinning-hive, on the principle of bee-hives, invented by the exhibitor, A. M. Bolzani (38, p. 1050), by the use of which no double cocoons can be produced. And also the specimens of silk exhibited by Kiszewski (39, p. 1050).

Russia.

From the examples of silk transmitted from Russia, the Jury select:—

P. Rier (138, p. 1370), from Tauride, district of Molotschansk, as exhibiting the finest quality of the thread, and as meriting the award of the Prize Medal. And as deserving 'Honourable Mention':—

A. Rebroff, of Stavropol (159, p. 1370); and M. Rayko, of Odessa (140, p. 1370).

Turkey.

The silks exhibited in this Department are, many of them, of a very fine character, exhibiting a good length of thread, with the qualities of fineness, strength, elasticity, and lustre. The Jury select, as meriting the Prize Medal, the following exhibitors:—

Moustapha Nouri Pacha, of Broussa (1764, p. 1387).
J. Paulaky, of Broussa (1711, p. 1388).
Scott of Schemlan, Mount Lebanon (60, p. 1387).
The School of Sericiculture at Broussa (1388).

The Jury desire, in same manner, to distinguish the excellent specimens of raw silk and of cocoons exhibited by Mighirditz Djezairglou (159, p. 1387), and by Morgue and of Co., Beyrout (191, p. 1387).

Bavaria.

A Prize Medal is awarded to—

Pellove, Brentano, and Co., of Augsburg (36, p. 1100).

Sicily.

The specimens of raw silk exhibited by W. Jaeger and Co., of Messina, exhibit the best qualities, and merit the award of the Prize Medal.

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* These exhibitors' names are inserted in the Award List of Class XIII.—W.

† These exhibitors receive Medals in Class XIII.

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Sweden.

Among the specimens of raw produce transmitted at a late period of the Exhibition from Sweden, the Jury desire to particularize, as meriting Honourable Mention, the fine examples of raw silk exhibited by Her Majesty the Queen of Sweden (1348).

India.

Very fine examples of silk are shown in the Indian Department, from which the Jury select, as meriting the Prize Medal, the following exhibitors:—

D. Jardine, of Calcutta (p. 891).
C. R. Jennings, of Commercolly (p. 892).
Mackenzie Brothers, of Bengal (p. 892).
W. McNair, of Surdah, Bengal (p. 891).
Watson, of Surdah, Bengal (p. 891).

The specimens of silks exhibited from Mysore deserve Especial Mention.

The raw silk from Persia exhibited by Mr. Thompson (3, p. 1426), likewise receives Honourable Mention.

China.

In the Chinese Department, the quality of the silk developed in the native country of the silkworm is worthily illustrated by the specimens exhibited by Yun-kee, of Shang-hae (p. 1418), to whom the Jury, therefore, adjudge the Prize Medal.

The Jury regard the specimens of silk, exhibited in this Department, by Messrs. Astell and Co. (p. 1422), Mr. C. J. Braine (p. 1424), Mr. Hammond (p. 1425), and Mr. Lindsay (1422), as severally meriting Honourable Mention.

Mauritius.

In this colony the cultivation of the silkworm has been greatly promoted by the company formed by the exertions of M. E. Dupont, of Port Louis (2, 956), and the Jury award to him the Prize Medal, for the excellent qualities of the white silk which he has transmitted.

Amongst the specimens of raw silk from the Roman States the Jury find worthy of Honourable Mention:—

D. Berretta (6, p. 1285), and M. Bolgain (38).

In those from Malta the Jury award Honourable Mention to

G. Pulis (4, p. 944).

England.

The specimens of silk, from silkworms reared on leaves of the white mulberry, at Godalming, Surrey, and exhibited by Mrs. Catherine Dodge (32, p. 197*), possess qualities which, considering the unfavourable conditions of climate, have deserved, in the opinion of the Jury, Honourable Mention.

The Jury regard the raw silk exhibited in the Canadian Department, by Messrs. MacKay and Co. (144, p. 966), as deserving Honourable Mention.

Feathers and Down.

An instructive and comprehensive collection of feathers and down, in different states of preparation for bed-stuffing, including English goose feathers, Irish goose and mixed feathers, Dantzic feathers, Russian goose feathers, and mixed duck feathers, Hudson's Bay goose and duck feathers, Russian down and Greenland eider-down, are exhibited by Messrs. Heal and Sons (59, p. 199*), of which the Jury desire to make Honourable Mention.

Messrs. W. and C. Nightingale (57, p. 199*) exhibit an illustrative collection of feathers and down, showing the effects of their mode of purifying feathers by steam, without the use of sulphurous gas. Of this collection the Jury desire to testify their approbation by Honourable Mention.

Messrs. Blyth, Hamilton, and Blyth (60, p. 199*), exhibit excellent examples of purified English white goose feathers and of Irish white feathers, for which also the Jury award Honourable Mention.

In the Russian Department good specimens of white Bejetsk bed-feathers, grey feathers, and goose-down are exhibited by J. Lapshin (145, p. 1371), of St. Petersburgh.

Madame Ladighin, of Tamboff (283, p. 1375), exhibits a fine quality of down from the breast of the goose; together with articles made of goose-down.

A. Popoff, of Moscow (144, p. 1371), also shows down of the first quality.

Each of these exhibitors deserves, in the opinion of the Jury, Honourable Mention.

B.—*FOR DOMESTIC OR ORNAMENTAL PURPOSES; OR FOR THE MANUFACTURE OF IMPLEMENTS.*

Oils, Wax, &c.

A class of substances was exhibited under the head of 'oils,' which are likely to prove of great commercial importance, as they possess properties differing from the finest vegetable oils, and some of them can, it appears, be supplied in large quantities, and at moderate cost. The Jury, with a view to mark their appreciation of this class, awarded a Prize Medal to R. Clarence, Cape of Good Hope (13, p. 950), for oil obtained from sheep's tails, and 'Honourable Mention' to G. Dominic (21, p. 1434); T. Emory (18, p. 1434); F. Frank (19, p. 1434); and Holbrook and Stanley (208, p. 1450), United States, for oil obtained from lard by pressure at a very low temperature.

Honourable Mention was also awarded to C. A. Jetu, Canada (109, p. 965), for oil obtained from porpoises, and which is used largely for lighting purposes; to C. Romer, Prussia (337, p. 1070), for a sample of oil exhibited by him.

A Medal was awarded to Moses, Son, and Davis, New South Wales (15, p. 990), for tallow.

Some fine white wax was exhibited in the Portuguese Department by M. F. Bretes (620, p. 1314), and by M. L. De Carvalho (617, p. 1314); both were awarded Honourable Mention. Honourable Mentions were likewise awarded to M. Guiso, Sardinia (23, p. 1303), and W. Rout, Van Diemen's Land (293, p. 998), and E. E. Visser, Netherlands (17, p. 1143), for the samples of wax exhibited by them.

Horns and Antlers.

Of these productions a great variety of fine and illustrative specimens are exhibited; amongst which the collection in the Indian Department (p. 892) merits the first notice for the number and variety of the examples. There are shown the dense antlers of the *Cervus Aristotelis*, of the 'bara sinha' (*Cervus Duvaucellii*), of the 'Samber' (*Cervus hippelaphus*), of the 'kaker' or barking deer (*Cervus vaginalis*, Boddaert), of the 'axis' (*Cervus maculatus*), of the 'mar' (*Capricornis bubalina*), of the 'hog-deer' (*Cervus porcinus*), of the 'Rusa,' and other species of Indian deer. Horns of the great 'Arnee' buffalo, (*Bos bubalus*), of the 'gour' (*Bos cavifrons*), of the 'gyal,' and of other kinds of Indian buffalo, ox, and antelope, were also exhibited.

Canada.—A pair of fine moose-horns (*Alces Americana*) are shown in No. 99, and a second pair, No. 237, p. 965, by Mr. J. Thompson, of Three Rivers.

From the Cape of Good Hope fine buffalo horns are shown in No. 16, p. 950, by Mr. Meeser; and rhinoceros horns, in No. 28, p. 950, by Mr. Hanbury.

From Egypt have been transmitted horns of the bull and buffalo, of antelopes, and of the two-horned rhinoceros.

It does not appear that any of the specimens exhibit improvements of size or texture as the consequence of modifications in the food or habits of the species, superinduced to that end by the art of man. The functions of the Jury, in judging between degrees of excellence as the consequence of human ingenuity and skill, find no exercise in regard to the present class of raw materials, and the Jury therefore limit themselves to the above notice of some of the more remarkable collections and specimens of 'horns and antlers.'

Ivory.

The same considerations necessarily limit the functions of the Jury with regard to the tusks of animals presenting the modification of dental substance to which the term 'ivory' is applied. Fine ivory, distinguished by the decussating curved lines on the surfaces of transverse fractures or sections of the tusk, is peculiar to the African and Asiatic elephant, among existing quadrupeds, and the best is obtained from the wild individuals; domestication of the elephant, in India at least, having been usually attended by deterioration of the length and quality of the tusks.

The finest specimens of elephants' tusks are—a pair weighing 325 lbs. of the *Elephas Africanus*, obtained from an animal killed near Lake Ngami, in South Africa; each tusk measures 8 feet 6 inches in length, and 22 inches in basal circumference. A single tusk, weighing 110 lbs., from the same locality, is associated with them. These specimens are exhibited by Mr. **Joseph Cawood** (p. 952), to whom the Jury award Honourable Mention.

Messrs. **Fauntleroy and Sons**, Potter's Fields, Tooley Street, exhibit an instructive collection of elephants' tusks in No. 135, pp. 205*, 206*. The largest of these is from the African elephant, and weighs 139 lbs. Varieties of tusks are also exhibited from the Gold Coast, the Gaboon River, Zanzibar, the Cape of Good Hope, Angola, Alexandria, Ceylon, and the East Indies. The mode of implantation of the tusks is illustrated by the skull of the African elephant. Of the tusks which exhibit a dense texture, but have not the engine-turn markings of true ivory, Messrs. Fauntleroy exhibit those of the 'narwhal,' the 'walrus,' and the 'hippopotamus;' and the Jury regard this instructive collection as deserving Honourable Mention.

Fine tusks of the Ceylon variety of elephant are shown in the collection from that country; and several examples of the continental Asiatic kinds are exhibited in the Indian Department, among which may be noticed some tusks of the Siamese elephants, one of which weighs 100 lbs., and shows a fine white compact kind of ivory.

Messrs. **Buchanan** and **Law** (p. 952) exhibit, from the Cape, an elephants' tusk weighing 103 lbs.; and Messrs. **Hutton** and **Sons** (p. 954), show ivory from Dahomy.

Tortoise-shell.

The substance, so called, consists of certain large horn-like epidermoid plates, which cover, in an imbricated or overlapping manner, the carapace or back-shell of the marine tortoises or turtles (*Chelone*). The species which afford the most valuable of these plates are—the 'Karet' tortoises or imbricated turtles (*Chelone imbricata*, *Chelone caretta*), from which are obtained 5 large plates off the middle of the carapace, and 4 large ones off each side; these plates, 13 in number, are technically called 'blades;' 25 smaller plates are obtained from the margin of the carapace, which are called the 'feet' or 'noses,' in commerce. The other plates, collectively, are called the 'head' of the turtle.

Fine specimens of 'tortoise-shell' have been sent for exhibition from Trinidad by Lord **Harris** (p. 973); of which, as well as of those sent from Labuan by Messrs. **Hammond** and Co. (p. 988), and from Ceylon (p. 938), the Jury desire to make Especial Mention.

Pearls.

These precious substances are the result of an excretion in superimposed concentric laminæ, of a peculiarly fine and dense nacreous substance, which consists of membrane and carbonate of lime. The finest quality of pearl is produced by the bivalve of the Indian Seas, called '*par excellence*' the 'pearl-oyster' (*Meleagrina margaritifera*), fine specimens of which are exhibited in the Indian and Ceylon collections.

Pearls of an inferior description, formed in a fresh-water bivalve (*Unio margaritifera*), are exhibited under No. 15, p. 122, Class I. by **John Nelis**, of Omagh, county Tyrone, from specimens obtained from the deepest parts of the river Strule, near Omagh. Similar pearls, also found in the *Unio margaritifera*, from the river Ythan, Aberdeenshire, are shown under No. 16, p. 122, Class I. by Messrs. **Cowie** and **Rae**, of Ellon, Scotland. It is probable that the pearls from this source, collected by the ancient Britons, may have given rise to the statement by Tacitus in his 'Life of Agricola,' of pearls "not very orient, but pale and wan," being among the indigenous products of Great Britain. Pearls, similar to those from the *Unio margaritifera*, are exhibited under No. 41, p. 1352, Sweden and Norway, by **Torstrup**, from Christiana.

Mother-of-Pearl, or Nacre.

In the Indian Collection are shown most of the shells which yield the manufacturer the finest kinds of nacre; these are the *Meleagrina margaritifera*, *Haliotis gigas*, *Haliotis iris*, and a large species of *Turbo*, which shells are known in commerce as flat-shells, ear-shells, green snail-shells, buffalo-shells, Bombay shells. The mother-of-pearl is the internal or nacreous layer of such shells.

Fine specimens of some of these shells, from Singapore and Manilla, especially the great *Meleagrina* and *Haliotis*, are exhibited by Messrs. **Fauntleroy**, under No. 135, pp. 205, 206; and by Mr. **Banks**, under No. 287, p. 626, Class XXII. in connexion with the manufacture of mother-of-pearl buttons. As no specimens, however, of this raw material exhibit improved qualities as the result of human skill or ingenuity, the Jury limit themselves to the Honourable Mention of the largest and most instructive collection—which will be found in the Indian Department.

Cameo-shells and Corals.

Specimens of cameo-shells (*Cassis rufa*), species of *Cypræa*, and of shells used as ornaments by certain natives of India, with the rude but efficient instruments for cutting them, are shown in the Indian Collection.

Shells adapted for cameo-cutting are dense, thick, and consist of three layers of differently-coloured shell-material. In the *Cassis rufa* each layer is composed of many very thin plates—in other words, is "laminated"—the laminæ being perpendicular to the plane of the main layer: each lamina consists of a series of elongated prismatic cells, adherent by their long sides. The laminæ of the outer and inner layers are parallel to the lines of growth, while those of the middle layer are at right angles to them. In the cowries (*Cypræa*) there is an additional layer, which is a duplicature of the nacreous layer formed when the animal has attained its full growth.

One of the finest examples of the red coral (*Corallium rubrum*) is exhibited by Messrs. **Paravagua** and **Casella**, under No. 84, p. 683, Class XXXIII., in connexion with cameo-work and carving in coral. The Jury desire to award to these exhibitors Honourable Mention for the branch of natural rough coral above referred to.

The Jury desire, also, to make Honourable Mention of the coral exhibited under No. 1, p. 949, **Maitland Mines**, from the Cape of Good Hope; and of the specimens of coral shown by Messrs. **Reffaelli** and **Son**, under No. 69, p. 1297, Tuscany. Specimens of red coral are exhibited in the collection from Algiers. A fine collection of both corals and madrepores, including the black flexible coral (*Gorgonia*) is shown by R. **Tucker** and Co. (Bermuda), for which the Jury award Honourable Mention.

Specimens of cameo-shells, of shells used as ornaments by certain natives of India, with the rude but efficient instruments for cutting the shells, and several kinds of coral and madrepore, are shown in the Indian collection.

Sponges.

Of the numerous varieties of the common flexible sponge (*Spongia officinalis*), shown in different departments of the Great Exhibition, the Jury select first, for Honourable Mention, the specimens exhibited in Tunis, by **Solymas Essaddy**, under the Nos. 73, 74, and 75, p. 1415. They likewise desire to distinguish, in the same manner, the samples of sponges shown by B. **Pavlides**, No. 12, p. 1402, Greece, from the Gulf of Nauplia; the sponges shown by MM. **Thieme-Widtmarkter** and **Puerschel**, Saxony, No. 4, p. 1104; and those shown by F. Winkler, Prussia, No. 31, p. 1049.

Very large and fine specimens of sponges are also shown in the collection transmitted from the Bahamas.

Spongio-Piline.

The substance so called, of which the patent 'epithems' for medical, surgical, and veterinary purposes are fabricated, is exhibited under a great variety of ingenious and useful forms, especially for applying heated fluids to the body in lieu of poultices and fomentations; and the Jury have pleasure in awarding to the inventor, manufacturer, and exhibitor, M. Markwick (114, pp. 203, 204), the Prize Medal.

Goldbeaters' Skin.

This substance is the peritoneal or serous membrane separated from the intestinal tube of the ox, and sometimes of other animals; it is attenuated by being beaten with a hammer, and subsequently prepared so as to resist putrefaction. The Jury desire to make Honourable Mention of the instructive series of this material in various conditions, exhibited in No. 108, p. 203*, by Frederick Puckridge; and also in No. 104, p. 690, Class XXIII., by E. S. Marshall.

C.—*AS AGENTS IN THE MANUFACTURE OF VARIOUS ARTICLES.*

Gelatines and Isinglass.

The raw materials chiefly used in manufactures derived from the gelatinous texture of animal bodies, may be divided, as regards their commercial value and application, into two kinds:—

1st. The gelatines and glues, properly so called, derived from the dissolution of certain animal tissues, and especially from the waste residue of parts of animals which have served for food, or for the operations of tanning, or for the fabrication, as from bones, of articles in imitation of ivory, or from the waste particles in the carving of ivory itself.

2nd. The cleansed and dried membranes of different species of fish, more especially of the sturgeon family (*Aripenseridæ*), preserving a peculiar texture, on which their value in the refining of fermenting liquors more especially depends; such membranes are called 'isinglass.'

Gelatines and Glues.

The most remarkable progress in the extraction and preparation of gelatines and glues, from the waste remnants of hides and skins, bones, tendons, ligaments, and other gelatinous tissues, has been made in France, in which country the well-arranged and systematic establishments for the slaughtering of the cattle, sheep, and horses in the large towns, give great facilities for the economical application of all the parts of animal bodies.

France.

L. F. Grenet (247, p. 1188).—Among the most beautiful productions of this industry in France are the specimens exhibited under the above number, which have been specially noticed in the Section of the Report on the awards of the Council Medal;—that distinction having been recommended by the Jury to their ingenious inventor.

Many manufacturers in France have risen to great eminence in this line by following the processes of M. Grenet.

H. Castelle, of Paris, exhibits (107, p. 1176) a still more varied assortment of the modifications of gelatine, among which are particularly deserving of notice the very large sheets of transparent gelatine, colourless, white, of various well-defined colours, and embossed or stamped with elegant patterns. Taking into consideration the variety and perfection of these modifications of gelatine, the Jury award to M. Castelle the Prize Medal.

D'Enfert Brothers (496, p. 1201); V. Pitoux (960, p. 1225); N. Le Clercq (1302, p. 1239); J. C. A. Royer (1461, p. 1245); Herve Brothers (1624, p. 1255); Bouasse, Lebel, and Co. (774, p. 1217), have exhibited beautiful collections of glues and gelatines similar to the foregoing, and applicable to all the purposes for which a pure, colourless, inodorous gelatine is adapted. MM. Coignet and Son, of Lyons, fabricate, from bones and various other animal remains, considerable quantities of glues and gelatines, good specimens of which are exhibited, together with other chemical products of animal bodies, in No. 1153, p. 1233. The Jury regard the above-named exhibitors of gelatines and glues as worthy of Honourable Mention.

MM. Reiss de Dreuze, of Meurthe (355, p. 1194), and M. Faussemagne, of Lyons (1599, p. 1253), merit notice for their excellent gelatines from bones and isinglass for the purpose of dressing various stuffs and cloths.

The Company of Bouxwiller (Bas-Rhin) (376, p. 1195), exhibits gelatine in small plates, much esteemed for various preparations or dressings; it is extracted from the bones from which the same Company obtains phosphorus and phosphates of lime. This Company—MM. Estivant Brothers (1214, p. 1235), and Humbert and Co. (1272, p. 1238)—who exhibit excellent specimens of glues — are severally, in the opinion of the Jury, deserving of Honourable Mention.

England.

The greater part of the gelatinous products exhibited by the English manufacturers is prepared from isinglass, and chiefly applied to articles of food. The commercial qualities of isinglass are instructively shown in the collection exhibited under Nos. 117, 118, and 141, p. 204. Some exhibitors, however, show excellent glues and gelatines, obtained from various residues of animal bodies, and destined for manufacturing purposes.

Mr. Muller (125a, p. 204*), has exhibited a fine assortment of glues and gelatines, analogous to the products of M. Grenet; but a part of his fine gelatine in threads, for confectionery purposes, appears to have been obtained from isinglass. This is deserving of Honourable Mention.

M. Dufaville (125, p. 204*), shows a beautiful sample of amber-coloured transparent gelatine in shreds, called 'crystalline,' from its glittering surface; and also good filaments of isinglass for culinary purposes. Messrs. Watt and Son (120, p. 204*), exhibit fine specimens of glue obtained from the refuse pieces of hides and skins. Mr. James Vickers* (117, p. 204*), exhibits a rich variety of specimens of isinglass in the different raw states in which it is imported, and in all the states of its preparation for the various applications for which it is sold. The variety of colours of the different kinds and parts of isinglass is exemplified in elegant forms and arrangements of this material. Messrs. Dawson and Morris (118, p. 204*), and Mr. Glass (141, p. 193*, Class III.), have exhibited good specimens of isinglass, dried, beaten into layers, and cut into threads, exhibiting care and skill in the latter kinds of preparation. The Jury desire to make Honourable Mention of each of the above exhibitors. The Jury also deem worthy of Honourable Mention the beautiful specimens of refined gelatine, exhibited by Messrs. Swinborne (119, p. 204*). The more opaque filamentary specimens resembling isinglass appear, from microscopic and chemical tests, to be refined gelatine, from which the shining surface has been removed by a process of damping. This is a good material for the purposes of the confectioner, but it is not adapted for clarifying white wines and beers, like true isinglass.

Canada.

Mr. A. MacFarlane (124, p. 966) exhibits good specimens of glue of the deep brown semi-transparent kind, adapted for cabinet-work, and deserving Honourable Mention.

Zollverein.

Three manufacturers here exhibit specimens of the present class of raw materials. One of these, J. G. Loosen, of Cologne (336, p. 1070), shows a fine specimen of an esteemed and long-known article called 'Cologne glue' (Colle de Cologne), which was the best kind of glue prior to the recent advance in the manufacture of gelatine, and which is still highly esteemed by the joiner and cabinet-maker. The Jury deem it deserving of Honourable Mention.

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* This exhibitor was awarded a Prize Medal in Class III.

M. A. Feigenspan, of Mühlhausen, Saxony (688, p. 1088), exhibits specimens of gelatines of the Dutch and Givet kinds, of the ordinary qualities.

The samples from *Belgium*—H. Biret, of Liege (93, p. 1154), and H. G. Hansotte Dellove, of Liege (94, p. 1154), consist of glues in thick, reddish, transparent plates, presenting the characters of good 'Givet glue,' and deserving Honourable Mention.

From *Portugal* have been sent (No. 627) specimens of glues of an inferior quality and putrescent odour. The specimens (Nos. 625 and 626) present qualities of the best productions of a gelatinous nature; but the denomination of 'grenetine' under which they are exposed, indicates their French origin.

The specimens (No. 7) from *Sardinia* of glue, in thin plates, betray an inferior quality and putrescent odour.

Isinglass.

This raw material owes the greater part of its commercial value to its special organization, which permits its separation into extremely delicate fibres, capable of operating, mechanically, in the clarification of white wines and malt liquors. In order to obtain the best isinglass, care must be taken to choose the most suitable membranes of the proper species of fish, and to avoid altering their peculiar tissue in the process of drying and preparing them.

Russia.

Under these two relations the products of Russia hold their first rank.

Marimanoff and Armakoona (81, p. 1369), display specimens of the best quality of isinglass, consisting of the tissues of the air-bladders of the sturgeon (*Acipenser Huso*), well cleaned, and removed and dried without the texture being affected. The Jury select this exhibitor as deserving Honourable Mention.

No. 116 presents a variety of isinglass obtained from the intestinal membranes in the form of elongated stripes, made into bundles. This substance, like the gelatines from the tendons, bones, and hides of cattle, serves well for different culinary purposes, and for the same uses in manufactures as fine gelatine from other sources.

India.

Among the specimens from India there are different kinds of isinglass in the raw state, from species of fishes distinct from those of Europe which commonly afford this substance. The principal of these are from a siluroid fish, the *Polynemus plebeius*, the dried air-bladders of which are exhibited by Dr. M'Clelland (p. 891). (A Prize Medal has been given to this exhibitor in Class III.) They possess the fine fibrous tunic which imparts the clarifying qualities that render isinglass so valuable in the manufacture of white wines and beers; and they are also well adapted for the fabrication of fine gelatines used in manufactures and confectionery.

In the same Collection from India are examples of dried sharks' fins, such as are prepared for culinary purposes for the Chinese market; but this raw material is doubtless applicable to the preparation of gelatine for economical and industrial purposes.

Albumen.

Some excellent examples of this substance obtained from eggs, dried and manufactured, are exhibited in France (1538, p. 1250), by M. H. Alleon, of Annonay, Ardèche, of whom the Jury desire to make Honourable Mention.

Animal Charcoal, Bone Black, Ivory Black.

The Jury have examined and compared many specimens of these substances, exhibited by different nations, and propose to distinguish, by a Prize Medal, the charcoal, exhibited by J. H. M. Violette, *France*, (1528, p. 1250), and by Honourable Mention the following:—

MM. Kuhlmann Brothers (555, p. 1205), for the specimens of granulated and pulverised animal charcoal, included in their instructive samples of different chemical products.

L. Raucher, Jun. (1422, p. 1244), for his samples of animal charcoal.

M. Tordeux (699, p. 1212), for his examples of bone-black, granulated, pulverised, and of various qualities.

Portugal.

J. F. Pinto Basto (629, p. 1314), for his specimens of animal charcoal, in powder.

Netherlands.

P. Smits (20, p. 1143), for his specimen of animal charcoal.

Zollverein.

J. Waechter (434, p. 1075), for his granulated and powdered animal charcoal, obtained from the scum of sugar in the process of refining.

Mecklenburgh-Schwerin.

M. Meyer (6, p. 1134), for his samples of charcoal.

Belgium.

B. Seghers (110, p. 1154), for his animal-black, bone-black, and ivory-black.

E. Verstraeten (108, p. 1154), for his specimens of animal-black.

England.

D. Chan (65, p. 541, Class XVII.), for his bone-black and ivory-black.

D.—*FOR PIGMENTS AND DYES.*

Cochineal and Carmine.

The beautiful red dye called 'cochineal' is obtained from the dried body of an insect (*Coccus cacti*), which feeds chiefly on the *Cactus coccinellifer* and the *Cactus Opuntia*. The female insects, which are wingless, are alone collected, and the different degrees of value attached to them depend chiefly on the different methods employed to kill and dry the insects. Analyses of the cochineal have yielded chitine, fatty matter, phosphates of lime and of potash, chloride of potassium and carbonate of lime, and the colouring matter to which the name of 'carminium' or carmine is given. The chief use of cochineal is the dyeing of scarlet: the fine colour which it yields is converted to that tint by means of chloride of tin, called by the dyer 'tin spirits.'

The following are the specimens of cochineal which, in the opinion of the Jury, demand Special and Honourable Mention.

England.

Jewesbury and Co. (66, p. 200*).—Varieties of cochineal from Honduras, Mexico, Teneriffe, Java, and the West Indies.

I. Sadler (76a, p. 200*).

Spain.

D. J. B. Berenguer (192a, p. 1341).

D. M. Gomez Alcaide (151, p. 1338).

D. E. Meron (150, p. 1338).

The culture of cochineal, in Spain, has extended itself of late years along the sandy and barren coasts of the Mediterranean, and with good success.

Another red dyeing substance, called *Grana kermes*, is obtained in some abundance from the shrubs of the province of Huelva, which is sold at Valencia at eight reals per lb. The Governor of the Province of Huelva (937, p. 1334), has transmitted a specimen of this kermes, of which the Jury desire to make Honourable Mention.

Algeria.

M. Hardy (28, p. 1261).—The Jury award Honourable Mention to this exhibitor for his very promising specimens of cochineal from that young colony.

Finally, amongst the animal raw products the Jury desire to select for Honourable Mention the specimens of guano from the Cape of Good Hope, exhibited under No. 37, p. 950, by J. Searight; No. 50, p. 952, by A. De Pass, and that from Van Diemen's Land, No. 255, p. 997, by J. Milligan.

RICHARD OWEN, Reporter.

London, November 1851.

CLASS V.

REPORT ON MACHINES FOR DIRECT USE, INCLUDING CARRIAGES, AND RAILWAY AND NAVAL MECHANISM.

[The figures after the Names (between parentheses), refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

Rev. HENRY MOSELEY, M.A., F.R.S., *Chairman and Reporter*, Education Office, Privy Council; Corresponding Member of the Institute of France, and formerly Professor of Natural Philosophy and Astronomy in King's College, London.
Colonel MORIN, *Deputy Chairman*, France; Member of the Institute of France and of the Central Jury, and Director of the Museum of Arts and Sciences.
Chevalier ADAM DE BURG, Austria; Director of the Imperial Polytechnic Institute, Vice-President of the Society of Arts and Manufactures, &c.
LUIGI CAPPELLETTO, Austria; Mechanical Engineer.
Professor WILHELM ENGERTH, Austria.
W. FAIRBAIRN, Manchester; Mechanical Engineer.
JOHN FAREY, 67 Upper Guildford Street, Russell Square; Consulting Engineer.
JOHN HICK, Bolton-le-Moors; Mechanical Engineer.
H. MAUDSLAY, 4 Cheltenham Place, Lambeth; Mechanical Engineer.
ROBERT McCARTY, United States; Machinist.
ROBERT NAPIER, Glasgow; Mechanical Engineer and Ship Builder.
C. DE ROSSIUS-ORBAN, Belgium; Vice-President of the Chamber of Commerce of Liege.

Associates.

EDWARD COWPER, Professor of Manufacturing Art and Machinery, King's College, London.
W. H. HATCHER, 22 Hawley Road, Camden Town; Engineer.

THE machines on which the Jury of Class V. has had to adjudicate are generally of the class called "Prime Movers," being those more directly connected with the development of power than with its application. Where, however, the application of the power to the result to be accomplished is direct and immediate, the mechanical expedients by which it is made were also assigned to the consideration of this Jury. Where the application is indirect, being made through a series of mechanical elements intervening between the prime mover and the point where the result is accomplished, such intervening machinery was reserved for the consideration of the Jury of Class VI.

It is obvious that in the consideration of this class of machines, the Jury must be chiefly guided by the principles of mechanics as distinguished from those of mechanism. The machines referred to the Jury were divided by the Commissioners into six classes, as follows:—

V. *Machines for direct use, including Carriages, and Railway and Naval Mechanism.*

A. STEAM ENGINES AND BOILERS, WATER AND WIND-MILLS, AND VARIOUS OTHER PRIME MOVERS.

1. Boilers.
2. Land Engines.
3. Marine Engines.
4. Wind-mills.
5. Water-wheels and Turbines.
6. Water-pressure Engines, as Richenbach's, and Armstrong's.
7. Vacuum Power Engines.
8. Electro-Magnetic Engines, &c. &c.
9. Miscellaneous.

B. SEPARATE PARTS OF MACHINES, SPECIMENS OF WORKMANSHIP. (See also WATER and GAS-WORKS in Class VII.)

1. Heavy Castings or Forgings in the rough; Castings or Forgings, plain, intricate, or beautiful, in the rough.
2. Specimens of Turning in Metals.
3. Specimens in filing and finished Work in Metals, such as Surfaces, Irregular Figures, &c.
4. Valves, Cocks, Pistons, Governors, &c.

C. PNEUMATIC MACHINES.

1. Air-pumps.
2. Blowing Fans.
3. Blast Engines for Furnaces, &c.
4. Miscellaneous.

D. HYDRAULIC MACHINES, CRANES, &c., PILE DRIVERS, &c. (See also Class VII.)

1. Hydraulic Machines—
   Pumps and Fire Engines.
   Water Rams.
   Hydraulic Presses, &c.
   Water Meters, &c.
2. Cranes—
   Any sort of Crane motion and contrivances, Jacks of all sorts. (For Windlasses, Captans, and Blocks, see Class VIII. E.)
3. Piling Engines—(See also Class VII. A.)
   By hand power, or steam.
   Pile Sawing Machines.
   Pile Extractors, &c.

E.

1. Railway Locomotives—
   Inside Cylinder.
   Outside Cylinder.
   Inside Cylinder Tank.
   Outside Cylinder Tank.
   Models.
   Compressed and Hot Air.
   Hydraulic.
2. Common Road Locomotives.
3. Railway Carriages, Waggons—
   Carriages.
   Trucks and Waggons.
   Carriage Models.
   Waggon Models.

4. Railway Velocipedes.
5. Atmospheric Railway Apparatus.
6. Breaks—
   - Full Size.
   - Models.
7. Buffers, Couplings, &c.
   - Buffers.
   - Couplings.
   - Wheels, Tires, Axles, Bearings.
   - Miscellaneous.

F. RAILWAY MACHINERY AND PERMANENT WAYS.

1. Permanent Ways complete.
2. Sleepers.
3. Chairs, &c.
4. Rails.
5. Switches.
6. Turn-tables.
7. Station Arrangements.
8. Signals.
9. Miscellaneous.

G. WEIGHING, MEASURING, AND REGISTERING MACHINES FOR COMMERCIAL, AND NOT FOR PHILOSOPHICAL PURPOSES.

1. Commercial Weighing Instruments.
2. Instruments of Measures.
3. Registering Instruments, Gauges, Indicators, and Tell-tales.

The total number of these objects exhibited was 537, distributed through the seven subdivisions as follows:—

NUMBERS of Objects in the Subdivisions of Class V.

A.	B.	C.	D.	E.	F.	G.
143	40	9	117	112	73	40

The following are the proportions in which they were contributed by different countries:—

Austria.	Belgium.	China.	Denmark.	Egypt.	England and the Colonies.	France.	Netherlands.	Portugal.	Sardinia.	Turkey.	Tuscany.	United States.	Zollverein.
5	21	2	1	2	424	63	6	1	1	1	1	16	4

The Jury held its first meeting on the 12th May, when it formed itself into three Sub-Juries, which respectively undertook to examine and report upon the objects included under the several subdivisions.

The number of objects referred to the first Sub-Jury (A, B) was 184, to the second (C, D), 128, and to the third (E, F, G), 224.

The reports of the Sub-Juries were made to the whole Jury, which met twice a-week for that purpose, and the Jury visited and examined collectively all those objects which were considered by the Sub-Juries to claim such further examination, including all those recommended for prizes. Its awards were made on that examination.

No other objects were examined by the Jury, in the English Department, than those placed by the Royal Commissioners in Class V. of the Catalogue, except such as were referred to them from other Juries. In the several foreign departments the objects were not classed in the Catalogue. The Jury had, therefore, to select those objects in these foreign departments which, in accordance with the instructions of the Commissioners, appeared to belong to their adjudication.

The number of meetings of the Jury was 18: they were all attended by Colonel Lloyd, special Commissioner, and minutes were kept of their proceedings by that gentleman and by the Secretary.

The Sub-Juries assembled, with few exceptions, daily, until their work was completed.

The final awards were made on the 20th of June; they were confirmed by the Group B, of which the Jury formed part, on the 30th of June, and by the Council of Chairmen on the 14th July.

The following table contains a general statement of the numbers of these awards in the several countries which have contributed to the Exhibition, together with the numbers of Exhibitors, and exhibits in each country, and the proportions which these bear to the Medals awarded.

As, for obvious reasons, the machines, so difficult of transport as those of Class V., sent from foreign countries, could not be expected adequately to represent the mechanical capabilities of those countries in respect to such machines, so the Jury are of opinion that the machines referred to their examination from Great Britain, however numerous and in many respects remarkable, do not, in the aggregate, for reasons which it is unnecessary to specify, duly represent the engineering resources and skill of Great Britain, and that any future exhibition would afford conclusive evidence of this fact.

LIST of COUNTRIES and PRIZES awarded or recommended for the three Subdivisions.

—	A, B.				C, D.				E, F, G.				TOTAL.			
			Medals.				Medals.				Medals.				Medals.	
	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
1. England and Colonies –	104	141	2	16	63	88	1	15	154	195	2	23	321	424	5	54
2. United States – – –	4	4	–	–	3	3	–	–	7	9	–	–	14	16	–	–
3. Austria – – – – –	2	2	–	1	1	1	–	–	2	2	–	1	5	5	–	2
4. Belgium – – – –	2	5	1	–	7	9	–	1	3	7	–	–	12	21	1	1
5. China – – – – –	–	–	–	–	1	2	–	–	–	–	–	–	1	2	–	–
6. Denmark – – – –	–	–	–	–	1	1	–	–	–	–	–	–	1	1	–	–
7. Egypt – – – – –	–	–	–	–	–	–	–	–	1	2	–	–	1	2	–	–
8. France – – – – –	9	30	1	2	14	22	–	3	8	10	–	3	32	63	1	8
9. German Zollverein – –	1	1	–	–	–	–	–	–	3	3	–	1	4	4	–	1
10. Netherlands – – – –	1	1	–	–	1	1	–	–	2	4	–	–	4	6	–	–
11. Portugal – – – –	–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	–
12. Sardinia – – – –	–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	–
13. Turkey – – – – –	–	–	–	–	1	1	–	–	–	–	–	–	1	1	–	–
14. Tuscany – – – –	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
Total – – –	123	184	4	19	92	128	1	19	182	234	2	28	399	548	7	66

List of Countries and Prizes awarded or recommended for the three Subdivisions—*continued.*

—	RATIOS.			
	Council to Prize Medal.	Council Medal to Exhibits.	Prize Medal to Exhibits.	1st & 2nd Medals to Exhibits.
1. England and Colonies -	1 to 11	1 to 85	1 to 7·8	1 to 7
2. United States - - -	–	–	–	–
3. Austria - - - - -	–	–	1 to 2·5	1 to 2·5
4. Belgium - - - -	1 to 1	1 to 21	1 to 21	1 to 10
5. China - - - - -	–	–	–	–
6. Denmark - - - -	–	–	–	–
7. Egypt - - - - -	–	–	–	–
8. France - - - - -	1 to 8	1 to 63	1 to 8	1 to 7
9. German Zollverein - -	–	–	1 to 4	1 to 4
10. Netherlands - - - -	–	–	–	–
11. Portugal - - - -	–	–	–	–
12. Sardinia - - - -	–	–	–	–
13. Turkey - - - - -	–	–	–	–
14. Tuscany - - - -	–	–	–	–
Total - - -	1 to 9·6	1 to 76·7	1 to 8	1 to 7·3

The contributions to the Exhibition of the following eminent engineers who were members of the Jury, or represented in it by gentlemen connected with their respective firms, were excluded from the competition for Medals.

No. 1542, p. 1250. M. C. ARNOUX, coachmaker, 23, Rue du Mont Parnasse, Paris. Articulated railway carriages.

No. 13, p. 212. HICK, B., and SON, Bolton. Steam-engine driving Hibbert and Platt's machinery. Portable forges. Expanding mandrils.

No. 130, p. 1014 (Austria). A Dynamograph, by the CHEVALIER DE BURG. No. 26, p. 214. FAIRBAIRN, W., and SONS, Manchester. Six horse-power steam-engine. No. 417. Wrought iron tubular crane. No. 522. Inside cylinder tank locomotive engine. No. 732. Model of tank locomotive engine.

No. 38, pp. 215-217. See Illustrations, 215, 216. MAUDSLAY, SONS, and FIELD, London. A 16 horse-power double cylinder direct acting high-pressure engine. Connecting rod for an 800 horse-power marine engine. A case of six models, viz., beam, double cylinder, annular cylinder, horizontal cylinder and steeple engines for shallow river navigation. Model of a gun-metal screw propeller.

The Jury has to acknowledge its obligations to COLONEL MORIN, its Vice-Chairman, for the assistance he was obliging enough to give it in conducting many of the dynamometrical experiments, of which the results are detailed in this Report; to Mr. HATCHER, for the calculations founded upon those experiments, for conducting other dynamometrical experiments, and for the zeal and ability with which he has aided the Jury in every department of its labours; to its able Secretary, Mr. HENRY MAUDSLAY, whose knowledge of the machinery on which the Jury has had to adjudicate, acquired as Chairman of the Metropolitan District Committee, has greatly aided its inquiries; and to its intelligent Assistant-Secretary, Mr. MARTIN. The Jury has, moreover, to thank Mr. HENSMAN, the Manager of the Machinery Department, for the intelligent co-operation and assistance it has received from him.

To these acknowledgments the Reporter of the Jury has to add his own, to Mr. HENRY MAUDSLAY, Mr. HATCHER, and Mr. MARTIN, who acted severally as the Secretaries of the three Sub-Juries, for the assistance given to him in the compilation of this Report, the details of which, whether contained in the tables prefixed to the several sections, or in the notices of machines to which prizes have been awarded in each section, have been collected chiefly by them.

In reporting on the labours of the Jury, it will be convenient to take the objects referred to its consideration, according to the subdivision of the Commissioners.

SECTION (A).

The following table (see pp. 170, 171) contains a classification of the objects exhibited under this subdivision, with the number under each class exhibited from each country.

Invention with regard to the steam-engine appears from this table to be specially directed to the economy of space.

The tubular boiler is a contrivance for that end, offering, within the same bulk, a greater surface to the action of the heat on the one side, and of the water on the other, than any other form of boiler. There are eight such, or models of them, in the Exhibition, intended for the land engine.

In marine engines this economy of space has a special value and importance. The direction which invention is taking with a view to this economy is shown in numerous expedients for the *direct* action of the piston rod upon the crank of the paddle-wheel or of the screw propeller, without the intervention of the beam. There are no less than thirty-four direct-acting engines or models exhibited.

A rotary steam-engine, if one could be contrived whose rubbing surfaces were steam-tight and durable, would effect a remarkable economy of space, and would be better calculated than any other to drive a screw propeller. The increased importance thus given by the use of the screw propeller to the invention of rotary engines is indicated by the exhibition of nine such engines or models.

If, among these, none appears to afford a complete solution of the problem, at any rate there is nothing to discourage further attempts. Nor is this problem the less likely to be solved now that a *gain of power* is no longer looked for from the use of rotary engines, but only a simpler and more convenient mode of applying it.

Such a *gain* might indeed result from a freer access of the steam to the piston from a diminution of the friction or the jar of the working parts, or from a more complete expansion; but, thanks to the more general diffusion of information in mechanics, practical men now know, that there is no more possibility of increasing the work of an engine by merely altering the direction of the motion of any of its working parts, than there is of increasing the quantity of water which a reservoir will supply, by varying the pipes which serve to distribute it.

The difficulty of assigning the best form to a solid body which is to receive and apply the resistance of a fluid, is indicated by twelve competing forms of paddle-wheels and fifteen different screw propellers.

Classification of Steam Engines and Boilers, showing the Number of each Class exhibited from each Country.

Sub-division.	ARTICLES.	England.				America.				Austria.				Belgium.				France.				Zollverein.				Total.			
		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.	
				Council.	Prize.			Council.	Prize.			Council.	Prize.			Council.	Prize.			Council.	Prize.			Council.	Prize.			Council.	Prize.
	Steam Engines and Boilers.																												
No. 1 Boilers.	1. Tubular land	4	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	4	–	–
	2. Models of ditto	3	4	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	5	–	–
	3. Chimneys	1	1	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	2	2	–	–
	4. Dampers	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
	5. Furnaces	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
No. 2 Land Engines of all sorts.	1. Vertical cylinder, direct acting, high-pressure	7	7	–	3	–	–	–	–	1	1	–	1	1	1	–	–	1	1	–	–	–	–	–	–	10	10	–	4
	2. Models of ditto	4	4	–	–	–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	–	–	–	–	–	6	6	–	–
	3. Horizontal cylinder, direct acting, high-pressure	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
	4. Models of ditto	1	1	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–
	5. Oscillating cylinder, direct acting, high-pressure	6	6	–	3	–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	–	–	–	–	–	8	8	–	3
	6. Models of ditto	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	7. Rotary cylinder, direct acting, high-pressure	4	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	6	–	–
	8. Models of ditto	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	9. Rotary hot-air engine	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–	–	–	–	–	2	2	–	–
	10. Beam engine	3	3	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	4	–	–
	11. Beam engine; hot-air engine	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
	12. Reciprocating cylinder engine	1	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	2	2	–	1
	13. Semi-rotary engine	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
	14. Disk engine	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
	15. Models of ditto	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	16. Double cylinder, direct acting, equal pressure	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	2	2	–	–
	17. Double cylinder, direct acting, high and low pressure	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
	18. Models of ditto	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	19. Elliptical direct acting cylinder engine	1	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	1

		STEAM ENGINES AND BOILERS.																											
No. 3	*Steam-boat Engines.*	1. Beam engine, screw-propellers	1	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	1
		2. Models of ditto, paddle-wheels	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–
		3. Oscillating cylinder engine, paddle-wheels	1	1	1	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	2	2	1	–
		4. Models of ditto, paddle-wheels	5	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	7	–	–
		5. Models of ditto, screw-propeller	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		6. Annular cylinder direct acting engine, model	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
		7. Double piston-rod direct acting engine, model	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
		8. Trunk cylinder direct acting engine, screw-propeller	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	–
		9. Horizontal cylinder direct acting engine	1	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	1
		10. Models of ditto	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–
		11. Rotary engine, direct acting, screw-propeller	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		12. Models of ditto	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		13. Inclined cylinder engine, direct acting, screw propeller	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
		14. Double cylinder direct acting engine, paddle-wheel	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
		15. Models of ditto	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		16. Disk rotary direct acting engine	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
		17. Compressed air and hot air engine	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 4		Windmills, horizontal and vertical	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
No. 5		Water-wheels, turbines	4	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	–	–	–	–	–	5	6	1	–
No. 6		Water-pressure engines	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
No. 7		Electro-magnetic engines	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 8	*Miscellaneous.*	1. Water-gauges	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	4	–	–	–	–	–	–	3	5	–	–
		2. Steam-gauges and barometers, &c.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	7	–	–	–	–	–	–	2	7	–	–
		3. Paddle-wheels, models of	10	12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10	12	–	–
		4. Screw-propellers, models of	7	15	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	15	–	1
		5. Fly-wheels	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
		6. Slide-valves	3	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	5	–	–
		Total	95	113	2	11	4	4	–	–	2	2	–	1	5	5	–	–	11	18	1	–	1	1	–	–	118	143	3	12

The advantages to be obtained by working steam *expansively*—long known to men of science—are now generally acknowledged. It is, indeed, obvious that by admitting the steam to the cylinder at a *higher pressure than that of the load*, and cutting it off before the stroke is completed, the piston and the mass it carries with it are driven on with a continually increasing velocity, until by the expansion of the steam—after the closing of the valve by which it is admitted—its pressure is reduced to an equality with the load; when the piston does not stop—by reason of the momentum it has acquired—but is carried on, the steam yet further expanding, until the stroke is at length completed and a cylinder-full of steam is discharged, expanded considerably *below the pressure* of the load. Whereas by working without expansion, at what is called full pressure, a cylinder-full of steam is expended at every stroke *of the pressure* of the load.

The Jury has had to adjudicate on various expedients for thus working engines expansively, called expansion gear.

AWARDS IN SECTION A.

No. 8, p. 211, and Illustration, 212. **JOHN PENN and SON**, Greenwich. 1. A pair of 12-horse power oscillating cylinder direct-acting engines, for river navigation, of light construction and good workmanship for small vessels. 2. A pair of 30-horse power patent direct-acting engines, called trunk engines, for driving a screw propeller.

In these engines, which are similar to those of H. M. steam-ships "Arrogant" and "Encounter," the piston-rod is widened into a hollow cylinder called the trunk, 14 inches in diameter, projecting through both ends of the steam cylinder (2 ft. 4 in. in diameter), and having the connecting-rod jointed to its centre; the width of the trunk, allowing for its play at every stroke (16 in.) in that position, and the stuffing-boxes serving as guides. A considerable economy of space is thus effected, and some costly parts of the machinery are dispensed with. The circular form of the ordinary piston being by this contrivance converted into that of a circular ring, a greater diameter of the cylinder is required to obtain the same area to receive the pressure of the steam, and a greater periphery has to be kept steam tight. There is also a radiation of the heat of the steam in the cylinder from the internal surface of the trunk, to which the ordinary engine is not liable, and a greater surface externally subject to this radiation.

The ordinary packing of a stuffing-box at one end is, moreover, in this engine, enlarged into that of the large convex surface of the trunk (14 inches in diameter) at both ends; and the difficulty of keeping the packing of these steam-tight, is increased by the lateral strain, to which, serving as guides, they are subjected.

These are practical disadvantages which may, for nautical purposes, be compensated by the economy of space which is effected in this engine. It is from this consideration that the Jury has included it, with the river engine, in the award which it recommends of a Council Medal to the makers.

No. 119, p. 1155 (Belgium). **COCKERILL, J.**, Seraing, Liege. 1. A pair of 140-horse power vibrating cylinder engines, for the navigation of the Rhine. The framing and paddle-centres, usually of cast-iron, being in these engines made of wrought-iron, the requisite strength is obtained with less weight.

The vibrating cylinders being so placed on opposite sides of the crank that each piston completes its stroke in an inclined position of its cylinder (and, of course, when the stroke of the other piston is incomplete), the same crank-pin is made to serve for both pistons, and a single crank supplies the place of the two at right angles to one another, commonly employed to pass the dead points.

2. An outside cylinder locomotive engine, of good construction and workmanship; with a small donkey-engine attached, for keeping up a constant supply of water to the boiler when the engine is stationary.

3. An oscillating direct-acting three-horse power portable engine and boiler, so combined that the weight of the boiler gives stability to the working parts of the engine fixed to the side of it. The arrangement is simple; the inside of the boiler may be easily cleaned, and the working parts reached.

4. A small donkey-engine, with its pumps and valve-boxes complete, for a steam-boat; to apply usefully the steam which would otherwise be blown off through the waste-steam pipe, in filling the boilers, pumping the water from the bilge or from the sea to wash the decks or sails, &c.; and in case of need, to extinguish fire. A Council Medal is recommended for this collection of machines.

No. 220, pp. 1184-1186. See Illustrations, pp. 1185, 1186 (France). **FROMONT and SON**, Chartres. A double turbine, constructed on the system of M. Fontaine Baron. The turbine is a hydraulic machine—of frequent use in France but almost unknown in England—which, instead of rotating vertically, as water-wheels usually do, rotates horizontally. When constructed with a careful reference to the principles on which the efficiency of all hydraulic machines depends, the turbine possesses these advantages:—*

1. It occupies a small space. 2. Turning very rapidly, it may, when used for grinding flour, be made to communicate the motion directly to the mill-stones. 3. It works under water. 4. It works equally well under small and great falls of water. 5. It yields, when properly constructed, and with the supply of water for which it was constructed, a useful effect of from 68 to 70 per cent., being an efficiency equal to that of any other hydraulic machine. 6. The same wheel may be made to work at very different velocities without materially altering its useful effect. This last property is one of great importance in certain applications, and constitutes an advantage of this machine over most others that have their established rates of working; from which it is not possible to deviate without a proportionate sacrifice of power.

The turbine of M. **FONTAINE BARON**, to which the Jury recommends the award of the Council Medal, appears, from experiments made on its efficiency, to be one of the most successful of the modifications of that form under which Fourneyron first introduced this machine in France, in the place of the old horizontal water-wheel.

The following exhibitors were awarded the Prize Medal:—

No. 6, p. 211. **WATT, JAMES, and Co.**, 18 London Street, London, and Soho, Birmingham. A pair of horizontal cylinder direct-acting marine engines, of 700-horse power, for driving the screw propeller.

The two cylinders of each engine are placed opposite to one another athwart the ship, and work, by means of guides and connecting-rods, on the same crank of the shaft which carries the propeller. The cranks of the two engines are fixed at right angles to one another.

No. 1, p. 210, and Illustrations. **ATHERTON, CHARLES**, H. M. Dockyard, Devonport. Patent expansion gear, by which the variations of the expansion may be registered whilst the engine is working.

No. 49, p. 219. **COLLINGE, C., and Co.**, 65 Bridge Street, Westminster. A new and simple method of reversing the slide of an engine, whereby the direction of its motion may be more easily changed.

No. 39, p. 218. **CLAYTON, SHUTTLEWORTH, and Co.**, Lincoln. A six-horse power oscillating cylinder direct-acting portable steam-engine, of plain and simple construction, having a good arrangement of the slide, and is easily manipulated.

No. 3, p. 210. **SMITH, F. P.**, Greenwich. A complete series of models, illustrating the gradual advance and improvement of the screw propeller; which was proposed and brought into general use by this gentleman.

No. 507, p. 1203 (France). **FLAUD, H. P.**, 27 Rue Jean Goujon, Paris. A high-pressure direct-acting five-horse power steam-engine. The revolving parts are well balanced throughout; whereby the strain upon the bearings, due to the centrifugal force, and the consequent wear and tear, and loss of power by friction, are avoided. This precaution, expedient in all engines, is the more required in this, as it is intended to work at high velocities (500 revolutions per minute). The high pressure (75 lbs. per square inch), at which it is proposed to work this engine, is, however, to be deprecated as attended with great risk, and with great loss by reason of the high temperature.

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* Leçons de Mécanique pratique, par Arthur Morin, vol. ii., pp. 329 and 362. The details of numerous experiments made to determine the efficiency of these machines, will be found in Colonel Morin's work.

No. 924, p. 1224 (France). Mauzaize, J. N., 4 Impasse St. Michel, Chartres (Eure et Loire). A friction clutch, for throwing out of gear a single pair of stones in a flour-mill without stopping the mill. On the spindle which carries the mill-stone is fixed a conical cup, into which a cone, fixed on the corresponding driving-spindle, is pressed by means of a screw, until a sufficient friction is obtained to carry the mill-stone round: the reverse motion of the screw releases it.

No. 967, p. 1226 (France). Pouyer, —, Mechanist, Rouen. Apparatus by which any number of prime movers may be connected or disconnected at pleasure, so as to work the same machine. By this simple and ingenious expedient, a water-wheel and a steam-engine may be made conjointly to drive the same machine with regularity, the steam-engine doing only so much work as is necessary to make up for the deficiencies of the water-wheel.

No. 40, p. 218. Pope and Son, Edgeware Road. A five-horse power oscillating cylinder direct-acting steam-engine, of good construction and good workmanship.

No. 105, p. 1013 (Austria). Schmidt, H. D., Vienna, engineer. A parabolic governor for a steam-engine. The balls and rods for raising the valves are the same as in the ordinary governor, except that the centres of the balls are made to move on the surface of a paraboloid of revolution instead of a sphere. This is effected by means of parabolic arms, fixed on opposite sides of the spindle, on which arms the balls slide, the rods which connect the balls with the valves sliding through them to admit of this motion.

Nos. 46, 203, pp. 218, 219. Siemens, C. W., Birmingham, working model of patent chronometric governor, well-known and approved.

No. 41, p. 218. Nasmyth, J., Patricroft, Manchester, a small portable direct acting steam-engine. The cylinder is fixed, vertical and inverted, the crank being placed beneath it and the piston working downwards. The sides of the frame which supports the cylinder serve as guides, and the bearings of the crank shaft and fly-wheel are firmly fixed in the bed plate of the engine: the arrangement is compact and economical, and the workmanship practically good and durable.

No. 25, p. 214. Crosskill, W., Beverley. A portable oscillating cylinder direct-acting steam-engine, of simple construction and good workmanship.

No. 12, p. 212. Edwards, T., Islington Foundry, Birmingham. Patent five-horse power direct-acting high-pressure steam-engine, of simple construction and good workmanship.

No. 14, p. 212. Simpson and Shipton, Trafford Street, Manchester. Short-stroke reciprocating high-pressure engine.

If a solid cylinder be conceived to be fixed eccentrically to an axis, and to be enclosed in a rectangular case, through the sides of which case an aperture is left for the play of the axis of the cylinder, and which is suspended from another axis about which it vibrates; and if the external surface of the cylinder be supposed so to fit the interior of the case into whatever position it may slide as it turns round, that it may divide the case into two chambers, the separation of which is steam-tight; then it is obvious that if there be a vacuum created in one of these chambers, and steam admitted into the other, the end of the case and the side of the cylinder will, in the latter chamber, tend to separate, and, in the former, to come together, which tendency will take effect, both the cylinder and the case being moveable. Instead of the axis of the cylinder being fixed and the case moveable, the axis of the cylinder may be moveable and the case fixed, as in the engine exhibited. The power is then transmitted from the moveable to a fixed axis by a crank. When the cylinder has thus been propelled to the opposite end of the case, completing one-half of a revolution upon its axis, it may obviously be made to complete the other half by reversing the action of the steam; provided that the dead points can be passed. This may be effected by a fly, or by placing a second cylinder on the same axis, at right angles to the first and, a second *case*,—either the rotation of the axis to which the cylinder is fixed, or the vibratory motion of the case serve to transmit the motive power. This ingenious contrivance appears to be liable to the same objection as others for the same object, in regard to the difficulty of packing. It has the advantage over them of a more even wear.

No. 16, p. 213. Davies, Joseph and George, Albion Foundry, Tipton, Staffordshire. Pair of elliptic revolving steam-engines. Two disc engines drive the same shaft, the discs being moveable with the shaft, and the case fixed. The governor is a hollow ball of metal surrounded by a metallic ring loaded on one side. In the bottom of this ball is a vertical slot, whose plane passes through the centre of gravity. The spindle traverses this slot and is jointed to the sphere at its centre. When it is whirled round by the engine, the centre of gravity of the ball and ring tends to rise by its centrifugal force, which is aided by the tendency of the ring to assume a position in which it may rotate about the least of its two principal axes of rotation. This tendency the slot allows to take effect. As the ball thus alters its position, a lever, whose fulcrum is within the ball acting upon a slide upon the spindle, controls the throttle valve. The whole of this mechanism is masked, and the slot being concealed by a cup, the ball appears to move freely in this cup unconnected with the machinery whose motion it regulates. The Prize Medal is awarded for the ingenious contrivance of the governor.

Honourable Mention is made of the following:—

No. 4, p. 210. Stothert, Slaughter, and Co., Bristol. A direct-acting engine for driving a screw propeller, of good workmanship.

No. 24, p. 214. Lynch and Inglis. Vertical cylinder direct-acting engine. Commended for compactness and good workmanship.

No. 30, p. 214. Ransomes and May, Ipswich. A five-horse power steam-engine, on Penn's patent trunk principle.

No. 34, p. 214. Butterley Company, Alfreton, near Derby. An eight-horse power oscillating steam-engine. Commended for simplicity and good workmanship.

No. 37, p. 215. Evans, J., and Son. Six-horse power high-pressure oscillating steam-engine. Commended for simplicity of construction and good workmanship.

No. 11, p. 212. Hawthorn and Co., Leith. High-pressure oscillating engine. Commended for its simple construction and good workmanship.

No. 526, p. 239, and Illustration. Wilson, E. B., and Co. A donkey-engine. Commended for arrangement and workmanship.

No. 70, p. 220. Constable, W., Brighton. Model of a compensating fly-wheel of ingenious construction.

No. 714, p. 251. Hinitt, James, 22, Vauxhall Row, Vauxhall. Working model of a locomotive-engine and tender. Extremely well made and creditable to the ingenuity and industry of the maker—a workman.

No. 200, p. 225. Tuck, Joseph Henry, 22, Pall Mall. Patent pneumatic governor for regulating the speed of steam-engines. Experience is said to have shown the usefulness of the invention.

No. 56, p. 219. Watkins and Hill, Charing Cross, London. Sectional models of steam-engines. Excellent models for educational purposes.

No. 328, Class VI., p. 297. Radcliffe, —. Trigger for shutting off steam from locomotives. Commended as a very simple arrangement.

No. 67, p. 220. Evans, William. Working model of a double cylinder engine. The inventor and designer of this model is blind.

No. 5, p. 211. Taplin, R., 7, Upper Woodland Terrace, Woolwich. Model of a telescope chimney for marine boilers. Commended as a good model.

No. 16, Class VI., p. 270. Mather, W. and C., Salford Iron Works. Spring rings for pistons, of good workmanship.

SECTION (B).

Sub-division.	ARTICLES.	England.				America.				Austria.				Belgium.			
		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.	
				Council.	Prize.			Council.	Prize.			Council.	Prize.			Council.	Prize.
No. 1	Heavy castings	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 2	Wrought iron, in the rough.	3	13	1	3	–	–	–	–	–	–	–	–	–	–	–	–
No. 3	Wheel-work, cog-wheels, &c.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 4	Finished work	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 5 *Valves.*	1. Expansion-valves	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	2. Safety-valves	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	3. Feed	4	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4. Discharged	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 6	Pistons	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 7	Governors, chronometric, pneumatic, patent friction	2	3	–	1	–	–	–	–	–	–	–	–	–	–	–	–
No. 8	Clutches, friction combining machines	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 9	Condensers, &c.	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 10	Whistles, water-alarm, &c.	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	17	28	1	4	–	–	–	–	–	–	–	–	–	–	–	–

Sub-division.	ARTICLES.	France.				Zollverein.				Total.			
		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.	
				Council.	Prize.			Council.	Prize.			Council.	Prize.
No. 1	Heavy castings	–	–	–	–	–	–	–	–	–	–	–	–
No. 2	Wrought iron, in the rough.	1	3	–	–	–	–	–	–	4	16	1	3
No. 3	Wheel-work, cog-wheels, &c.	1	2	–	–	–	–	–	–	1	2	–	–
No. 4	Finished work	–	–	–	–	–	–	–	–	1	1	–	–
No. 5 *Valves.*	1. Expansion-valves	–	–	–	–	–	–	–	–	–	–	–	–
	2. Safety-valves	–	–	–	–	–	–	–	–	1	1	–	–
	3. Feed	–	–	–	–	–	–	–	–	4	4	–	–
	4. Discharged	–	–	–	–	–	–	–	–	1	1	–	–
No. 6	Pistons	–	–	–	–	–	–	–	–	1	1	–	–
No. 7	Governors, chronometric, pneumatic, patent friction	2	2	–	–	–	–	–	–	4	5	–	–
No. 8	Clutches, friction combining machines	1	1	–	2	–	–	–	–	2	2	–	–
No. 9	Condensers, &c.	–	–	–	–	–	–	–	–	2	2	–	–
No. 10	Whistles, water-alarm, &c.	2	4	–	–	–	–	–	–	3	5	–	–
	Total	7	12	–	2	–	–	–	–	24	40	1	6

Awards in Section B.

No. 647, p. 247. **The Derwent Iron Company**, Newcastle-upon-Tyne. 1. Rolled iron plates from 17 to 20 feet long for ship-building purposes and for the sway beams of engines. 2. Rolled keel iron, a railway bar, measuring 66 feet 9 inches in length. A great importance has of late years been given to the manufacture of wrought iron in large masses by the increased scale, which every form of construction of iron is assuming. The limited dimensions of the wrought-iron plates, sway-beams, shafts, bars, &c., with which the engineer has to work, are indeed among the chief obstacles to construction in iron. Although much progress has of late years been made in the scale on which it is wrought, yet these are believed to be among the largest specimens ever produced in their respective departments of manufacture, and the Jury were unanimous in their recommendation of a Council Medal to the makers of them. They regret that this recommendation, not having been adopted by the Council of Chairmen, they have only the Prize Medal to award to them.

No. 543, pp. 241, 242. **Patent Shaft and Axletree Company**, Brunswick Iron Works, Wednesbury. 1. Specimens of iron of their manufacture. 2. Patent railway carriage axles and other axles, with illustrations of their process of manufacture. 3. Patent links for suspension bridges, rolled at a single heat.

To form these axles, plates of iron are placed together like the radii of a circle, and tied with pieces of wire. In this state they are heated to a welding heat and then placed under forge-hammers, which have, together with their anvils, circular cavities of the dimensions of the axle to be formed. The fibrous quality of the iron derived from the plates, which are welded together to form it, thus remains unimpaired in the forging. A Prize Medal has been awarded for these articles.

No. 641, p. 247. **Coalbrook Dale Company**, Staffordshire. Specimens of iron, viz., square, round, flat, half-round, oval bar-iron. Angle, T, and girder iron. Tire iron for wheels. Engine, floor, and foot-plate iron. For which collection of exhibits a Prize Medal is awarded. (Council Medal awarded by Class XXII.)

No. 649, p. 247. Mersey Iron Company, Liverpool. Samples of patent rolled iron, principally for ship-building, whereby a saving of workmanship in knees for ships is effected. A Prize Medal awarded.

No. 202, p. 226. Ashby, Jonathan, Croydon Common, Surrey. A screw friction clutch. Commended as a good invention, of which Honourable Mention is made.

SECTION (C).

Sub-division.	ARTICLES.	England and the Colonies.			America.			Austria.			Belgium.		
		Exhibits.	Medals.		Exhibits.	Medals.		Exhibits.	Medals.		Exhibits.	Medals.	
			Council.	Prize.		Council.	Prize.		Council.	Prize.		Council.	Prize.
Pneumatics.	1. Air pumps - -	–	–	–	–	–	–	–	–	–	–	–	–
	2. Blowing fans - -	3	–	1	–	–	–	–	–	–	2	–	1
	3. Blast engine - -	1	–	–	–	–	–	–	–	–	–	–	–
	4. Miscellaneous - -	–	–	–	–	–	–	–	–	–	–	–	–
	Total - - -	4	–	1	–	–	–	–	–	–	2	–	1

Sub-division.	ARTICLES.	China.			Denmark.			France.			Netherlands.			Turkey.		
		Exhibits.	Medals.		Exhibits.	Medals.		Exhibits.	Medals.		Exhibits.	Medals.		Exhibits.	Medals.	
			Council.	Prize.		Council.	Prize.		Council.	Prize.		Council.	Prize.		Council.	Prize.
Pneumatics.	1. Air pumps - -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	2. Blowing fans - -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	3. Blast engines - -	–	–	–	–	–	–	3	–	1	–	–	–	–	–	–
	4. Miscellaneous - -	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total - - -	–	–	–	–	–	–	3	–	1	–	–	–	–	–	–

Awards in Section C.

No. 300, p. 226. Lloyd, G., 70 Great Guildford Street, Southwark, Inventor and Manufacturer of the patent centrifugal disc blowing machine, is awarded a Prize Medal.

The vanes of the blower are curved, and the sides conical. The air enters into a space left for its admission about the axis, and is expelled when the vanes are put rapidly in motion at its periphery, into a case which surrounds it, from which it is conducted by a pipe, and the blast applied by a nozzle. The exhauster differs from the blower in not having an outside case. The air is conducted by a pipe from the space to be exhausted to the central part of the exhauster, and expelled at its periphery. The improvement claimed is in the curving of the vanes and in the conical form of the sides. The action is stated to be noiseless, and the power consumed, less than that in the ordinary blower.

The Jury, being desirous of verifying these statements, directed a series of experiments to be made, of which the results are detailed in the following table (see p. 176). The blower being driven by Messrs. Clayton and Shuttleworth's steam engine, through a band which was passed over the drum of M. Morin's dynanometer, the work expended in driving it was registered by that instrument, with whatever velocity it was driven. The number of revolutions made per minute was measured by a counter, and the blast being received into a closed reservoir, was allowed to escape from it by a rectangular pipe, whose aperture could be varied by a slide. The pressure of the air in the reservoir was measured outside, by means of a bent glass tube communicating with the interior, and containing water.

The pressure of the air in the reservoir being known, and the dimensions of the aperture by which it escaped, the velocity and density of the blast could be calculated.* Hence its *vis viva* was known, half of which represents the *work* which the blast was capable of doing if all its power could have been applied. The apparatus was constructed under the direction of Mr. Hensman, and the experiments were made and the table calculated by Mr. Hatcher (see page 176).

The blower of Mr. Lloyd was found to work comparatively without noise. It is due to him to state that the apparatus at the command of the Jury did not enable them to drive the fan with that velocity which he alleged to be necessary for obtaining the greatest useful effect.

No. 120, p. 1155 (Belgium). The Marcinelle and Couillet Smelting Company. A ventilator for airing mines. A. Fabry, inventor. This machine consists of two wheels, having parallel axes, each carrying three vanes of a peculiar form, and made to revolve in opposite directions. These vanes engage and disengage with one another like toothed wheels; and as they separate, create, by their peculiar epicyclical forms, a vacuum about the axes of the wheels, discharging the air into a surrounding case, by their peripheries. The wheels do not drive one another by the contact of their vanes, but by an independent mechanical connexion of their axes.

An economy of power is claimed in the use of this machine, as compared with the ordinary means of ventilation in mines. It has been introduced within the last few years in various mines in Belgium, particularly in those near Charleroi. The Jury have awarded a Prize Medal to the exhibitor.

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* A *resumé* of the theory of this subject, and of other practical questions to which the attention of scientific men has of late years been directed, will be found in the useful work entitled "Aide Mémoire des Ingénieurs, par G. T. Richard. Paris, 1848."

EXPERIMENTS ON BLOWING FANS.

Fan No. 1. Lloyd's Form.—Conical sides; curved vanes. Diameter 30 inches.

Number of Experiment.	Area of Inlet Opening in Square Inches.	Number of Revolutions made by Fan per Minute.	Velocity of Tips of Vanes in Feet per Second.	Pressure of Air in Air-Chamber.		Area of Opening from Air-Chamber in Square Inches.	Velocity of the Air at Orifice from Air-Chamber in feet per Second.	Horse-power at which Engine driving the Fan worked.	Units of Work given out by Engine per Minute, in pounds raised One Foot high.	Units of Work in effluent stream of Air measured by half its *vis viva*.	Proportion per Cent. of Work yielded by Fan to that given out by Engine. Useful effect per Cent.
				In Inches of Water.	In lbs per Inch.						
1	82·51	984	128·9	2·90	0·1047	36	112·9	1·77	58,423	19,913	34
2	,,	1,066	139·6	2·20	0·07[illegible]6	72	98·9	3·26	107,622	26,215	24
3	,,	1,066	123·9	1·30	0·0470	108	75·5	2·84	93,847	17,901	19
4	,,	1,087	142·4	0·90	0·0326	144	63·4	3·11	102,681	14,801	14
5	,,	1,066	139·6	4·30	0·1556	Closed.					

Fan No. 2. Common Form.—Straight vanes, inclined slightly to the radii. Diameter 30 Inches.

Number of Experiment.	Area of Inlet Opening in Square Inches.	Number of Revolutions made by Fan per Minute.	Velocity of Tips of Vanes in Feet per Second.	Pressure in Inches of Water.	Pressure in lbs per Inch.	Area of Opening from Air-Chamber in Square Inches.	Velocity of the Air at Orifice from Air-Chamber in feet per Second.	Horse-power at which Engine driving the Fan worked.	Units of Work given out by Engine per Minute.	Units of Work in effluent stream of Air.	Useful effect per Cent.
1	250·8	760	99·6	2·1	0·0760	36	96·4	1·22	40,389	12,202	30
2	,,	722	94·6	1·5	0·0543	72	81·2	2·45	80,734	14,750	18
3	,,	893	117·0	2·5	0·0905	,,	104·7	4·55	149,928	31,780	21
4	,,	912	119·5	1·1	0·0398	144	69·8	3·81	125,6[illegible]9	20,145	16
5	,,	893	117·0	3·1	0·1123	Closed.					

No. 830, p. 1220 (France). **ENFER, E. —**, 32, Rue de Malte, Paris. Various blowing machines. M. Enfer's blowing machine is an improvement on the ordinary blacksmith's bellows, giving to it a more steady blast. It is composed of two air-vessels, communicating by two pipes, in one of which a cylindrical bellows is worked, and the other serves as a reservoir. By simple but ingenious contrivances the pressure of the air in the second air-vessel or reservoir is regulated, and the bellows is made to drive air into it, both when it ascends and descends. A Prize Medal is awarded.

SECTION (D).

In reporting upon the Hydraulic Machines exhibited, it is impossible to refrain from adverting to the general neglect of those elementary principles of scientific knowledge on which the perfection of such machines always depends, and, in some cases, their whole usefulness in an economical point of view.* The Exhibition affords positive evidence of the sacrifice of a large amount of capital, and of much mechanical ingenuity, due simply to the ignorance of certain acknowledged principles of hydraulic science. In adverting to this fact, the Jury cannot but observe that the success with which the principles of mechanical science,† in their application to practical questions, are beginning to be cultivated in France, appears in the superiority of the French hydraulic machines. Thus their water-wheels have attained a perfection which is probably nowhere else to be found in the application of water-power. The total amount of such power derivable from the running waters of France, and applicable to manufacturing purposes, has been largely increased, by expedients of a scientific character.‡ Among the most remarkable of these is the introduction, now almost universal in France, of the curved float-boards of M. Poncelet in undershot and breast-wheels, and of the turbine of M. Fourneyron. It is not, however, only in the adoption of new forms of water-wheels in France, that the improvement has been apparent, but in the better establishment and more skilful working of the old forms; such as are in use in this country.

Of all such expedients for the economical application of water-power, it is a principle that, as far as it may be possible, the water should be received on the machine, without shock, and that it should leave it without velocity. For that there is power lost by the shock of water is apparent from the fact that the whole power of a fall of water may be absorbed in the reservoir into which it falls, by the shock and commotion of its particles; and it is plain that if the water which works a machine leaves it with any velocity which might have been avoided, then the power which must have been expended in giving it that velocity has been thrown away. It is another condition, founded on the same principle as that of avoiding a shock of the water, that there should be no sudden contractions or expansions of the influent or effluent streams. It is, we repeat, on the scientific application of these principles that all expedients for the economical working of hydraulic machines are founded. We have, however, only to pass through the rooms of the Exhibition assigned to this class of machines to find them almost universally ignored.

The record of this fact is important, as placing in an obvious point of view the necessity of other means than are now afforded for the scientific education of mechanical engineers.

PUMPS.

Notwithstanding the great antiquity of the pump, and its extensive use, it is one of our worst machines, considered, in a mechanical sense, as a means of producing a given result with the least possible expense of power. Simple as is its construction, it appears from the experiments of M. Morin,* that the amount of power *lost* in lifting and forcing pumps (such as fire-engines, &c.), amounts to *from 55 to 80 per cent. of the whole.* So that of the work (in pounds one foot high) done by the motive power to drive the pump, only 45 per cent. in the best, and 18 per cent. in the worst pumps, is found to be yielded; when the weight of water actually raised in pounds is multiplied by the height to which it is raised in feet; the rest of the work being lost in the passage of the

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* This is the case with the horizontal water-wheel; without the various scientific expedients adopted in the construction and working of that wheel, as the turbine, it could not probably in any case be employed with advantage.

† It is but reasonable to expect that the superiority which the French have confessedly attained in certain branches of industry, by cultivating the arts of design, will eventually appear, through the agency of the Ecoles des Arts et Métiers, in the scientific character of their machines.

‡ The whole establishment of a water-wheel partakes of this character: the form and dimensions, for instance, of the sluice and coursers—the number, dimensions, and forms of the float-boards—the dimensions of the wheel itself—and the rate of working. It has been abundantly shown, by experiment, that by varying these conditions, the work of the same fall may be varied by from one-half to two-thirds of its whole amount.

* Rapport du Jury Central, sur les produits exposés en 1849, vol. ii., p. 14. Paris, 1850.

SECTION (D).

Subdivision.	ARTICLES.	ENGLAND.			CANADA.			AMERICA.			AUSTRIA.			BELGIUM.		
			Medals.			Medals.			Medals.			Medals.			Medals.	
		Exhibits.	Council.	Prize.	Exhibits.	Council.	Prize.	Exhibits.	Council.	Prize.	Exhibits.	Council.	Prize.	Exhibits.	Council.	Prize.
	HYDRAULICS, &c.															
Pumps, &c. –	1. Lift pumps – – –	7	–	1	–	–	–	–	–	–	–	–	–	–	–	–
	2. Lift and force pumps	7	–	–	–	–	–	–	–	–	–	–	–	1	–	–
	3. Centrifugal – – –	3	1	–	–	–	–	1	–	–	–	–	–	–	–	–
	4. Rotary – – – –	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	5. Fire-engines – –	11	–	2	1	–	1	–	–	–	Hose	–	–	2	–	–
Water-rams –	Water-rams – –	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hydraulic presses	Hydraulic presses –	5	–	2	–	–	–	–	–	–	–	–	–	–	–	–
Water-meters –	Water-meters – –	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cranes, jacks, &c.	1. Lifting cranes – –	6	–	3	–	–	–	–	–	–	–	–	–	–	–	–
	2. Lifting and weighing cranes – –	2	–	1	–	–	–	–	–	–	–	–	–	–	–	–
	3. Jacks – – – –	6	–	2	–	–	–	–	–	–	–	–	–	–	–	–
	4. Mine lifts – – –	2	–	1	–	–	–	–	–	–	–	–	–	2	–	–
	5. Hoists – – – –	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Piling engines –	Piling engines – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Miscellaneous –	1. Hydraulic engines –	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	2. Cocks and taps – –	6	–	–	–	–	–	1	–	–	–	–	–	–	–	–
	3. Valves – – – –	1	–	1	–	–	–	–	–	–	–	–	–	1	–	–
	4. Filters – – – –	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	5. Distillation – – –	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	6. Archimedean screws	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–
	7. Sundries – – –	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total – – –	83	1	13	1	–	1	2	–	–	–	–	–	7	–	–

Subdivision.	ARTICLES.	CHINA.			DENMARK.			FRANCE.			NETHERLANDS.			TURKEY.		
			Medals.			Medals.			Medals.			Medals.			Medals.	
		Exhibits.	Council.	Prize.	Exhibits.	Council.	Prize.	Exhibits.	Council.	Prize.	Exhibits.	Council.	Prize.	Exhibits.	Council.	Prize.
	HYDRAULICS, &c.															
Pumps, &c. –	1. Lift pumps – – –	2	–	–	–	–	–	1	–	–	–	–	–	–	–	–
	2. Lift and force pumps	–	–	–	1	–	–	4	–	–	–	–	–	1	–	–
	3. Centrifugal – – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4. Rotary – – – –	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–
	5. Fire-engines – –	–	–	–	–	–	–	2	–	1	–	–	–	–	–	–
Water-rams –	Water-rams – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hydraulic presses	Hydraulic presses –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Water-meters –	Water-meters – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cranes, jacks, &c.	1. Lifting cranes – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	2. Lifting and weighing cranes – –	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
	3. Jacks – – – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4. Mine lifts – – –	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–
	5. Hoists – – – –	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Piling engines –	Piling engines – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Miscellaneous –	1. Hydraulic engines –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	2. Cocks and taps – –	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–
	3. Valves – – – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4. Filters – – – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	5. Distillation – – –	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
	6. Archimedean screws	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	7. Sundries – – –	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–
	Total – – –	2	–	–	1	–	–	19	–	2	1	–	–	1	–	–

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water through the pump. This fact cannot be too distinctly stated. There are hydraulic machines which yield, in the water raised, from 75 to 80 per cent. of the work done to raise it, and 60 per cent. is a common proportion; but so imperfect an instrument is the lift and force-pump, that the best yields only 45 per cent., the average not yielding more than 36 per cent. So that if that pump could be so improved as to be no more wasteful of power than a well-made water-wheel, or a turbine, or Mr. Appold's centrifugal pump; then the same power applied to it would raise from a given depth nearly twice the amount of water that it now does. The causes of this loss of power are to be sought—

1st. In the small size and the peculiar construction of the valves.

2nd. In the proportion of the section of the barrel to that of the suction and force pipes.

3rd. In the form of the suction-pipe at the extremity where the water enters it, and of the force-pipe at the extremity where the water is discharged.

4th. In the forms of these pipes where they unite with the barrel.

5th. In the proportion of the length of the barrel to the depth from which the water is raised.

It is impossible to say to what extent the loss of power due to these causes may be removed, without experiments directed expressly to that end; this much is, however, certain, that it would be sensibly diminished by increasing the size of the valves, or by any other expedient which should diminish that sudden variation in the section of the stream which the valves create. That variation, attended as it is by a corresponding sudden variation of the velocity of the stream, involves a loss of power varying as the square of the difference of the two velocities,[*] and dependent, therefore, on the ratios of the sections of the suction-pipe and force-pipe to the section of the barrel. From inattention to this arises the second source of loss of power we have enumerated. It is well known that the form of the nozzle by which water is discharged from a force-pump influences largely the amount of the discharge, but it is not equally well known that the form of the extremity of the suction-pipe by which the water enters has an equal effect in facilitating its ingress.[†]

A similar remark applies to that extremity of each pipe by which it communicates with the barrel, and the neglect of it accounts for a fourth source of the loss of power in pumps. A fifth cause to which attention appears not hitherto to have been directed, is the loss of power due to the communication of an unnecessary velocity to the water raised. Any one who gives a succession of quick strokes to the piston of a common suction-pipe, allowing sufficient time between them for all the water which can find its way into the barrel to enter it, will find the discharge per stroke to be considerably greater than when the piston is raised slowly. The reason of this is obvious; a certain amount of power, and no more, is required to be done on the piston in order to raise enough water from the well to fill the barrel. If more than this is done, the surplus manifests itself under the form of vis viva communicated to the water, by which vis viva, if space be afforded for it to take effect (as in the common suction-pump by efflux from the spout, or by the raising of the valve in the bucket), more water is brought into the barrel than is due to the volume generated by the piston. Half the vis viva of the water under the piston at the end of the stroke measures this surplus work. If a sufficient pause be allowed, and if the head of water above the piston be not considerable, as in the common suction-pump, the upward rush of the water beneath it at the end of the stroke will lift its valve, and a portion of the surplus work (represented by half the vis viva) will take effect in the elevation of more water into the barrel than would fill the space generated by the piston; and thus is explained the fact of the greater discharge from such pumps when worked by quick strokes with intervening pauses, than when worked slowly. If the head of water above the piston be, however, considerable, as in the force-pump, any vis viva which may remain in the water at the end of the stroke will produce a shock, and a corresponding loss of power. This shock, commonly experienced in the action of force-pumps, is accompanied by a violent and prejudicial action of the valves, especially when they are of metal. When the down-stroke of the piston follows so rapidly on the up-stroke as to meet the ascending stream produced by the preceding stroke, the resistance to its descent is increased, as well as the loss of power due to the commotion of the particles of the fluid it traverses.

It is obvious, therefore, that the proportions of a pump, to be worked by a given motive power, should be such, that the power to be expended at every stroke may just bring the water raised to rest, at the end of each stroke.[*]

It is immaterial in what proportions this work is distributed over the stroke, or under what varying degrees of pressure it is generated, provided that the pressure never exceeds that of the atmosphere on the surface of the piston.[†] If this pressure be exceeded, the piston may separate itself from the water beneath it in the barrel, the pump drawing air; and this is more likely to occur at the commencement than at any other period of the stroke, the motion of the water at that point being necessarily slow.

To communicate a finite velocity to the water at the commencement of the stroke, or while the space described by the piston is still exceedingly small, requires a much greater pressure than afterwards; and, the greater, as the section of the suction-pipe is less, as compared with that of the barrel, and as the lift is greater. Thus at the commencement of the stroke a finite velocity of the piston can only be obtained by an extraordinary effort of the motive power associated with the chance of drawing air and of a shock, if the pressure be suddenly applied. A remedy for some of these evils in the working of a pump has been sought in the application to it of a second air vessel, communicating with the suction-pipe immediately below the barrel, or with the top of the suction-pipe and the bottom of the barrel. The commencement of each stroke is eased by a supply of water from this air-chamber to the space beneath it. The influx of the water into that

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[*] It is measured by half the vis viva due to the difference of the velocities. This application of a theorem of Carnot, having reference to the impact of inelastic bodies, is due to M. Poncelet. It has been fully confirmed by experiment.

[†] It appears from the experiments of M. Eytelwein, that by expanding that extremity of a pipe by which the water enters, into a cone, the diameter of whose wider end is 1·2 times that of the other, the contraction of the vein may be nearly destroyed, the coefficient of the ingress being increased from ·62 to ·967. An analogous result may be produced by expanding the extremity by which the water is discharged. By uniting these expedients, a discharge may be obtained which is *greater than that due to the section of the pipe*; practically converting the contraction into an expansion of the fluid vein. If the length of the intervening pipe be nearly equal to its diameter, the coefficient of this expansion will be 1·35; if it be the length of sixty times the diameter, it will be 1·17.—*Morin, Leçons de Mécanique pratique*, vol. ii., pp. 49, 50.

[*] These proportions are determined without difficulty. If a represent the vertical height of the bottom of the barrel above the surface of the water to be raised, b the length of the stroke, K the section of the piston, and μ the weight of a cubic unit of water; then $\mu K b$ represents the weight of the water raised from the well into the barrel per stroke, and $a + \frac{1}{2}b$ is the height of its centre of gravity above the surface from which it has been raised; therefore $K \mu b (a + \frac{1}{2}b)$ represents the work done in raising it. Taking then U to be the work yielded by the motive power per stroke, we have, in order that the whole of this work may be expended in raising the water, and that there may be no vis viva in it when all has been raised,

$$K \mu b (a + \tfrac{1}{2} b) = U; \text{ whence } b = \sqrt{a^2 + \frac{2U}{\mu K}} - a.$$

[†] If we conceive the stroke to be completed under a *constant* pressure, which, with the assistance of the valve-reservoir, is possible, the extreme height to which the water in the barrel will ascend is greater than that at which this pressure would hold it suspended without the closing of the suction-valve.

space is aided by the pressure of the condensed air in the air-chamber, and when the stroke is completed, the state of condensation of this air is, by the momentum of the water in the suction-pipe, restored, causing it to rush through the passage by which that pipe communicates with the air-chamber. Thus, by this contrivance, the surplus work, or half the vis viva, which remains in the water of the suction-pipe at the conclusion of each stroke, is stored up in the compressed air of the air-chamber, and helps to begin the next stroke of the piston.

The nature of this action will be best understood from that of the hydraulic ram. The contrivance constitutes, indeed, in some respects, a union of the action of the ram with that of the pump; and, besides accomplishing the object for which it was applied, appears to have the effect of considerably economising the power employed in working pumps.

The suction air-chamber has been added to a common suction-pump, exhibited by Mr. Self (452, p. 235), in the Agricultural Department, where, being made of glass, its action was readily to be seen. It is also introduced in a class of small pumps, called "fire-syringes," exhibited by Mr. Baddeley (409, p. 227), and Messrs. Shand and Mason (410, pp. 227, 228). Except in the case of the Canadian engine, it does not, however, appear to have been applied in any of the larger class of engines exhibited. It should probably be constructed of much larger dimensions than have been given to it in either of these engines.

Awards in Section D.

No. 181 (Canada), p. 968. G. Perry and Brothers, Montreal. A carriage fire-engine, to be worked by forty men. Highly commended for the large proportion of the sectional area of the suction-pipe to that of the barrel, the large dimensions of the valves, the application of an air-chamber to the suction-pipe, and the general arrangement. In the experiments made by direction of the Jury, no other engine threw a column of water so high as this, or discharged so great a body of water per man, or yielded so great an amount of work per man measured by the vis viva of the water passing the nozzle. A Prize Medal is awarded.

No. 1310, p. 1239 (France). Letestu, 118 Rue du Temple, Paris. 1. A fire-engine without a carriage, to be worked by ten men. 2. A marine fire-engine, to be worked by ten men.

Highly commended for the ingenious, simple, and economical arrangement of the pistons, the large dimensions of the valves, and the large sectional area of the suction and force-pipes, in comparison with the barrel.[*]

The piston is a hollow perforated cone of brass, to the interior of which is applied a circular piece of leather, like a filtering paper to a funnel, but having a sector cut out, instead of being folded; the radial edges of the leather overlap, and its periphery projects beyond the edges of the cone, adapting itself to the internal surface of the barrel.

When this piston is to be used for suction, it is fixed to the rod with the base upwards; and when for forcing, with the base downwards. In the return stroke, the water passing through the perforations of the brass cone finds a passage between the loose radial edges of the leather, which it separates.

The valve in the air-vessel is a simple disc of leather, screwed down at its centre on a perforated plate. The Jury have awarded the Prize Medal for these engines.

No. 410, p. 227. Shand and Mason, 245 Blackfriars Road, London. London Brigade carriage fire-engine, worked by twenty-eight men. Metallic valves; for which a Prize Medal is awarded.

Moses Merryweather, 63 Long Acre, London (401, pp. 226, 227, and Illustrations). London Brigade carriage fire-engine, to be worked by thirty men. In compliance with a wish expressed by some of the Exhibitors, the merits of the above-mentioned engines were subjected to trial in the presence of the Jury, and the following table contains the results of the trial. The engines were worked by soldiers of Her Majesty's regiment of Grenadier Guards, obligingly placed at the disposal of the Jury by their Colonel. Those who worked upon the different engines appeared of the same average size and strength. Their whole effort was in each trial given to the work, and it was so intense as to be continued with difficulty for three or four minutes. No more certain means of comparison could perhaps have been adopted under the circumstances, but if more time had been allowed for the labours of the Jury, and if arrangements could have been made to drive the pumps by steam-power, and to apply to them the dynamometer of MM. Poncelet and Morin, the relation of the useful effect of each to the power expended in working it could have been determined with a precision not otherwise attainable.—(See Table, page 180.)

No. 448, p. 234. A Prize Medal is awarded to S. Cheavin, Spalding, for a pump for taking the surface-water only of a well, and at the same time filtering it. The suction-pipe is jointed, so as to allow of one portion of it moving in a vertical plane. The moveable portion is supported by a ball float, so that its open extremity may always be near the surface. To prevent impurities from entering, this extremity is protected by six hollow cones of copper finely perforated, of different degrees of fineness, covering one another.

Honourable Mention is made of the following Exhibitors:—

No. 402, p. 227. William Shalders. Fountain pump. Its peculiarity lies in the connexion of the bucket with the cylinder by a collar of leather blocked into the shape of a truncated cone, its smaller end being fixed to the bucket, and the larger to the barrel. The play of the piston is limited to the height of this leather cone. The cone is supported by a metal collar of a corresponding conical form, from which it unfolds itself as the bucket plays backwards and forwards. Commended as an ingenious and useful application of a known principle.[*]

No. 935, p. 1225 (France). Nillus, —, jun., Graville, near Havre. A double pump, with large cylinders and six-inch valves, constructed on the same principle as Shalders' pump; mounted upon a carriage to be used in excavations. Commended for convenient arrangement and good workmanship.

No. 424, pp. 232, 233 (Illustrations, p. 233). Warner, John and Sons. Deep well force-pump. Commended for the facility with which the valves can be removed to be repaired, and for good workmanship.

No. 409, p. 227. Baddeley, William, 29 Alfred Street, Islington. A portable farmer's fire-engine, applicable also as an agricultural force-pump. Commended for easy access to the valves, the application of a jet-spreader to the nozzle, and for simplicity and convenience of arrangement.

No. 299, p. 1191. Leclerc, H. Eugene, Maker, 105 Quai Valmy, Paris. A revolving pump, and various jets-d'eau. Commended for ingenuity of combination and arrangement.

Centrifugal Pumps.

In these pumps, water admitted at the axis of a hollow wheel, traversed by vanes and made to revolve rapidly, is expelled at its circumference.

The pipe by which the water reaches the axis of the wheel (or the reservoir which feeds it) becomes, under these circumstances, a suction-pipe, and if the reservoir into which the water is received from the periphery of the wheel be closed, and a pipe be carried from it upwards, the latter becomes a force-pipe.

The greatest economy of power in such a pump may be expected to be attained when there is the least possible loss of the vis viva of the water in its access to the wheel, and when there remains the least possible vis viva in it when it leaves it. For if there be any loss of the vis viva of the water in its ingress to the pump which

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[*] The pumps of Letestu gave a greater useful effect, in proportion to the power expended in driving them, than any others, in the dynamometrical experiments of Colonel Morin at the Paris Exhibition of 1849. This useful effect did not, however, amount to *one-half* the power expended.

[*] A pump on this principle is described in the Traité de Mécanique of Borguis. Paris, 1819. The invention is there ascribed to MM. Denisart et Deville, Machines Hydrauliques, p. 52; it is probably, however, more ancient.

TABLE of the QUANTITIES of WATER raised from the same Depth and thrown into the same Reservoir in equal times, by the same FIRE-ENGINES, each worked by an appropriate Number of Men.

Name and Country of Maker and Exhibitor.	1 Dimensions of Barrel of Pump, in Inches.		2 Length of Stroke, in Inches.	3 Dimensions of Nozzle, in Inches.		4 Diameter of Suction Pipes, in Inches.	5 Area of Valves, in Square Inches.		6 Number of Men working Engine	7 Number of Double Strokes made per Minute.	8 Gallons of Water which would have been delivered per Minute, if a Barrel full had been delivered at each stroke.	9 Real Number of Gallons of Water delivered per Minute.	10 Proportion of the Water delivered per Stroke to the whole contents of Barrel.	11 Velocity of the effluent Stream, in Feet, per Second, at the Nozzle.	12 Space, in Feet, travelled over by Piston per Minute.	13 Extent of Movement of Handles of Pumps, in Feet.	14 Space, in Feet, travelled over by Handle per Minute.	15 Gallons of Water delivered per Man per Minute.	16 Half the vis viva of the Water delivered per Man per Minute, at the Nozzle.	17 Height due to the Velocity of the Water at the Nozzle.
	Diameter.	Area.		Diameter.	Area.		Suction Valve.	Valve into Air Vessel.												
(1) Merryweather, London, large engine –	7·00	38·48	8·05	$\frac{13}{16}$	0·515	2·5	5·41	5·41	24	52	115·96	111	0·96	83·03	64·70	2·66	276·64	4·63	4,952	107
				–	–	–				63	140·49	123½	0·88	92·35	84·49	–	335·16	5·15	6,813	132
				$\frac{7}{8}$	0·602	–				56½	125·99	112½	0·88	71·97	75·71	–	300·58	4·69	3,435	73
(1) Shand and Mason, London, large engine –	7·00	33·48	8·05	$\frac{13}{16}$	0·515	2·75	5·94	4·91	24	53	118·29	113½	0·96	84·87	71·00	2·86	303·16	4·73	5,287	112
				–	–					64	142·72	130½	0·91	97·58	85·70	–	366·08	5·44	8,042	147
				$\frac{7}{8}$	0·602					57	127·11	123	0·97	78·68	76·40	–	326·04	5·13	4,928	96
(2) Perry, Canada * –	7·00	33·48	15·8	1	0·785	4·06	23·0	25·34	30	57	251·60	188	0·74	92·23	140·90	4·5	513·00	6·27	8,279	132
	–	–	–	–	–	–	–	–	–	48	211·87	184	0·87	90·27	126·20	–	432·00	6·13	7,764	127
Merryweather, small engine – – – –	6·25	30·68	6·25	$\frac{3}{4}$	0·442	2·5	2·27	2·01	14	57	78·77	73	0·93	63·69	59·30	2·04	232·56	5·21	3,275	63
(3) Letestu, Paris, marine engine – – –	5·6	24·63	7·19	$\frac{9}{16}$	0·248	3·56	9·05	–	10	44	56·19	51½	0·92	80·00	52·80	2·96	260·48	5·15	5,120	99
	–	–	–	–	–	–	–	–	–	45	57·43	57	0·99	88·51	54·00	–	266·40	5·70	6,536	122
Letestu, small fire-engine, forcing-pump only † –	5·6	24·63	5·69	$\frac{9}{16}$	0·248	None.	None.	7·63	10	58¾	63·29	50½	0·79	78·42	55·60	2·0	234·00	5·05	4,823	95

* In the first experiment with this engine the pistons were purposely not allowed to strike home at each stroke. In the second experiment they were struck home. The maker preferred, in practice, that they should not be struck home.

† This pump is not fitted for lifting its water. The barrels are fixed in a cistern, into which the water is supplied by buckets.

Comparative Experiments on the Quantities of Water delivered by different Engines.

Experiment 13. Merryweather's small engine, with 10 men; employed to feed the small French engine, also worked by 10 men. The supply just equal to the consumption.

,, 14. The two French engines, each worked by 10 men, employed to feed Merryweather's large engine, worked by 20 men. The two engines supplied in two minutes 30 gallons more than the large engine could throw off.

,, 15. Shand and Mason's large engine, worked by 20 men, feeding Merryweather's large engine, also worked by 20 men. The first engine delivered in three minutes 22 gallons more than the last could throw off.

Experiments on the greatest range of Engines.

—	With Suction-pipe clear.		With Suction buried in Gravel.		Suction washed clear.	
	Ft.	in.	Ft.	in.	Ft.	in.
Exp. 16. Merryweather, large engine, with $\frac{13}{16}$ in. nozzle, worked by 24 men, ranged	137	4	48	4	86	0
,, 17. Shand and Mason, ,, $\frac{13}{16}$ in. ,, 24 ,,	123	4*	–		–	
,, 18. ,, ,, $\frac{7}{8}$ in. ,, 24 ,,	129	4*	–		–	
,, 19. Perry, ,, 1 in. ,, 36 ,,	136	8	56	0	104	0
,, 20. ,, ,, 1 in. ,, 36 ,,	147	0				
,, 21. Merryweather, Shand & Mason, working together with 1 in. nozzle each, by 24 ,,	142	0	–		–	
,, 22. Letestu, marine engine, with $\frac{9}{16}$ in. ,, 10 ,,	119	6	116	0	–	
,, 23. Merryweather, small engine, with $\frac{3}{4}$ in. ,, 12 ,,	119	0	–		–	
,, 24. ,, ,, $\frac{5}{8}$ in. ,, 12 ,,	109	0	102	0	–	

* No experiment with sand, the suction-pipe being accidentally left clear.

might have been avoided, it is evident that power must have been expended unnecessarily in producing that vis viva. And in like manner, if any vis viva remain unnecessarily in the water when it leaves the wheel, it is evident that the power by which that vis viva was created might have been saved.

The expedients by which the water may be brought to the wheel with the least loss of vis viva are common to this and to other hydraulic machines; those by which it enters and is delivered *from* the wheel are peculiar to the centrifugal pump.

If the vanes be straight, it is evident that whatever may be the velocity of the water in the direction of a radius, when it leaves the wheel, its velocity in the direction of a tangent will be that of the circumference of the wheel, so that the greater the velocity of the wheel, the greater will be the amount of vis viva remaining in the water when discharged, and the greater the amount of power uselessly expended to create that vis viva.

If, however, the vanes be curved backwards, as regards the motion of the wheel, so as to have nearly the direction of a tangent to the circumference of the wheel at the points where they intersect it, then the velocity due to the centrifugal force of the water carrying it over the surface of the vane in the opposite direction to that in which the wheel is moving, and nearly in the direction of a tangent to the circumference, will—if this velocity of the water over the vane in the one direction be equal to that in which the vane is itself moving in the other—produce a state of absolute rest in the water, and entire exhaustion of vis viva. And in whatever degree the equality of these two motions—of the water in one direction over the vane, and of the vane itself in the opposite direction—is attained, in that same degree will the water be delivered in a state approaching to one of rest. The expedient of curved vanes is adopted in Mr. Appold's pump.

With regard to the admission of water to the wheel, it is obvious that it should pass directly from the suction-pipe into the wheel without the intervention of any reservoir in which the vis viva of the influent stream—communicated in the act of rising through the pipe—may expend itself, and that such space should be allowed at the centre as not to alter the dimensions of the influent stream. It would further seem expedient, by means of properly constructed channels, to divide the water into separate streams, and to give to these divergent streams such curvatures as would facilitate their entrance upon the channels formed by the vanes; as in the turbine.

It is obvious that the tendency of the centrifugal force continually to increase the velocity of the water *over the vanes* as it recedes from the centre cannot take effect in respect to all the particles of water in the same section, unless the sections of the channels diminish. If they do not, some of the particles of water in each section must be continually retarded, and power be uselessly expended in producing this retardation; whilst the current cannot but suffer from it a disturbance destructive of its vis viva.

This diminution of the sections of the channels might probably best be effected by giving to the sides of the wheel the forms of conical discs; an expedient which is adopted in Mr. Lloyd's blowing-machines, and in Mr. Bessemer's centrifugal pump.

The communication of motion to the water of the reservoir in which the wheel revolves, and into which the water is discharged, should by every practicable expedient be avoided; and for this object the water should be kept as much as possible from the sides of the wheel. This is effected in Mr. Appold's pump, by fixing the wheel between two cheeks which project from opposite sides of the reservoir. The velocity with which the wheel must be driven depends upon the height to which the water is to be raised. Beyond a certain height this velocity is practically unattainable. But long before this limit is reached, it becomes inconsistent with an economical application of the power which drives the pump. It is probably therefore only in comparatively small lifts, where a large quantity of water is to be discharged, that the centrifugal pump will be found useful.

No. 420, p. 232 (England). The Council Medal has been awarded to J. GEORGE APPOLD, 23 Wilson Street, Finsbury Square, London, for a centrifugal pump,[*] one foot in diameter, having curved vanes, separated by a central diaphragm, perpendicular to the axis and intersecting the vanes, so as to form a double wheel; to the two parts of which access is given for the water by central apertures six inches in diameter, on opposite sides of the wheel, whose axis is fixed to the diaphragm.

To determine the useful effect of this pump, a series of experiments were made under the direction of Colonel Morin, the Vice-Chairman of the Jury. The results of these experiments are detailed in the following Table. (See page 182.)

The work of the motive power was determined by the well-known dynamometer, constructed by M. Morin, on a principle proposed by General Poncelet. It is the distrintcive feature of this dynamometer that it registers each effort of the motive power with the space through which the machine is driven by that effort, however

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[*] The centrifugal-pump is by no means a new invention. Without entering into further particulars of its history, which appears to date back more than a century, it is sufficient to state that it was used in America as far back as 1830; that one was erected in the Navy Yard, New York, by our colleague, Mr. M'Carty, in the year 1838, and that improvements in it were patented in the United States in the following year. The curved form of the vanes was adopted in some of the American pumps.[*] The true principles of that part of the invention would seem, however, not to have been generally understood; and it is a fact not without interest in the history of the invention, and strikingly illustrative of the importance of other views of the principles of mechanics than are common among practical men, that these curved vanes appear to have been discarded for straight ones.[†] In an able memoir by M. Ch. Combes, Member of the Institute of France, entitled, "Sur les Roues de Réaction," read before the Academy of Sciences on the 23rd of July, 1838 (see "Comptes Rendues," vol. vii., 2me Sémestre, 1838, p. 306), the theory of the centrifugal ventilator is discussed and its obvious relations to the theory of the centrifugal pump are pointed out. The curved form proper to the vanes is insisted on in this paper, and its theory investigated.

In August, 1838, this gentleman took out a *brevet d'invention*, entitled, "Pour une machine universelle, à force centrale, propre à déplacer les liquides et les fluides aeriformes," &c., which appears to have been a centrifugal-pump; a name which indeed he applied to it in a note addressed to the Academy of Sciences in February 1839. From this period M. Combes appears constantly to have advocated the use of the centrifugal-pump, and with this view to have caused a model of such a pump to have been constructed, which still exists in the collection of the "Ecole Nationale des Mines," at Paris. The expediency of giving a curved form to the vanes could not but be apparent to him from those scientific considerations on which his investigations were founded, and it is insisted upon or implied in them all.

In 1843 he published a work entitled, "Récherches théoriques et expérimentales sur les Roues à réaction ou à tuyaux," in which, treating specially and principally of the turbine, he nevertheless establishes principles applicable at the same time to the centrifugal-pump, and arrives at formulæ which are applicable to it by a slight modification of the symbols. This relation and this application he specially points out. This explanation has been considered due to our distinguished colleague, M. Combes. The question of priority, either in the invention of the machine or in the mathematical discussion of it, is one on which it is not the province of the Jury to enter.

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[*] A model of one of them was exhibited to the Jury, by Mr. Gwynn, having this form of vane.

[†] The following passage is from the prospectus of the inventor of a centrifugal-pump: "In attempting to construct a centrifugal-pump a very large number of inventors have exhausted their skill in making arrangements of spiral or curved arms on an axle, or in endeavours to find the supposed angle or curve, with the diameter, which the fluid would make in passing off, being in utter ignorance of the fact, that in obedience to the law of central forces, the escaping fluid takes the shortest line to reach the circumference; or, in other words, that each particle of matter in a state of rotation, when free to escape, moves directly in the line of the radius until it reaches the circumference, and thence follows the tangent line until influenced by gravity or some other disturbing force."

variable it may be; and that it does this, not for a single stroke of the engine, or revolution of the wheel by which the machine is driven, but continuously, for a lengthened period. The dynamometer was applied to a drum, a strap from which drove the pump. To ascertain the work yielded by the pump, the water, raised by it from a reservoir beneath the floor on which it stood, to a given height above it, was received into a reservoir on the floor, wherein was an aperture of a rectangular form through which it could flow back into the reservoir, and which could be opened or closed to any extent by a slide. When the pump was set to work, the dimensions of the aperture were so adjusted by means of the slide, that the water remained steadily at the same height in the reservoir. The quantity of water which escaped by the aperture was then obviously the same with that raised by the pump. The dimensions of the aperture and the depth of the water being known, the quantity of water which escaped could be calculated, and thus the water raised by the pump was known.

To ascertain the influence of the curved form of the vanes on the efficiency of the pump, straight vanes were applied to a wheel of the same size, worked under the same circumstances. The results are stated in the Table.

The pumps of Mr. Gwynne (140, p. 1441) and Mr. Bessemer (421, p. 232), on which similar experiments were made, the particulars of which are detailed in the Table, had straight vanes.

Experiments on Appold's Centrifugal Pump.

Curved Arms.

Number of Experiment.	Height to which the Water is raised.		Discharge per Minute.		Ratio of Power to Effect.	Revolutions of Wheel per Minute.	Remarks.
	Feet.	Metres.	Gallons.	Litres.			
1	8·2	2·50	2,100	9,540	0·588	828	All these experiments were made with Poncelet and Morin's dynamometer.
2	9·0	2·745	1,664	7,440	0·648	620	
3	18·8	5·69	1,164	5,274	0·649	792	
4	19·4	5·897	1,236	5,610	0·680	788	
5	19·4	5·847	1,248	5,676	0·650	800	
6	26·2	7·97	432	1,962	0·398	844	
7	27·6	8·235	681	3,090	0·463	876	

Straight Arms, inclined at 45°.

1	18·0	5·48	560	2,544	0·398	694	
2	18·0	5·48	736	3,348	0·434	690	

Radial Arms.

1	18·0	5·48	369	1,674	0·232	624	
2	18·0	5·48	474	2,148	0·243	720	

Experiments on Gwynne's Centrifugal Pump. (Straight parallel radial channels.)

Number of Experiment.	Height to which the Water is raised.		Discharge per Minute.		Ratio of Power to Effect.	Revolutions of Wheel per Minute.	Remarks.
	Feet.	Metres.	Gallons.	Litres.			
1	13·8	4·17	290	1,320	0·19	675	Experiments made with dynamometer.
2	13·8	4·17	280	1,272	0·19	920	

Experiments on Bessemer's Centrifugal Pump. (Radial arms and conical sides. Experiments made with McNaught's Indicator.)

Number of Experiment.	Height to which the Water is raised.		Discharge per Minute.		Ratio of Power to Effect.	Revolutions of Wheel per Minute.	Remarks.
	Feet.	Metres.	Gallons.	Litres.			
1	3·37	1·027	832	3,781	0·18	60	
2	3·62	1·158	1,006	4,567	0·13	71	
3	2·2656	0·700	–	–	–	40·5	No water thrown. The water just kept suspended up to the level of lip.
4	3·427	1·100	896	4,067	–	60	
5	3·28	1·000	846	3,849	0·225	69	

Water Rams.

Honourable Mention is made of the following Exhibitors:—

F. Roe & Hanson, 70 Strand (462, p. 235, and Illustrations). Hydraulic ram, for raising water to the tops of houses.

Easton, J. & Amos, C.E., Grove, Southwark, part Inventors and Manufacturers (408, p. 227). Improved patent hydraulic ram. The hydraulic ram* requires to be adjusted, as to the loading of its valves, for each particular case in which it is applied. The following Table contains the results of experiments made to determine the useful effects of the two above-mentioned rams at the Exhibition by Mr. Hatcher:—

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* The hydraulic-ram, usually attributed to Mongolfier, appears to be an English invention, the first having been erected at Oulton, in Cheshire, by Mr. John Whitehurst, in the year 1772. We are indebted for a knowledge of this

Name of Exhibitor.	Number of Experiment.	Play given to Valve of Ram in Inches.	Number of Blows made by Valve per Minute.	Mean fall of Water supplying Ram in Feet, measuring from level of Cistern to Ram.	Quantity of Water in Gallons passed into Ram.		Quantity of Water raised by Ram in Gallons.		Height to which the Water was raised in Feet above level of Ram.	Per Centage relation of useful effect yielded by Ram to the Work done upon it by the fall of Water.	Relation of quantity of Water raised to that flowing into Ram.
					Absolute.	Per Minute.	Absolute.	Per Minute.			
Roe and Hansom	1	¼	70	2·92	107·00	8·92	6·87	0·57	20·84	45	0·064
Ditto - - -	2	3/16	60	,,	101·05	11·23	6·25	0·69	,,	44	0·062
Ditto - - -	3	1/16	74	,,	95·11	3·14	1·81	0·06	,,	13	0·019
Easton and Amos	1	–	44	5·26	56·27	5·63	6·62	0·66	19·87	44	0·117
Ditto - - -	2	3/16	45	5·42	28·36	5·67	3·31	0·66	,,	42	0·116
Ditto - - -	3	5/16	29	5·21	49·41	9·88	3·03	0·61	,,	23	0·062
Ditto - - -	4	¼ full	–	5·33	41·17	8·23	3·06	0·61	,,	28	0·074
Ditto - - -	5	1/16	68	5·5	11·43	2·28	2·19	0·44	,,	69	0·191
Ditto - - -	6	¼	52	5·44	21·05	4·21	3·31	0·66	,,	57	0·157

HYDRAULIC PRESSES.

The Prize Medal was awarded to the two following:—

No. 412, pp. 228–230. The **BANK QUAY FOUNDRY COMPANY**, Warrington, for a large hydraulic press, used for raising the tubes of the Britannia Bridge. This press, one of the largest ever constructed, has a ram 20 inches in diameter, and a stroke of 6 feet; it lifted, when raising the Britannia Bridge, a dead weight of 1,144 tons, the cylinder sustaining a pressure of nearly 4 tons (3·809) per square inch. It employed an engine of 15-horse power for about half an hour to drive water enough into the cylinder to complete one lift of the press with this weight, or to raise it 6 feet. The weight to be raised was suspended by chains from the two extremities of a crosshead of cast iron fixed on the top of the ram. To strengthen this crosshead, slabs of wrought iron were shrunk upon the top of it, 29 inches thick. The total weight of the press as exhibited is from 60 to 70 tons.

JACKSON, P. R., Salford Rolling Mills, Manchester, (682, p. 249), sends a model of a powerful hydraulic press, which will lift upwards of 3,000 tons. To form the cylinder of this press, rings of wrought iron are shrunk on a thin surface of cast iron. Thus great strength is obtained with a comparatively small weight of metal.

Honourable Mention is made of **BELLHOUSE, E. T. & Co.**, Eagle Foundry, Manchester (416, p. 230), for their hydraulic press for packing cotton or other material in bales.

WATER METERS.

The labours of the Health of Towns Commission have given fresh importance to the invention of water-meters. To afford an unlimited supply of water it is necessary that some means should be afforded of measuring the quantity each house consumes. If each house were provided with a reservoir, into which the water for its consumption were from time to time received, and from which it was distributed, this would be comparatively easy by means of a meter constructed on the principle of a rain-gauge with a divided chamber and a tumbling shoot. The desideratum is, however, to measure the efflux directly from the pipes, under whatever pressure the service may be made, and to dispense with the reservoir.

Five different contrivances for this object are exhibited. The Jury has, however, found none so far perfected as to satisfy the conditions of a good meter. In the majority of them the measurement is made by the revolution of a fan, like a screw-propeller, fixed within the pipe, and driven round by the effluent stream. Among other objections to which this principle of construction is liable, is the fact that a considerable leakage may be obtained without giving sufficient motion to drive the fan.

A water-meter, exhibited by **DONKIN, BRYAN, & Co.** (42, p. 218), is constructed on the well-known principle of the disc steam-engine. Although this is free from the defects which belong to meters constructed on the principle of the revolving fan, it is open to those of insecure packing and unequal wear.

CRANES, &c.

The Prize Medal is awarded to the following Exhibitors:—

No. 404, p. 227. **FOX, HENDERSON, & Co.** Derrick crane. This great crane was used in the construction of the Exhibition building itself, and for placing in it the heavy machines exhibited. When required to remove a great weight at a great distance from the vertical column of the crane, the huge arm or derrick is made to descend by the unwinding of a chain from one of its windlasses, a second windlass, driven by the intervention of a wheel and pinion, from the first, is made to wind up a chain, which, passing over a pully at the end of the derrick, lifts the weight; thus counteracting the effect on the weight of the descent of the extremity of the derrick, and keeping it always at the same distance above the ground. To produce this compensation accurately, it is necessary to give to one of the windlasses the form of a clock fusee.

No. 44, p. 218. **ARMSTRONG, W. G.**, Newcastle-upon-Tyne. Model hydraulic crane for unshipping coals, and for railway stations, docks, and quays. The pressure of water—accumulated by the action of a steam-engine in a cylindrical reservoir loaded with a heavy weight, which cylinder, like a gasometer, rises as it becomes filled—is made by mechanical expedients, of great ingenuity, to communicate the required motions to the crane.

No. 434, pp. 233, 234. **M'NICHOL and VERNON**, Liverpool. Working model of a patent steam-travelling crane, for lifting and removing heavy weights in timber-yards, goods' depôts on railways, &c.

Like the ordinary hand-travelling crane, this machine moves upon a tram-road laid upon longitudinal beams, raised from 15 to 20 feet above the ground. A square shaft runs the entire length of this road, and is connected at one extremity with the engine, which causes it to revolve. This shaft is supported by brackets, which swing on centres; so that each may be readily displaced

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fact to the researches of M. Morin at the Conservatoire des Arts et Métiers, who has recorded it in the following words on the original ram of Mongolfier, which is preserved there:—"Belier Hydraulique etabli, par John Whitehurst in 1772, à Oulton, Cheshire, pour la service de la Brasserie d'Egerton, et rendu automoteur par Joseph Mongolfier en 1796, au moyen d'une seconde soupape." It is due to the manufacturers of the rams on which the experiments were made, to state that the arrangements of the Exhibition Building did not allow of the water being admitted through (what they considered to be) a sufficient length of straight pipe to obtain the greatest useful effect.

by pressure applied in the direction of the length of the shaft. Motion is communicated from this shaft to the machinery of the crane by means of a drum, which slides upon it—carried along by the crane – and which displaces each bracket as it passes it.

No. 76, p. 1146. (Netherlands). K. **ENTHOVEN**, the Hague, Inventor and Manufacturer. An iron crane for weighing and lifting, constructed on an ingenious principle, and of good proportions and workmanship.

No. 411, p. 228. **JAMES** and Co., 24 Leadenhall Street, Manufacturers. A patent weighing crane for raising heavy goods, and at the same time obtaining their weight.

No. 406, p. 227. E. N. **FOURDRINIER**, 38 Barclay Street, Sunderland, Inventor. Patent safety apparatus for preventing loss of life and property, when a rope or chain breaks in the shafts of mines. Besides the expedient of a wedge, acting by its pressure upon a wooden frame to arrest the descent of the cage, as in other contrivances for the same purpose, Mr. Fourdrinier's machine adds the security of a grip upon a chain.

No. 627, p. 208 (France). J. M. F. **MÉHU**, Engineer of the Mines of Anzin, Nord. Model apparatus for the extraction of ores, and for the free and safe ingress and egress of miners to and from the mines. By this contrivance it is proposed to make the same shaft and engine lift the ore and the miners, and work the pumps. A four-sided vertical frame, extending from the bottom to the mouth of the shaft, serves as a guide to a series of square cages, which are lifted through one stage of the frame by each ascending stroke of the beam of the engine, and prevented from descending with the descending stroke by a series of stops, which, swinging on swivels, are pressed back by the carriages as they pass them, and recover their positions by their weight. A similar expedient gives to the shaft which lifts the cages a hold upon each as it rises, and relaxes it as it descends. The cages are made by an ingenious contrivance to unload themselves, and to pass from the ascending to the descending frame at the top, and conversely, from the descending to the ascending, at the bottom. (Awarded a Prize Medal in Class I.)

Honourable Mention is made of Mr. **DANIEL GREATOREX** (415, p. 230), 9 Desborough Terrace, Harrow Road, Paddington, for his model of an improved hoisting machine for raising and lowering goods, which can be worked by hand or by steam. The person ascending or descending with the machine can stop it at any point of the ascent or descent.

JACKS.

No. 509, p. 237. The Jury award a Prize Medal to **GEORGE ENGLAND** and Co., Hatcham Iron Works, New Cross, for their traversing screw-jack, useful for railway purposes, and commended for ingenuity of contrivance, and economy of material and space.

No. 490, pp. 236, 237 (Illustration, 237). Also to S. **THORNTON** and **SONS**, Birmingham, for their hydraulic lifting-jack, constructed on the principle of the hydraulic press.

VALVES.

No. 201, pp. 225, 226. A Prize Medal is awarded for R. **HOSKING**'s triple-beat valve for large pumps, which affords three passages for the water. They are annular and concentric, and, by an adjustment of the weight of the load on each to the surface it offers to the pressure of the water, are made to open and close *in succession*, thereby diminishing the first effort of the lift of the piston (due to the inertia of the water) and the *blow* on its descent.

COCKS.

Honourable Mention is made of the following:—

No. 476, p. 235. Major **ROBERT LITTLE**, Woolwich Common, Inventor, for an improved water-cock for connecting pipes without breaking joints. The plug of this cock may be removed to be re-ground, without unsoldering the pipes.

No. 1608, p. 1254 (France). — **FRINAULT**, Brass-founder, Orleans. Hermetic tap. A cock closed or opened by means of a coarse screw acting upon a valve. A good and simple contrivance, not likely to get out of order.

SECTION (E).

Subdivision.	—	ENGLAND.				AMERICA.				AUSTRIA.				BELGIUM.			
				Medals.				Medals.				Medals.				Medals.	
		Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
No. 1	Railway locomotives –																
	Inside cylinder – – –	3	3	1	2	–	–	–	–	–	–	–	–	1	1	–	–
	Outside cylinder – – –	1	2	–	–	–	–	–	–	–	–	–	–	1	1	–	–
	Inside cylinder tank – –	3	3	–	1	–	–	–	–	–	–	–	–	–	–	–	–
	Outside cylinder tank – –	3	3	–	2	–	–	–	–	–	–	–	–	–	–	–	–
	Models – – – – –	14	14	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Compressed and hot air –	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Hydraulic – – – –	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 2	Common road locomotives –	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 3	Railway carriages, waggons—																
	Carriages – – – – –	5	5	–	3	–	–	–	–	–	–	–	–	–	–	–	–
	Trucks and Waggons – –	1	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–
	Carriage models – – –	15	15	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Waggon models – – –	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 4	Railway velocipedes – – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 5	Atmospheric railway apparatus	3	3	–	–	1	1	–	–	–	–	–	–	–	–	–	–
No. 6	Breaks—																
	Full size – – – – –	2	2	–	1	–	–	–	–	–	–	–	–	–	–	–	–
	Models – – – – – –	8	8	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 7	Buffers, couplings, &c.—																
	Buffers – – – – – –	4	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Couplings – – – – –	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Wheels, tires, axles, bearings	19	19	–	5	1	1	–	–	–	–	–	–	1	1	–	–
	Miscellaneous – – –	7	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	99	100	1	15	2	2	–	–	–	–	–	–	3	3	–	–

Subdivision.		Egypt.				France.				Zollverein.				Netherlands.			
				Medals.				Medals.				Medals.				Medals.	
	—	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
No. 1	Railway locomotives—																
	Inside cylinder	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–
	Outside cylinder	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Inside cylinder tank	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Outside cylinder tank	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	–	–	–	–	1	1	–	–	–	–	–	–	1	1	–	–
	Compressed and hot air	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Hydraulic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 2	Common road locomotives	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 3	Railway carriages, waggons—																
	Carriages	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Trucks and waggons	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Carriage models	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Waggon models	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
No. 4	Railway velocipedes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 5	Atmospheric railway apparatus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 6	Breaks—																
	Full size	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
No. 7	Buffers, couplings, &c.—																
	Buffers	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Couplings	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Wheels, tires, axles, bearings	–	–	–	–	–	–	–	–	1	1	–	1	–	–	–	–
	Miscellaneous	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–
	Total	–	–	–	–	3	3	–	–	1	1	–	1	3	3	–	–

Subdivision.		Portugal.				Sardinia.				Tuscany.				Total.			
				Medals.				Medals.				Medals.				Medals.	
	—	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
No. 1	Railway locomotives—																
	Inside cylinder	–	–	–	–	–	–	–	–	–	–	–	–	5	5	1	2
	Outside cylinder	–	–	–	–	–	–	–	–	–	–	–	–	2	3	–	–
	Inside cylinder tank	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	1
	Outside cylinder tank	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	1
	Models	–	–	–	–	–	–	–	–	–	–	–	–	16	16	–	–
	Compressed and hot air	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
	Hydraulic	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
No. 2	Common road locomotives	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
No. 3	Railway carriages, waggons—																
	Carriages	–	–	–	–	–	–	–	–	–	–	–	–	5	5	–	4
	Trucks and waggons	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	1
	Carriage models	–	–	–	–	–	–	–	–	–	–	–	–	15	15	–	–
	Waggon models	–	–	–	–	–	–	–	–	–	–	–	–	3	4	–	–
No. 4	Railway velocipedes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 5	Atmospheric railway apparatus	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
No. 6	Breaks—																
	Full size	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	1
	Models	–	–	–	–	–	–	–	–	–	–	–	–	9	9	–	–
No. 7	Buffers, couplings, &c.—																
	Buffers	–	–	–	–	–	–	–	–	–	–	–	–	4	4	–	–
	Couplings	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
	Wheels, tires, axles, bearings	–	–	–	–	–	–	–	–	–	–	–	–	22	22	–	6
	Miscellaneous	–	–	–	–	–	–	–	–	1	1	–	–	9	9	–	–
	Total	–	–	–	–	–	–	–	–	1	1	–	–	110	112	1	16

The introduction of curves in railways, unless their radii be very great, has hitherto been considered unsafe, and the cost of the construction of railways is, under certain circumstances, greatly increased by this consideration. To give to a train the power, under certain circumstances, itself to change that rectilinear motion to which by the first law of motion it tends, into a motion which shall cause it to follow any curvature it may be convenient to give to the line, would be to afford new facilities for the construction of railways.

Our colleague, M. ARNOUX, who, as a member of the Sub-Jury A., on Carriages, was placed out of the number of competitors for medals,* has attempted the solution of this problem on the railway from Paris to Sceaux, and a working model of one of his trains is exhibited in the French Department. On this railway there is a zigzag, the radii of whose curves vary from 165 to 200 feet, which is said to have been traversed without accident by the trains of M. Arnoux daily, at a speed of from sixteen to eighteen miles an hour, since the month of June 1846.*

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* As the labours of the Sub-Jury for carriages were conducted independently of the principal Jury, the exclusion

Various models of atmospheric railway apparatus are exhibited; none of which probably will remove that unfavourable impression to this principle of locomotion which recent experiments on a large scale have created.

The construction of railway carriages admits of great improvement, a fact to which the attention of inventors is obviously directed. In the construction of railway waggons, the use of corrugated iron has been introduced; and cast steel for the construction of railway springs appears to be coming into more extended use. Several beautiful specimens of this manufacture from the Continent, as well as from Great Britain, have been exhibited.

To maintain a great speed, the first requisite in a locomotive engine is great evaporating power, and to obtain this there must be a large surface of metal exposed to the action of the heat on the one side, and of the water on the other. This is obtained by Mr. Stephenson's admirable expedient of a series of tubes which traverse the boiler, conveying the heated air from the furnace to the chimney; by which expedient the absorption of the heat from the air, heated by the fire, into the water, is made to extend over a greater surface than by any other.

AWARDS IN SECTION E.

No. 512, p. 238. See Illustrations, p. 234. In the engine called the "Liverpool," patented by Mr. T. R. **CRAMPTON**, to which the Jury recommends the award of the Council Medal, a heated surface of no less than 2,136 square feet is obtained by means of the tubes, besides the surface exposed to the direct action of the heat in the furnace, which measures 154 square feet. The evaporation resulting from this vast amount of heated surface is stated to yield a steam-power equivalent to that of 1,140 horses.

It is a second condition of great speed in locomotive engines, that the piston should make the fewest possible number of strokes whilst the engine traverses a given space; for which purpose the driving-wheels must be the largest possible. By bringing these from the position they have been accustomed to occupy (near the middle of the boiler) to the foot-board of the furnace, Mr. Crampton has succeeded in giving to the driving-wheels of his engine, the "Liverpool," a diameter of 8 feet.

It is a further advantage in the use of large driving-wheels, that for a given velocity of the engine, they diminish the *angular* velocity of the wheel, thus diminishing the tendency of the wheel to jump, by reason of its centrifugal force when the crank is not truly balanced,† a tendency which, before the attention of engineers was called to the necessity of balancing the crank, was fruitful in accidents. The same expedient by which Mr. Crampton obtains space for larger driving-wheels, enables him to place the boiler lower, and thus—giving a lower position to the centre of gravity of his locomotive—to increase its stability.

The Jury award Prize Medals to the following:—

No. 509, p. 238. **GEORGE ENGLAND** and Co., Hatcham Iron Works, New Cross. Improved locomotive engine for railways of light traffic, weighing, with coke and water, ten tons. The centre of gravity is low, and a good mode has been adopted of heating the water before it is pumped into the boiler. The driving-wheels of engines so light as this, require to be very truly balanced, or their weight should be very small in comparison with the engine, that they may travel with safety. The award is made for ingenious arrangement and good workmanship.

No. 510, p. 237. W. **BRIDGES ADAMS**, 1 Adam Street, Adelphi, London. 1. A light locomotive engine coupled to a four-wheeled carriage which supports the end of the engine in case of accident. The engine carries water beneath the floor, and has a sledge break. 2. An eight-wheeled double railway-carriage for first and second-class passengers.

The award is made for combination and arrangement in the locomotive, for the break, which is well executed, and for good proportions and workmanship in the carriage.

No. 506. The **GREAT WESTERN RAILWAY COMPANY**. Locomotive engine and tender, constructed at the Company's Works at Swindon. One of the ordinary class of engines, manufactured by this Company for passenger traffic since 1847. It is capable of taking a passenger-train, of 120 tons, at an average speed of 60 miles per hour, upon easy gradients. The evaporation of the boiler, when in full work, is equal to 1,000-horse power—the effective power, as measured by a dynamometer, is said to be equal to 743-horse power. The weight of the engine, empty, is 31 tons; coke and water, 4 tons—engine in working order, 35 tons. Tender empty, 9 tons; water, 1,600 gallons, 7 tons 3 cwt.; coke, 1 ton 10 cwt.: total, 17 tons 13 cwt.

The heating surfaces are, fire-box, 156 feet; 305 tubes, 1,759 feet.—Diameter of cylinder, 18 inches; length of stroke, 24 inches; diameter of driving-wheel, 8 feet; maximum pressure of steam, 120 lbs. The actual consumption of fuel in practice, with an average load of 90 tons, and speed of 29 miles, including stoppages (ordinary mail train), has averaged 20·8 lbs. of coke per mile. The award is made for good proportion of parts and superior workmanship.

No. 536, p. 240, and Illustrations, p. 241. R. and W. **HAWTHORN**, Newcastle-upon-Tyne. First-class passenger locomotive engine. The award is made for a good arrangement of parts, and for an improved link motion.

No. 534, p. 240, and Illustration, p. 1078. **KITSON, THOMPSON**, and **HEWITSON**, Leeds. A locomotive tank engine. The award is made for good workmanship.

No. 473 (Prussia). **PIEPENSTOCK** and Co., Hoerde, near Dortmund, Inventors and Manufacturers. Disc wheel and hollow axle for railways. The wheel consists of a single disc of wrought iron, fitted accurately to the axle and the tire by turning. On the end of the axle and in the inside of the tire, flanges are formed, and the disc being dropped into its place, as the lid of a tin box would be dropped into its rim, is then secured to these two flanges with rivets parallel with the axle. Hence there is no tendency to draw or loosen the rivets, nor are they exposed to any wear or injury when the wheel is revolving. The axle being made tubular, has its stiffness considerably increased, without any corresponding increase of weight. The whole presents an arrangement in which great strength and firmness are obtained without additional expenditure of material.

No. 555, p. 242. J. **SPENCER** and Son, Newcastle-on-Tyne. Baillie's patent volute springs. These springs are made of a long plate of steel coiled spirally round a centre, so as to present an outline somewhat like the fusee of a watch. The base being supported, any force applied at the summit tends to force this inwards, and to bring the spring into the form of a flat coil. Several applications of these to the purposes of bearing-springs, buffer-springs, and draw-bar springs are shown.

No. 636, p. 246, and Illustrations. G. B. **THORNEYCROFT** and Co., Wolverhampton, Inventors and Manufacturers. Specimens of Brigg's patent compound axle, tire, and rails. The distinguishing principle of the construction of these parts is the forming them of two different characters of iron adapted respectively to the kind of deterioration to which each part is liable, and the strain to which it is subjected. Thus, in the wheel tire, the centre of the

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of M. Arnoux from competition for the prizes awarded by the Jury of Class V. is made rather according to the letter than the spirit of our instructions.

* A pair of guide-wheels placed at an inclination of 45 degrees to the vertical on the first carriage of the train, and a similar pair on the last, compel these to take and to keep the curved line of the rail. The wheels of the intermediate carriages are not, as in other railway-carriages, fixed, but loose upon their axles. The axles turn on central pivots, and each axle is made to take the proper position for turning the curve, by a pole which grasps it by two arms on opposite sides of the pivot, and slides upon it laterally, and which is fixed to the next carriage in the train, or to the axle of the next pair of wheels in the same carriage.

† Or from the momentum of the connecting rod, &c., as at every revolution it ascends.

breadth and the inside of the flange are formed of a hard iron fitted to resist the greater wear of these parts against the rail, while a softer and more tenacious iron is used to make those edges of the tire which are exposed to no wear. The great tenacity of this softer iron supplies the strength required in the tire. Similarly the upper surface of the rail is formed of a hard iron, which will not wear away, and which gives strength to the rail by its resistance to the compression to which its upper surface is subjected, while the lower flange is constructed of a tough and tenacious metal fitted to resist the extension produced on those parts of the rail. The railway axles are, in like manner, formed by welding up a tough metal round a central hard core. The two metals are welded together in the course of the manufacture, so as to render the combination of the different qualities of iron perfect.

No. 637, p. 246. **George Worsdell** and Co., Warrington, Manufacturers. Railway axle and railway wheel-tire, forge-hammered. The iron is carefully faggoted and welded up, and the excellence of the work is indicated by the tenacity and strength of the completed axle. The specimen exhibited, which has been bent cold under a pressure of 84 tons, offers a good sample of the result of the process, and is commended as an excellent specimen of manufacture.

No. 646, p. 247. **Beecroft, Butler**, and Co., Kirkstall Forge, Leeds, Manufacturers. Specimens of railway wheels and axles. Messrs. Beecroft exhibit, among others, a form of wheel peculiarly adapted for express trains, in which lightness should be combined with great strength. These wheels are constructed entirely of wrought iron, the boss and spokes (single and double) being forged in one piece. The tires are then shrunk on and riveted as usual. Their wrought-iron disc wheel displays a mode of so dovetailing the disc to the interior of the tires as to obviate the necessity of rivets. These wheels have also wrought-iron bosses. They are commended for judicious combination and good workmanship.

No. 682, p. 249. P. R. **Jackson**, Salford Rolling-mills, Manchester, Manufacturer. Locomotive and carriage tires. The carriage tires exhibited by Messrs. Jackson are rolled in one piece, and are admirably finished. The exhibit presents a valuable feature in the steeled tires, in which the outer and wearing surface is formed of a thin plate of steel welded (by a process said to be peculiar to the manufacturers) to the iron. By this application it is anticipated that the tendency of the tires to become grooved will be diminished, and their durability be proportionably increased.

No. 640, pp. 246, 247. **Ransomes** and **May**, Ipswich. Water-crane, patent compressed treenails, and wedges for railways.

No. 507, p 237. J. **Lee**, Long Acre, Inventor and Patentee. Carriage break. A good example of what has been termed the sledge break. It is analogous to the drag or shoe on common roads. Instead of the resistance necessary to stop the train being created by the pressure of the break against the periphery of the wheel, an iron shoe or sledge is pressed down before the wheel upon the rail, and the wheel mounts the sloping surface of this sledge, which then slides along the rail until the resistance absorbs the vis viva of the train, and brings it to rest. The resistance created by this break being very great, it should not be applied to all the carriages of a train at once. With this precaution it is commended as a useful contrivance.

No. 530, p. 239. C. C. **Williams**, Glasshouse Yard, Goswell Street. A railway carriage, constructed of Moulmein teak, varnished. This carriage is strong, convenient, and neatly executed; in the substitution of varnish for paint there is an economy, and the carriage may thereby be the more quickly repaired.

No. 532, pp. 239, 240, and Illustrations, pp. 239, 240. **Henry H. Henson**, Pinner, near Watford. Patent covered waggon for the conveyance of merchandise by railway; fire-proof when closed, and so arranged that the side or roof may be opened for loading or unloading. The award is made for the combination of corrugated iron and wood in its construction.

No. 539, p. 240. J. E. **McConnell**, Wolverton. Railway-passenger carriage. This award is made for an excellent adaptation of corrugated iron to the construction of railway carriages, and for superior workmanship.

No. 541, pp. 240, 241. **John Coope Haddan**, 29 Bloomsbury Square. Patent railway carriage. Rewarded for the application of papier maché to the construction of railway carriages.

Honourable Mention is made of—

No. 642, p. 247. M. **Percival Parsons**, 6 Duke Street, Adelphi, Patentee and Designer. Among the various exhibits of Mr. Parsons, Normanville's patent axle-box deserves notice. The bearing is entirely inclosed in a cast-iron box, which keeps the axle free from dust or sand, while it preserves the grease, which would otherwise fall on the road and be wasted. This box is cast in one piece, and around the axle is fixed a collar of stiff leather, so as to form a close joint, and prevent the ingress of dirt. As an improvement in the details of the railway system this well deserves attention.

No. 346, p. 969. **Pierre Rodier**, Nova Scotia. Working model of a locomotive engine, made by the exhibitor, a boy 14 years old. A paper accompanying this exhibit certifies the boy to have received no aid, either in drawings or workmanship, which display ability and deserve encouragement.

No. 231, p. 1451 (United States). L. C. **Higginbotham**, Vernon, New York. Miniature model of a locomotive engine; made by a boy who lived by the side of a railway. The passing of the trains was the only information within his reach. A remarkable fact, to which the Jury would draw attention as a proof of the youth's singular powers of observation.

SECTION (F).

Awards in Section F.—(See Table, page 188.)

No. 618, pp. 244, 245, and Illustrations (England). The Council Medal is awarded to T. **Dunn**, Windsor Bridge, near Manchester, for a traversing frame to remove carriages from one line of rail to another.

A strong frame supported on wheels, which are covered by its sides, travels on a railway at right angles to the lines, from one to the other of which the carriages are to be transferred. The level of the upper surface of the transverse rail is a little above that of the principal lines, so that the latter are cleared by the flanges of the wheels of the frame, which therefore freely traverses them. The transverse line is broken where it crosses the principal lines, space being left for the trains to pass. To receive the carriage, a rail is placed like a shelf or ledge at the bottom of the sides of the frame, so as just to clear the surface of the permanent rails; and to raise the carriage upon this shelf a switch is provided, which, turning upon a hinge, may be brought, when the frame is properly placed, into the direction of the principal line. The upper surface of this switch forms an inclined plane, up which the carriage may be raised until its wheels rest upon the shelf. The frame, with its burden, is then pushed sideways along the transverse rail, to the rail to which the carriage is to be transferred, and the switch supplies an inclined plane by which the carriage descends. This traversing frame, supplying (for many purposes) the use of the turn-table, is commended as a useful invention, affording increased facilities for railway traffic.

The Prize Medal is awarded to the following exhibitors:—

No. 602, p. 242. W. H. **Barlow**, Midland Railway, Derby, Inventor. Wrought-iron permanent way for railways. The rail in Mr. Barlow's invention is made to form its own continuous bearing. In section the rail somewhat resembles an inverted V (Λ), with the ends considerably turned outwards. This portion forms the surface by which the rail bears upon the ballasting, the apex of the V being formed with flanges in the ordinary form of rails; and the rail therefore beds throughout on the ballast. It can be very easily packed up and adjusted when out of place, and all the fittings of sleepers, chains, and keys are done away with, nothing being required besides the rails themselves, except a cross or tie-rod at the joints to hold them at the proper distances asunder, so as to keep the gauge of the line. This rail has been tried on the Midland line, and the results, as shown by the diminished

SECTION (F.)

Sub-division	—	England.				America.				Austria.				Belgium.			
				Medals.				Medals.				Medals.				Medals.	
		Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
No. 1	Permanent way complete	6	6	–	1	–	–	–	–	–	–	–	–	–	–	–	–
	Models	4	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 2	Sleepers	3	3	–	–	–	–	–	–	–	–	–	–	2	2	–	–
	Models	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 3	Chairs	3	3	–	–	–	–	–	–	–	–	–	–	1	1	–	–
No. 4	Rails	4	4	–	2	–	–	–	–	–	–	–	–	1	1	–	–
No. 5	Switches	3	3	–	1	–	–	–	–	–	–	–	–	–	–	–	–
	Models	1	1	–	–	2	2	–	–	–	–	–	–	–	–	–	–
No. 6	Turn-tables	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	4	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Traversing-frames	3	3	1	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 7	Station arrangements	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 8	Signals	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	14	14	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 9	Miscellaneous	9	9	–	2	2	2	–	–	–	–	–	–	–	–	–	–
	Total	62	63	1	6	4	4	–	–	–	–	–	–	4	4	–	–

Sub-division.	—	Egypt.				France.				Zollverein.				Netherlands.			
				Medals.				Medals.				Medals.				Medals.	
		Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
No. 1	Permanent way complete	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 2	Sleepers	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 3	Chairs	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 4	Rails	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 5	Switches	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 6	Turn-tables	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Traversing-frames	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 7	Station arrangements	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 8	Signals	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
No. 9	Miscellaneous	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–
	Total	–	–	–	–	1	1	–	–	–	–	–	–	1	1	–	–

Sub-division.	—	Portugal.				Sardinia.				Tuscany.				Total.			
				Medals.				Medals.				Medals.				Medals.	
		Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
No. 1	Permanent way complete	–	–	–	–	–	–	–	–	–	–	–	–	6	6	–	1
	Models	–	–	–	–	–	–	–	–	–	–	–	–	5	5	–	–
No. 2	Sleepers	–	–	–	–	–	–	–	–	–	–	–	–	5	5	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
No. 3	Chairs	–	–	–	–	–	–	–	–	–	–	–	–	4	4	–	–
No. 4	Rails	–	–	–	–	–	–	–	–	–	–	–	–	5	5	–	2
No. 5	Switches	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	1
	Models	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
No. 6	Turn-tables	–	–	–	–	–	–	–	–	–	–	–	–	1	2	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	4	4	–	–
	Traversing-frames	–	–	–	–	–	–	–	–	–	–	–	–	3	3	1	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	–
No. 7	Station arrangements	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–
No. 8	Signals	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
	Models	–	–	–	–	–	–	–	–	–	–	–	–	14	14	–	–
No. 9	Miscellaneous	–	–	–	–	–	–	–	–	–	–	–	–	12	12	–	2
	Total	–	–	–	–	–	–	–	–	–	–	–	–	72	73	1	6

oscillation and vibration of the trains in passing, and the smaller number of hands required to keep this portion of the line in order, are said to be satisfactory.

No. 638, p. 246. **Ebbw Vale Company**, 83 Upper Thames Street, London, and Abergavenny, Manufacturers. Sections of railway bars of all the forms used in railways. The Prize Medal is awarded to this exhibit in consideration of the facilities it affords for the comparison and study of the different forms of section, which have been devised for giving strength and durability to railway bars.

No. 645, p. 247. The **Cwm Avon Iron Company**. Railway bars, 70 feet in length. The award is made for skilful workmanship.

No. 643, p. 247. W. **Baines**, Birmingham, Inventor. An improved railway switch, in which the tongue is formed to pass under the upper flange of the fixed rail, by which expedient the point is prevented from rising, and the carriage is made to pass more easily upon the new line. The switch is so formed as to have a broad base for its bearing on the chairs, and it is made so much deeper than the main or fixed rail, that the lower flange of the switch passes under the lower flange of the fixed rail. Two advantages result from this. The flange of the switch keeps the tongue, when closed, from rising, and any stones or dirt which may fall between the switch and rail are swept, as it closes not *against* the main rail, but under it: thus closing without risk of impediment from dirt or rubbish. The bearings of the switch are also placed a little aside of the bearings of the rail, in order that any stones lying on them may in the same way be swept clear off, and not be caught, so as to prevent the proper closing of the point.

No. 600, p. 243. **Charles Young** and Co., Inventors and Manufacturers. "Simultaneous-acting level-crossing gates for railways." Serious accidents have arisen from the inability of the policemen in charge of level-crossings on railways to open in time all four gates to give passage to an approaching train. Messrs. Young's gates are hung on posts so set at the four angles of a square or a rhombus, that they close either across the line, and leave the road clear, or close the road, and shut off all approach to the line. By a very simple and obvious connexion beneath the ground between the heels of the several gates by means of iron rods, the motion of any one is accompanied by the corresponding motion of the other three divisions. The policeman has not, therefore, to open and close each of the four in succession, but by simply acting on one, he produces simultaneously the required movement in all. The advantages arising from this arrangement, which is available either for straight or oblique crossings, are obvious, while cost of construction and maintenance is increased only in a small proportion.

No. 552, p. 242. C. **De Bergue**, 9 Dowgate Hill, Inventor and Manufacturer. Patent station buffer. Mr. De Bergue has aimed at producing a station buffer, which should offer to a train impinging upon it a gradually increasing resistance through a long space, thereby absorbing the vis viva of the train gradually, and without shock of the carriages upon one another; and he has sought to do this without the aid of a spring, the recoil of which, when powerfully compressed, might be attended with danger. In his station buffer the train impinges on the end of a long stout beam of wood, slightly tapering from one end to the other. This beam has its smaller end fitted to enter a strong iron box or case. The force necessary to drive this taper beam into the case continually increases as the larger end approaches the case, or as the wood must be more and more compressed to enter the case. At the same time the beam, when driven in to any point by the impact of a train, remains fixed there, having no tendency to fly out or return to its first position. All the injury which may be produced by the recoil of a powerfully-compressed spring is thus avoided, while on the removal of the carriage the iron case is easily unscrewed, and the beam of wood loosened and drawn out to assume its ordinary position.

SECTION (G).

Sub-division.	—	England.				America.				Austria.				Belgium.			
				Medals.				Medals.				Medals.				Medals.	
		Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
No. 1 –	Commercial weighing instruments – – – –	10	10	–	3	–	–	–	–	1	1	–	1	–	–	–	–
No. 2 –	Instruments of measure –	1	1	–	–	1	1	–	–	–	–	–	–	–	–	–	–
No. 3 –	Counters and tell-tales – –	5	5	–	–	1	1	–	–	–	–	–	–	–	–	–	–
	Gauges – – – –	3	3	–	–	1	1	–	–	–	–	–	–	–	–	–	–
	Indicators – – – –	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Manometers, dynamometers	1	1	–	–	–	–	–	–	1	1	–	–	–	–	–	–
	Total – – –	22	22	–	3	3	3	–	–	2	2	–	1	–	–	–	–

Sub-division.	—	Egypt.				France.				Zollverein.				Netherlands.			
				Medals.				Medals.				Medals.				Medals.	
		Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.	Exhibitors.	Exhibits.	Council.	Prize.
No. 1 –	Commercial weighing instruments – – – –	1	2	–	–	2	2	–	2	1	1	–	–	–	–	–	–
No. 2 –	Instruments of measure –	–	–	–	–	1	1	–	–	1	1	–	–	–	–	–	–
No. 3 –	Counters and tell-tales – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Gauges – – – –	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Indicators – – – –	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–
	Manometers, dynamometers	–	–	–	–	3	3	–	1	–	–	–	–	–	–	–	–
	Total – – –	1	2	–	–	7	7	–	3	2	2	–	–	–	–	–	–

Sub-division.	—	Portugal.				Sardinia.				Tuscany.				Total.			
		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.		Exhibitors.	Exhibits.	Medals.	
				Council.	Prize.			Council.	Prize.			Council.	Prize.			Council.	Prize.
No. 1 -	Commercial weighing instruments - - -	1	1	–	–	–	–	–	–	–	–	–	–	17	17	–	6
No. 2 -	Instruments of measure -	–	–	–	–	–	–	–	–	–	–	–	–	4	4	–	–
No. 3 -	Counters and tell-tales - -	–	–	–	–	1	1	–	–	–	–	–	–	7	7	–	–
	Gauges - - - -	–	–	–	–	–	–	–	–	–	–	–	–	4	4	–	–
	Indicators - - - -	–	–	–	–	–	–	–	–	–	–	–	–	3	3	–	–
	Manometers, dynamometers	–	–	–	–	–	–	–	–	–	–	–	–	5	5	–	1
	Total - - -	1	1	–	–	1	1	–	–	–	–	–	–	40	40	–	7

Among the instruments exhibited in this Section are some dynamometrical machines but little known in this country, but which have been applied in France, with great success, to determine the most favourable conditions for the construction and working of machines, with respect to the economy of power. The machines heretofore used for this purpose have been the steam-indicator of Watt and the friction-break of Prony. The former serves to determine the work done by the steam upon the piston of a steam-engine during any single stroke; and the other, being applied to a driving-shaft when all other work is thrown off it, serves to measure the work by which that shaft is driven, from whatever source it may be derived. It is the object of these dynamometrical instruments to determine the work transmitted to the whole or any part of a machine, not for a single stroke only of a piston, but continuously, through any given period; and to do this without absorbing—as the friction-break does—the whole work to be measured, but whilst the machine is performing its customary work. The amount of work necessary to yield given useful results is thus determined, independently of the influence of any other parts of the machine than those which operate directly on the result.

Every such admeasurement is a manufacturing constant of great value, capable of being employed to determine the cost of production under other and widely different circumstances. Such constants as have yet been thus determined, science owes chiefly to the labours of French engineers.* These dynamometers have been used not only to determine the power transmitted by machinery from steam-engines and water-wheels, but to manual labour, as applied to the working of pumps and driving machinery by cranks, and to the traction of horses. Every effort of a team of horses through successive days of labour, and journeys as long as that from Amiens, Nancy, and Le Mans, to and from Paris, has thus been measured and recorded, and the work expended on such efforts estimated, aggregated by the machine, and registered in numbers.

The invention of these machines is due to General Poncelet. They were constructed under the direction of Colonel Morin.

The following are the dynamometers exhibited:—

1. The "Dynamometre de rotation," for determining the work transmitted by a revolving shaft.

2. A dynamometer for determining the manual labour of driving the handle of a pump or a crank.

3. A dynamometer for registering the work of the steam on the piston of an engine through any number of strokes. Constructed on the principle of the constant indicator, made in the year 1841 for the British Association of Science, and described in their Report for that year.

It will be sufficient to describe† the rotation dynamometer, which is that used by the Jury in its experiments on the centrifugal pumps.

Upon an axis, having cast-iron supports, capable of being fixed by screws upon the floor, are placed two pulleys, which we will call A and B, the one, A, is fixed on the axis; the other, B, is moveable upon it between limits hereafter to be specified. Let it now be supposed that the machine, the power employed in driving which is to be measured, is worked by means of a strap passing over two drums, one of which is upon a shaft connected with the engine, or other motive power, which we will call the driving-shaft. Let this strap be removed, and the dynamometer being conveniently placed and screwed firmly to the floor, let a strap from the drum on the driving-shaft be passed over the drum, A, and one from the drum on the machine over B; then it is plain that if B were fixed to the axis as A is, the strap passing over B would transmit the motion of the driving-shaft on to the machinery; so that the latter would be driven as it was before, except that the work would now be transmitted through the dynamometer, which before it was not. To cause the axis to carry the drum B round with it, a spring, fixed in the axis, passes between knife edges, fixed near the circumferences of the wheel B. This spring being carried round by the axis, and pressing on one of the knife edges of the drum B, carries it round with it, first deflecting under the resistance until the force with which it tends to recover itself is equal to that resistance. This deflection being measured, measures the resistance to be overcome to drive the machine, and the space travelled by the point where it is applied, measures the space through which that resistance is overcome.

The registration of these measurements, under every change of resistance and motion to which the machine may be subjected, is effected as follows:—

A radial frame, fixed to the axis, carries three rollers, *r*, *q*, *s*, round which passes a long strip of paper, winding (when the rollers are put in motion) *off* *r* and *on* *s*, passing, between them, over *q*. To put them in motion a bevel wheel, whose axis—at right angles to the axis of the dynamometer—has its bearings fixed to the frame, so as to be carried round with the axis of the dynamometer, engages with another bevel wheel, which runs loose on the axis of the dynamometer, and which is held at rest by a fixed bracket. The bevel wheel carried round by the frame and engaging in this fixed bevel wheel, carries with it the roller *r*, and obviously communicates to it, and therefore to the strip of paper, a motion *proportional* to that of the point where the spring presses on the knife edge. The roller *s* is made to take up the paper thrown off by *r*, by means of a spiral spring inclosed in it. The strip of paper being thus understood to pass over the roller *q* with a motion proportional to that of the point of application of the pressure which drives the machine, let it be observed that on an arm of the drum B is fixed a style, carrying at its extremity a pencil, which is pressed by a spring upon the paper passing over the roller *q*. When the strap which the drum B drives is taken off, that drum is carried round by the drum A without resistance; there is, therefore, no deflection of the spring, and no turning of the pulley upon the axis consequent upon that deflection. The trace of the pencil upon the paper will, under these circumstances, be a straight line; and in all experiments the pencil is made first to trace such a line.

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* They have been collected by Colonel Morin in his "Aide Mémoire de Mécanique Pratique." Fifth edition, 1849. Matthias. Paris.

† It is not easy to make this description clear without a drawing. For a more intelligible explanation, the reader is referred to the "Leçons de Mécanique Pratique," of M. Morin.

When, however, the strap is replaced, and the work is put on the drum B, the latter turns upon its axis, pressing the spring upon the knife edge, and deflecting it until its resistance is equal to that opposed by the machine driven by the strap. By this turning of the drum the pencil is moved at right angles to the line which it before traced on the strip of paper, by a space proportional to the deflection of the spring, and, therefore, to the pressure by which the spring is deflected; and this proportion being maintained, however the pressure may be varied, an irregular curved line is traced upon the paper, whose distance from the straight line before traced upon it, is always proportional to the pressure by which the machine is driven; whilst the corresponding distance along the straight line previously drawn, being measured from the commencement of the motion, is proportional to the space described by the point of application of that pressure. Hence it is apparent that, as in the case of the common steam-indicator, the area of the curvilinear space between the straight line traced by the style before the work was put on, and the curved line traced by it afterwards, is proportional to the work done in driving it. There are two other contrivances worthy of notice.

1st. A contrivance for correcting the want of uniformity in the motion of the paper, produced by the diminution of the diameter of the roller r, as more of the paper winds off it. This correction is rendered necessary by the great length sometimes given to the strip of paper. This correction is effected by the intervention of a fusee-wheel.

2nd. An admirable method of M. Poncelet for registering in numbers in one part of the dynamometer the work which in another (as described above) is registered, under the form of a curvilinear area. This is effected on a principle, which has also been applied to the mechanical quadrature of areas, in an instrument called the planimeter, of which several are exhibited in the department of Philosophical Instruments. The two registrations serve to verify one another.

Awards in Section G.

No. 1151, p. 1233 (France). P. Clair, 93 Rue de Cherche Midi, Paris. 1. MM. Poncelet and Morin's rotary dynamometer. 2. Lapointe's constant indicator. 3. Clair's indicator. The award is made for good and intelligent workmanship in the construction of these machines, under the direction of MM. Poncelet and Morin. Among the articles exhibited by M. Clair is also an admirably constructed model of a locomotive engine in metal, the working parts of which are opened or shown in section, for explanation and instruction.

No. 761, p. 1216 (France). J. Béranger and Co., Lyons. Scales, weighing-machines, and various other implements for weighing. Guided by an ingenious mathematical theorem, M. Béranger has so combined a system of levers that he can place one of his scale-pans at any distance from the other—according to the form he wishes to give to his weighing-machine—without affecting the equality of weights which balance in the two scale-pans.

This combination of levers is simple, economical, compact, and admits of a ready application to all purposes of commerce. M. Béranger has, in fact, made that application in the collection of convenient and ornamental weighing-machines which he exhibits.

No. 914, p. 1225 (France). Parent, 33 Rue des Arcs, Paris. Weighing-scales, weights, and measures, which have many of the more important characteristics of instruments made for philosophical and chemical purposes, and a degree of precision and accuracy is thus attainable for the purposes of commerce, which is not to be looked for in common balances. The award is made for an attempt to improve commercial balances, and for the admirable workmanship of those exhibited.

No. 105, p. 1013 (Austria). H. D. Schmidt, Vienna. Model of a patent weighing table.

The mode of suspending the platform on a quadruple lever, and of connecting this lever with the steelyard, is the same as usual. But a very advantageous arrangement is made for relieving the steel fulcra of the levers, when the machine is not in use, from the weight of the platform, and of any carriages passing over it. Under the points where the platform rests are the four levers; these levers have stout projections or bosses projecting downwards, and nearly touching the upper surfaces of four short pillars of iron fixed into the masonry at the bottom of the pit. When the machine is not required for weighing, the long end of the lever is lowered, together with the steelyard counterpoise and framework, by means of a winch and screw, until the bosses of the levers rest on the pillars beneath them. The weight of the platform and any carriage upon it is then borne by these pillars, and not by the steel fulcra of the fourfold levers. These fulcra are thus saved from much unnecessary deterioration. On raising the frame with the steelyard and the end of the long lever, the weight of the platform is thrown on its fulcra, and the machine is then ready for use.

No. 774, p. 252. Jonathan Davidson and Co., Barony Street, Edinburgh, Inventors and Manufacturers. The steelyards and weighing-machines of these exhibitors are manufactured in a very creditable manner. The parts appear well proportioned; and care has been taken to prevent deterioration, as far as possible, by applying steel at all the points peculiarly exposed to wear. The arm of the steelyard is truly balanced on the fulcrum, and is marked off in equal divisions. Hence the scale is available for any counterpoise, as the several weights read off merely show multiples or sub-multiples of the counterpoise. The arrangements and proportions of the several parts are judiciously determined, and the whole is well finished.

No. 784, p 253. H. Pooley and Son, Liverpool, Inventor and Manufacturer. Patent weighing-machines. These are remarkable for simplicity, neat and effective construction, and good workmanship. The principle is alike in all. The weighing platform rests on four points, very near the fulcra of a quadruple lever, as in the common street weighing-machine. One of these fourfold levers is prolonged, and at its extremity is connected with the short end of the lever, to which the scale-pan with its weights, or the sliding counterpoise, is attached.

The locomotive weighing-machine appears very deserving of notice. This consists of a system of three such tables, placed so that a locomotive running over them may have each pair of its wheels on a separate table. Then the three counterpoises may be adjusted until each one correctly balances the proportion of the weight bearing on its table. A bar with a light lever, and a handle projecting from it over each steelyard, enables the attendant, standing opposite the centre one, to check the vibrations of all three, and inspect with accuracy the state of adjustment. By the use of this multiplied weighing-machine the proportion of weight borne by each pair of wheels may be tested, and the inquirer is thus enabled to alter the adjustment of the springs until he has secured such a distribution of the load as may be most likely to lead to good working.

No. 772, p. 252. Day and Millward, 118 Suffolk Street, Birmingham. Patent weighing-machines. The award is made for simplicity of construction and cheapness.

Wandsworth, October 1851. HENRY MOSELEY, M.A., Reporter.

CLASS Va.

REPORT ON CARRIAGES GENERALLY, NOT INCLUDING THOSE CONNECTED WITH RAIL OR TRAM ROADS.

[The figures after the Names (between parentheses), refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Sub-Jury for Carriages.

The Earl of JERSEY, *Chairman*, 38 Berkeley Square.
J. HOLLAND, *Deputy Chairman and Reporter*, 258 Oxford Street; Coach-builder.
M. ARNOUX, France; Engineer.
T. HUTTON, Summer Hill, Dublin; Coach-builder.
O. McDANIEL, United States.
ANTOINE PONCELET, Belgium; Engineer-in-Chief.

BY the "*Instructions from the Council of Chairmen to the Juries*," we are directed to consider the articles coming within our province for examination, under two divisions, and to regard as qualifications of merit in the first class, or, "carriages of luxury" especially, a "successful application of any new material, with elegance of design, and excellence of workmanship, strength and lightness, and reasonable cheapness;" and in the second class, or "carriages for the public service," lightness, sufficient solidity for safety, durability, and cheapness.

Our examinations and awards have been made in strict conformity with these Instructions.

We find that the contributions in our department are apportioned among various countries as follows, viz.:—

—	Contributors.	Carriages.	Bath Chairs.	Hearses.	Omnibuses.	Velocipedes.	Sleighs.	Droitschas.
Great Britain –	69	79	11	2	2	3	–	–
France – – –	5	5	–	–	–	–	–	–
Belgium – –	4	7	–	–	–	–	–	–
Hamburgh – –	1	1	–	–	–	–	–	–
Prussia – – –	2	2	–	–	–	–	–	–
Grand Duchy of Hesse –	1	1	–	–	–	–	–	–
Sardinia – –	1	1	–	–	–	–	–	–
Austria – – –	2	2	–	–	–	–	–	–
Russia – – –	1	–	–	–	–	–	2	3
Turkey – – –	1	–	–	–	–	–	1	–
Canada – – –	5	1	–	–	–	–	5	–
United States –	8	8	–	–	–	–	1	–
Total – –	100	107	11	2	2	3	9	3

(Messrs. J. HUTTON and SONS, of Dublin (884, p. 257), exhibit four carriages, which are excluded from competition as Mr. Hutton is a Juror in this class.)

Besides the articles in the foregoing table, we have had under examination a number of *models* of minor importance, patent axles, wheels, and other parts of carriages, coach-lace, &c., the peculiar merits of which are not sufficiently evident to entitle them to especial notice or commendation.

The fact most obvious in the display of carriages is *the want of variety in the kind*, and the absence particularly of the higher class of equipages, of travelling carriages, properly so called, and of vehicles intended "for the public service." The dress or plain *vis-a-vis*, the dress or plain coach, the landau, the mail-coach, &c., have no representatives in the Exhibition.

We confess we are somewhat surprised at the deficiency in this respect; but regard it as accounted for in a great measure by the demand for carriages of these descriptions having been so materially diminished by the general introduction, within a recent period, of railways.

We are also of opinion that the trade is not fairly any more than fully represented, and that the art of carriage-making has attained a point of excellence which would warrant the expectation of a higher standard of merit than is shown in the Exhibition. While we recognize very generally the use of superior woods, leather, and other materials, in the construction of carriages, the most admirable workmanship, and a nice attention to details, we perceive many defects in style, and the display frequently of bad taste. There is often an injudicious expenditure on costly ornament and elaborate finish, which are incompatible with the serviceable class of carriages to which they are applied. In many instances this is carried to an extent that mars instead of enhancing the beauty of the vehicle, and besides increasing the cost, is a positive detriment.

Comparing the state of the art of carriage-building of former and not very distant times with that of the present, we consider the principles of building in many respects greatly improved, and particularly with reference to "lightness" and a due regard to "strength," which is evident in carriages of British make, and especially displayed in those contributed by the United States, where there is commonly employed in the construction of wheels and other parts requiring "strength and lightness" combined, a native wood (upland hickory) which is admirably adapted to the purpose. The carriages from the continental States do not exhibit this useful feature in an equal degree.

We observe many innovations and contrivances in springs, steps, fore-carriage locking movements, &c., which are not always improvements, and yet convenience and nice adaptation have been much advanced in these respects also within a few years. We notice a justly meritorious and very nice automatic step on the carriage of Mr. David Davies of London (828, p. 256), and an ingenious spring door-lock on a carriage of M. Moussard of Paris (657, p. 1209).

In our judgment the appearance of the carriage has not been improved by a deviation quite common from the lines hitherto adopted and approved, and we regret to remark, under the head of "elegance of design," that we find in the exhibition of carriages a great deficiency. While we admit, therefore, that there has been considerable progress in the principles of carriage-building, we are of opinion that the style has been injured by injudicious innovation.

We are aware that the coach-builders of the present day have had no easy task to perform, in meeting the new demands of the age, which require them to construct vehicles to convey the greatest number of persons. It can hardly be expected that in carriages of such a description they can preserve those outlines which have been esteemed elegant and graceful. It is to be deprecated, however, that this necessity in some cases, of departure from the rules approved by good taste, should be displayed in the higher class of carriages of pleasure and luxury, since these must be exempt from the difficulty referred to; and it is to be hoped that future innovations in that direction will be governed by a nice discrimination, pure taste, and sound judgment.

We do not observe that there has been, what may be properly considered, a "successful application of any new material," although we may mention the application recently of a band of caoutchouc around the rim of carriage wheels, in order to render them "noiseless." This application may be useful to a limited extent on light carriages, but it is of very doubtful general utility, and does not appear to be adapted to long or hard street service. We are pleased to see the general use of very superior patent and enamelled leathers, combining in a remarkable degree, pliancy and water-proof qualities. This is conspicuous in the contributions of Great Britain, France, Belgium, and the United States. The iron-work is also generally of the best description, in point of quality of the metal and the execution, but in many cases it lacks due simplicity in form and arrangement of some of the parts. The perfection which textile manufacture has attained of late years, has had a corresponding effect on the interior fittings of carriages, which in linings, &c., are now beautifully appointed at a comparatively moderate cost.

The consideration of "reasonable cheapness" has been duly observed; but it is obviously very difficult to determine the exact intrinsic value of an article like a carriage, and to judge positively whether the affixed price is excessive or not. The cost is often much increased by ornament, finish, or contrivance, that might be advantageously dispensed with, and thus a carriage, otherwise extravagant in price, be reduced to a standard of "reasonable cheapness." And this useless addition of expense is a fault of common occurrence to which we have previously alluded. Extravagant prices may fairly diminish the claim for approval; but at the same time we are convinced that what may be deemed high prices are not always exorbitant prices, but that with carriages as with articles of household furniture, the most similar perhaps to those under our notice where the quality of the article is more or less concealed, the lowest priced may often prove to be the dearest purchase.

After a patient, and we believe thorough examination, we are unanimously of opinion that there is no contribution among the articles in our department which possesses such "pre-eminent and indisputable merit" (Sec. 20, Instructions) as to be entitled to the "Council Medal," and therefore we do not recommend that this distinguished award be bestowed on any. But while we withhold the highest mark of merit, from a sense of duty, we do not deny the prominent claims of many contributors to distinction; and we have endeavoured to select those upon which we think we can confer with the greatest justice the only mark of merit at our disposal. A list of contributors, to whom we award the "Prize Medal," is subjoined.

AWARDS, CLASS Va.

		GREAT BRITAIN.	
No. 802	Andrews, Richard	Southampton	Pony Phaeton.
No. 811	Briggs, G. and Co.	London	Town Chariot.
No. 814	Browne, W.	Dublin	Two Jaunting Cars.
No. 828	Davies, D.	London	Basterna Brougham.
No. 862	Hallmarke, Aldebert, and Hallmarke.	London	Park Barouche.
No. 872	Holmes, H. and A.	Derby	Park Phaeton.
No. 874	Hooper, G. N.	London	Brougham.
No. 933	Peters and Sons	London	Park Barouche.
No. 950	Robinson and Co.	London	Park Phaeton.
No. 956	Rock and Son	Hastings	Diaropha.
No. 968	Silk and Brown	London	Park Phaeton.
No. 997	Ward, J.	London	Bath Chair.
No. 996	Wyburn, Meller, & Turner	London	Dress Chariot.
		FRANCE.	
No. 50	Balvalette Brothers	Boulogne	Buggy Drag.
No. 490	Dumaine, J. A.	Paris	Town Berlin.
		BELGIUM.	
No. 118	Jones Brothers	Brussels	Cab Phaeton.
No. 122	Van Aken, P. and Son	Antwerp	Cab Phaeton.
		UNITED STATES.	
No. 466	Childs, Charles	Springfield, Massachusetts	Slide-top Buggy.
No. 361	Watson, G. W.	Philadelphia, Pennsylvania	Sporting Waggon.

JOSEPH HOLLAND, Reporter.

London, June 11, 1851.

CLASS VI.

REPORT ON MANUFACTURING MACHINES AND TOOLS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

General J. V. Poncelet, *Chairman*, France; Member of Institute, late Director of Polytechnic School, &c.
Rev. R. Willis, M.A., F.R.S., &c., *Deputy Chairman and Reporter*, Jacksonian Professor of Natural and Experimental Philosophy, Cambridge.
Professor Filippo Corridi, Tuscany; Director of the Technological Institute, Florence.
Luigi de Cristoforis, Austria; Vice-President of Chamber of Commerce, Milan; Member of the Scientific Institute of Bologna.
Benjamin Fothergill, Manchester; Mechanical Engineer.
Charles Gascoigne Maclea, Leeds; Mechanical Engineer.
Guilherme Kopke, Portugal; Mechanical Engineer.
John Penn, Greenwich; Mechanical Engineer.
George Rennie, F.R.S., Whitehall Place; Mechanical Engineer.
T. R. Sewell, Carrington, near Nottingham; Lace Manufacturer.
Samuel Webber, United States; Civil Engineer.
Professor W. Wedding, Zollverein; Member of the Board of Trade and Commerce at Berlin.

Associates.

A. Barclay, Brewery, Park Street, Southwark; Brewer.
Robert Davison, 33 Mark Lane; Civil Engineer.
— Dolfousse, France.
J. Mercer, F.C.S., Oakenshaw, near Accrington, Lancashire; Calico Printer.
A. Payen, France; Member of the Institute.
Dr. Varentrapp, Zollverein; Professor of Chemistry.

The Jury for "Manufacturing Machines" have inspected the articles contained in that Class of the Exhibition, and have to Report thereon as follows:—

They find it to contain a collection unparalleled for number, importance, ingenuity, beauty of execution, and every quality by which the machines of the present day are distinguished; but they desire carefully to guard against the supposition that every branch of manufacturing mechanism is represented. On the contrary, great inequality prevails in this respect; some manufacturing processes being abundantly and almost superfluously illustrated, others wholly omitted, and the remainder represented by very few specimens.

The textile processes in general, the preparation and spinning of cotton, flax, wool, and silk, weaving in all its branches, are, for the most part, well illustrated by the public spirit of various exhibitors, who have not only sent complete series of the respective machines, but also maintain them in motion, doing work, so that these materials are actually shown to the visitors in their gradual progress from the raw state to the saleable product. But even in this division many machines are necessarily omitted, especially if the nature of their work unfits it to be carried on in the presence of a crowd of spectators.

Such are the preparatory washings and cleansings of raw material; all kinds of fulling, calendering, dyeing, and the like, which either derive their sole interest from processes that are accompanied by excessive noise, dust, disagreeable smells, splashing and spilling of water and other liquids, or similar annoying phenomena; or are of such a nature as to occupy time, or demand more care than can be bestowed in the presence of an assembly of spectators; or which require peculiar conditions of temperature or other arrangements incompatible with a public exhibition. Paper-making may be placed under this head, and consequently only a few of its models and machines are exhibited; and those, at rest.

For completeness and value, the collection of machine tools for working metal and wood may take its place next to the textile mechanism; and here may be seen specimens of nearly every one of the engines that have been introduced in the present century by our machine-makers, and by means of which the construction of the vast and complicated machinery that now pervades all classes of industrial occupations has been rendered possible. But the magnitude of the work usually executed by such engines—the steadiness of foundation which they require, and which is unattainable in this building—and other considerations, appear to have prevented the exhibition of their action; for although they are placed in the department of machines in motion, and some of them are actually kept in motion in part, no work is placed upon them. For obvious reasons, all processes of working metal which require heat are impracticable, and very few of the machines which belong to such are here to be found. Thus the reduction of metals from the ores to bars and sheets, and all founding or casting processes, are wholly unrepresented, as well as the curious and interesting operations belonging to the glass and pottery manufactures. To these may be added machines which are so bulky or so easily deranged as not to justify, in the opinions of their owners, the risk and expense of removing them to the Exhibition, or the sacrifice of the work which they are producing in their own manufactories.

A great variety of printing presses will be found in the collection, many of them maintained in constant action; also many mills for grinding and crushing vegetable products, with the cleansing and sifting apparatus connected with them; but of course not exhibited in action. Besides these, there are various miscellaneous machines which will be indicated as we proceed. Enough, however, has been said to show that the present collection does not represent the real extent to which machinery is employed in the manufactures of this country, seeing that, at all events, those machines are omitted which derive their sole interest from the processes with which they are connected, and when these are of such a nature as to forbid their being carried on in the presence of an assemblage of spectators or in an ornamental building. It will be remarked that the greater part of the machines which are exhibited are sent by their makers and not by manufacturers.

The above remarks are more especially directed to the British part of the Exhibition; but they apply with still greater force to the foreign, in which the distance of the respective countries and the risk of damage to the mechanism have necessarily interposed many difficulties to the transmission of large, valuable, or delicate objects of this description. Hence, notwithstanding the considerable number of beautiful and ingenious machines that are placed in the eastern division of the building, any attempt to estimate from this collection the relative employment of machinery in any branch of manufactures by their respective countries, or the relative standard of excellence which each has attained in the construction and contrivance of machines, would lead to the most fallacious and unjust conclusions.

The machinery of the Exhibition, and the foreign machines especially, must therefore be looked upon as a collection of miscellaneous articles, sent by individuals without any principle of concurrence or any attempt to ensure the fair and equable representation of every class of manufacturing machinery, or of the styles and mode of workmanship which prevail in different countries or districts.

It will of course be understood that the above remarks are strictly confined to the articles which belong to the class of *manufacturing* machines; for the portions of the building wherein they are placed also contain many of those that are included in Class V., especially in the foreign departments, in which the machines of the two Classes V. and VI. are also mixed up with agricultural and other mechanism of all kinds, and with hand-tools and manufactured articles that properly fall under the denomination of "cutlery" or "general hardware." Many machines which are inserted in the Catalogue have not been sent by their respective exhibitors, or they prove upon inspection to be either models of small importance, or to have been so deranged by the transit as to make it impossible to set them in motion, or form any just opinion of their merits, especially in cases where the exhibitor is neither to be found, nor has left any representative capable of explaining them.

In round numbers it appears that the English exhibitors amount to about two hundred and twenty. France has contributed between fifty and sixty; the United States, fifteen; Belgium and the Zollverein, ten or twelve each; Russia and the Netherlands two or three; while Sardinia and Switzerland have merely sent some machine-tools used in the manufacture of watches. Since it thus appears that the machines sent by each country, whether British or foreign, bear no proportion to the relative employment of machinery, considered either with respect to geographical distribution or to the different departments of manufacture, it will be useless to examine each country by itself. In the following more detailed survey of the collection, the machines will be classed according to their functions, including under each head all those that have been contributed by the different nations.

(A.) Conversion of Raw Material into a continuous Thread, and subsequent Processes.—(1.) Cotton. (2.) Wool. (3.) Flax and Hemp. (4.) Silk.

(B.) Weaving of all kinds.—(5.) Looms. (6.) Lace-frames. (7.) Knitting or hosiery frames. (8.) Heald machines, sewing machines, &c.

(C.) Paper and Printing.—(9.) Making, cutting, and folding paper. (10.) Type printing. (11.) Numbering, paging, and ruling machines. (12.) Lithographic and copper-plate presses.

(D.) Working parts of the above Machines.

(E.) Machines for Working in Metal, Wood, Stone, Clay, Leather, &c. &c.—(13) Lathes for metal (including also those for wood, &c.). (14.) Machines for planing. (15.) Slotting. (16.) Shaping. (17.) Drilling and boring. (18.) Other machines and tools for working metal. (19.) Machines for sawing, planing, mortising, &c. wood. (20.) Working in other materials, as stone, coal, clay, leather, glass, &c.

(F.) Mills for grinding and preparing Flour, and other Vegetable Products.—(21.) Grinding. (22.) Separating.

(G.) Machinery for the Manufacture of Sugar.

(H.) Apparatus for Brewing, Distilling, and Manufacturing Chemistry.

We cannot conclude these prelimenary remarks without expressing our cordial thanks to Colonel Lloyd; to whose zeal, ability, and diligence, we have been so greatly indebted throughout the whole period of our labours.

(A.) Conversion of Raw Material into a continuous Thread, and subsequent Processes.

(1.) *Cotton.*

In the exhibition of machinery for spinning, and its preparatory processes, Messrs. **Hibbert, Platt**, and **Sons** (1, pp. 263—268) have taken the lead, by establishing and maintaining in operation a complete series, beginning with the opening machine and scutcher, and including the various carding engines, the drawing, slubbing, and roving machines, two self-acting mules (the one adapted to the weft, the other to the warp), and also a throstle, a winding-machine, and a doubling machine. This splendid series of nineteen machines is of their own manufacture, and contains many improvements on the ordinary constructions, besides affording a complete picture of the progress of the raw material from the state in which it is imported, to that in which it is delivered to the weaver. Attention must also be directed to the beauty and excellence of the mill gearing and its framing, by means of which these various machines receive their motion from the steam-engine. This part of the work is exhibited by Messrs. **Hick** and **Son**, of Bolton (1, p. 268). The cotton cleaning and opening machine of the above series is on Mr. F. A. **Calvert**'s construction, who also exhibits (27, p. 271) other specimens of his new and effective method of making wool-burring, cotton cleaning, and carding cylinders.

Other makers have sent admirable specimens of some of these machines, each distinguished by peculiarity of construction, important improvements, or beauty of workmanship. Amongst these the new throstle of Messrs. **Sharp, Brothers**, and Co. (15, p. 270), is remarkable. The principle of this machine, which is derived from America, is—that a small loop running on a ring is substituted for the usual flyer, whence it is termed "the ring and traveller throstle." The framing and disposition of its parts are greatly improved by the present makers.

Messrs. **Higgins** and **Sons** (14, p. 270) exhibit their roving-frame, and Mr. J. **Mason** (10, pp. 268, 269) a drawing-frame, a roving-frame, and a slubbing-frame, furnished with their patent collars, by which the spindles revolve with greater steadiness, and an increased velocity can be attained. Also separating plates for the slubbings, and a brake motion for more effectually stopping the machine. Messrs. **Parr, Curtis**, and **Madeley** (6, p. 268) exhibit an extensive contribution of machines, including a carding-engine, drawing, slubbing, and roving-frames, and three patent self-acting mules, each of a different construction. A new self-acting mule is also shown in operation by Mr. G. P. **Macindoe** (24, pp. 270, 271), in which a radial arm is employed to produce the return motion, or putting-up of the carriage. Mr. R. **Sutcliffe** (42, p. 273) exhibits a doubling-frame of an improved construction, in which the flyer is drawn by the bobbin, and other arrangements are carried out for the purpose of obtaining a high velocity. Messrs. **Gardner** and **Bazley** (87, p. 279) contribute a small doubling-frame for lace thread, in which the spindles are driven by contact wheels in lieu of bands, an arrangement that has also been used in the throstle of Messrs. **Sharp** already described. Mr. **Paterson** (28, p. 271) exhibits a machine for winding cops: M. De **Fontaine Moreau** (p. 273) a mode of driving spindles with tooth gear, and Messrs. **Lewis** and **M'Lardy** (209, p. 292) a spindle for roving, slubbing, or doubling, which combines the advantage of top bearings with facility of doffing.

The Foreign Department contains very few machines for the manufacture of cotton.

Mr. **Risler** (France, 1438) exhibits a machine, which he terms "L'Epurateur," for opening and cleaning cotton upon a new system, that promises great advantages; and Messrs. **Stamin** and Co. (France, 1021, p. 1227) contribute a large roving frame, of excellent workmanship, in which the spindles are wholly driven by spur-wheels. From Belgium, the Phœnix Company (134, p. 1155) have sent a well-made "soft-bobbin" frame, in which the cone and pulley, usually employed to produce the variable motion required by the bobbins, are replaced by a group of spur-wheels. Mr. W. Hayden, of the United States (386, pp. 1461, 1462), exhibits a drawing-frame for cotton, with an ingenious self-acting mechanism for regulating the weight of the slubbing, and Messrs. Bates, Hyde, and Co. (440, p. 1463), send a saw-gin for cotton. Messrs. W. and C. Mather (16, p. 270) exhibit a calico-printing machine, for printing eight colours at one operation.

(2.)—*Wool.*

The machinery for the woollen manufacture, notwithstanding its extent and importance, is very slenderly represented. Mr. G. E. Donisthorpe (40, p. 273) contributes a machine for long-wool combing, recently patented, on a new principle, of great ingenuity and admirable promise; and Messrs. Berry and Sons (48, p. 274) have furnished a series of the six machines employed in the manufacture of worsted yarns, of the best workmanship and of improved construction. By these the complete progress of the material, from the state of a sliver to the spinning, inclusive, is shown in daily operation. Mr. Mason (46, pp. 268, 269) exhibits, in the short-wool department (or clothing branch), two carding-machines and a mule. These deserve especial notice, as being on the plan now adopted very generally on the Continent, and universally in the United States, by which endless slubbings are formed directly from the card. The old billy-machine, and the operations connected with it, are thus dispensed with, and the yarn produced is more level. Mr. Mason's machines contain several important improvements, of his own invention; especially an apparatus for condensing the slubbing from the first card. In the French Department, a set of woollen machinery, on the same system, is exhibited by Messrs. Mercier and Co., of Louviers (632, p. 1208); namely, two carding-machines and one semi-self-acting mule. These machines are of highly-finished workmanship, and in the best style of modern French machine building. In this department (283, p. 1190), Messrs. Lacroix and Sons contribute a fulling-machine, of admirable construction upon a system which has entirely superseded, on the Continent, the old method of fulling-stocks. In the English part, Mr. E. Hunt (49, p. 274) exhibits a gig-mill, of a new and simplified construction, which, by working on both sides, and thus finishing the process of dressing with teasels, without removing the cloth from the machine, is rendered capable of turning out considerably more work than on the usual system.

The English mechanists have not contributed a single shearing-machine, but in the Foreign Department there are exhibited several of very creditable workmanship; namely, by Messrs. Thomas (Prussia 57, p. 1060), H. Troupin Brothers (Belgium, 128, p. 1155), and Schneider and Legrand (France, 1001, p. 1227).

(3.)—*Flax and Hemp.*

The Flax manufacture is represented, in the present collection, with the same spirit and completeness as the cotton.

Mr. R. Plummer exhibits his patent rotatory disc machine (74, pp. 275—277), with other machines for breaking, cutting, and dressing flax; also his application of gutta percha to the holders. Messrs. Lawson and Sons contribute a set of sixteen machines (75, pp. 277, 278), which, for beauty of execution, value and completeness of illustration, are fully equal to those which Messrs. Hibbert have furnished in the department of cotton. These machines are divided into three series, that include the three departments of flax manufacture; namely, the tow, the long flax, and the cut flax; and they contain all the machines used in each respectively, by which the raw material is converted from the form in which it is imported, to the thread, as delivered to the weavers, or others, by whom it is employed. Among them are the machines by which the spinning of flax has been so greatly facilitated by substituting cold water for warm, which was formerly employed to the great detriment of the health of the workpeople. Messrs. Higgins (14, p. 270) have also exhibited excellent specimens of the four machines employed in the long flax spinning, and the preparatory steps which belong to it.

In the article of Hemp we find only the large machine of Mr. J. Crawhall (78, p. 279), by which yarns, spun by processes not exhibited, are converted into a rope. This machine, compared with the previous ones, from which it is derived, is remarkable for simplicity of arrangement.

The Foreign Department does not contain a single machine relating to the flax manufacture.

(4.)—*Silk.*

The simpler machinery of the silk manufacture is completely exemplified by the beautifully-finished machines of Mr. J. L. Davenport (80, p. 279), which include the complete series employed in that branch, for throwing, winding, cleaning, spinning, doubling, and reeling; the whole of which are exhibited in operation. Mr. J. Frost (84, p. 279) also contributes models (or rather, short portions) of his improved machines for winding, cleaning, throwing, &c., and of his spinning and doubling machine, in which the two operations are performed by one process.

In the Zollverein Department is a machine for silk-winding, by Mr. T. H. Diepers (472, p. 1078); and in the Russian (150, p. 1371), a machine, by Mr. H. Graff, for spinning silk directly from the cocoon.

Attention must also be directed to the ingenious machines for manufacturing the cards with which the carding-machines for cotton-wool, &c., are clothed. Two specimens of this machine are exhibited, the one in the English Department, by Mr. T. Crabtree (3, p. 268); the other in the French, by Messrs. Papavoine and Chatel (339, p. 1193), both of excellent workmanship, although differing very little from the well-known machine of Mr. Dyer.

From this rapid survey of the machinery in the Exhibition, for converting the raw materials of cotton-wool, flax, and silk, into a continuous thread, it appears that nearly all the processes are represented, and some of them in the most satisfactory and complete manner. It is to be regretted that no specimens have been sent of the curious machines, by which caoutchouc is manufactured into a continuous line.

(B.)—Weaving of all Kinds.

(5.)—*Looms.*

We may now proceed to the various classes of *looms*, of which a great variety are placed in the Exhibition, and most of them maintained in operation, either by power or hand; many of them also are remarkable for novelty of construction and for important improvements, which can only be alluded to, here, as it would be impossible to render them intelligible without the aid of drawings or very long descriptions. Those, however, which appear of the greatest importance may be mentioned.

Messrs. C. E. and C. Parker's power-loom for sail cloth (77, p. 278) is distinguished by peculiar and effective arrangements for maintaining the uniform and regular delivery of the warp, and a constant but adjustable tension in the taking-up motion, by which the firmness of this important article of manufacture is insured.

Mr. Brown (56, p. 275) also exhibits a sail-cloth power-loom with peculiar arrangements, adapted to the same objects.

In Mr. Barlow's double jacquard loom (82, p. 279) two cylinders are employed, and the cards are disposed upon these in alternate order, so that, while one cylinder with its cards is brought into action upon the horizontal wires, the other is withdrawn for the purpose of rotating it, and shifting the card, and *vice versâ*. By this arrangement the loom can be worked with a velocity 40 per cent. greater than that of the ordinary construction: the steadiness of its action is greatly increased, and the strain upon the warp diminished, by another improvement, which consists in lowering the warp threads as well as raising them; whereas in the ordinary jacquard loom those threads which are not carried up by the lifting bars are allowed to remain in the horizontal position.

The power-loom of Messrs. **Kenworthy** and **Bullough** (21, p. 270) is characterised by two self-acting methods of stopping the loom by throwing off the belt; the one when the weft breaks, the other when the shuttle *traps*,—that is, sticks in its course through the shed.

Mr. **Mason**'s large loom for wool (10, pp. 268, 269), has a motion which releases the swell of the shuttle-box at the instant of *picking* or driving the shuttle, whereby the force required for the latter operation is greatly diminished.

Mr. M. **Smith** (22, p. 270) exhibits several power-looms with a peculiar mode of delivering the warp; one of them has a self-action for changing the shuttles, and thereby working in three colours in any desired order, the changes being governed by a kind of jacquard apparatus.

Mr. **Fromage** (France, 219, p. 1184) contributes a power-loom in which two shuttles are employed, and shifted by an endless chain, provided with tappets fixed in the order required by the pattern.

Messrs. **Taylor** and **Son**'s power-loom (23, p. 270) is provided with four jacquard cylinders working simultaneously, and Mr. **Chalmers** (32, p. 273) exhibits a large power-loom for damask-weaving, provided with a jacquard and some new arrangements.

Mr. **Crichton**'s model (35, p. 273) shows a taking-up motion that adjusts itself to the increasing diameter of the cloth beam with more precision than any previous contrivance.

Other looms are exhibited by Messrs. **Harrison** (18, p. 270), **Henning** (43, p. 273), **Elliott** and **Heys** (50, p. 274), **Milligan** (38, p. 273), **Cross** (64, p. 275), and J. **Smith** (59, p. 275).

A jacquard loom of the most beautiful workmanship and mechanism, for weaving silk-flowered damask of the richest quality, is maintained in constant action by Messrs. **Atkinson** and Co., of Dublin (12 and 15; and the **Lowell Machine Shop** have sent from America (447, p. 1464) a power-loom of highly-finished workmanship. The power-loom for weaving fringe by Messrs. **Reed** and Co. (85, p. 279), is a remarkable piece of mechanical contrivance, weaving without shuttles thirty-four pieces of fringe simultaneously.

Mr. **Harrison** (18, p. 270), exhibits a power-loom made fifty or sixty years ago, which will be looked upon with great interest as a specimen of the mode in which machinery was constructed at that period.

Notwithstanding the great employment of the jacquard loom in France (the country to which the world is indebted for this admirable piece of mechanism), the only specimens that have been sent from thence on the present occasion are two jacquard cylinders by Messrs. **Martin** (323, p. 1192), and **Acklin** (399, p. 1197), which exhibit two different ways of employing a continuous sheet of paper in lieu of the chain of pasteboards usually applied.

Well-made jacquards of the ordinary construction are exhibited in the Zollverein Department by Messrs. **Winter** (56, p. 1050), and **Bonardel Brothers** (53, p. 1050); in the Austrian, by the Heirs of P. **Gamba** (109, p. 1013), and in the Russian by the **Imperial Alexandrovsk Manufactory** (149, p. 1371); from Belgium, M. **Vandevin** (126, p. 1155) sends a singular loom in which a pattern, painted on soft cloth, is employed in a kind of jacquard-frame to act instead of the chain of cards; this simple device appears to succeed well enough for coarse damask, linen, and other common goods.

Various applications are shown of small jacquard machines which act on the heddles of power-looms in lieu of tappets, or in other ways, so as to produce diapers or other figured patterns of limited range; as, for example, by Messrs. **Goudeau** (Belg. 135, p. 1155), M. **Smith** (22, p. 270), J. **Smith** (59, p. 275), **Mason** (10, pp. 268, 269).

A simple machine for reading the jacquard patterns and punching the cards, well adapted for small weavers, is shown by Messrs. **Bonardel** (Prussia, 53, p. 1050), and a reader with keys similar to those of an organ, by Mr. **Mackenzie**, (39, p. 273).

Mr. **De Fontaine Moreau** (30, p. 273) exhibits a jacquard loom, in which a cylinder like that of a barrel organ, and provided with pegs that can be shifted to suit any required pattern, is substituted for the usual chain of cards.

(6.) *Lace Frames.*

Mr. **Birkin** (94, p. 280) exhibits, in operation, a single tier jacquard bobbin-net machine, making figured laces. This machine is of excellent workmanship, and most judiciously arranged, combining all the recent and important improvements in this branch of manufacture.

Mr. **Sewell** (92, p. 279), one of the jurors of this class, contributes a double-tier bobbin-net-machine, making Brussels net, combining great simplicity of arrangement and symmetry of proportion with efficient operation.

Messrs. **Ball, Dunnicliff**, and Co. (90, p. 279) maintain, in operation, a warp-lace machine, making silk blond, of excellent workmanship and design, and remarkable for the noiselessness of its complex movements.

A frame for "gassing lace"—that is, for burning the minute fibres from it by passing it rapidly over gas flames, is exhibited by Messrs. **Burton** (96, p. 280); but they are unfortunately prevented from showing this most interesting process by the necessary restrictions against the introduction of gas into the building.

Messrs. **Hudson** and **Bottom** (88, p. 279) show a lace-dressing machine of superior construction, but are also prevented from exhibiting its operation by the unsuitableness of the process.

(7.) *Stocking or Hosiery Manufacture.*

In this Department are several machines, both English and foreign, well worthy of remark. Messrs. T. and T. G. **Carver** (89, p. 279) exhibit a well-made and beautifully-finished stocking-frame of the ordinary form.

Messrs. **Whitworth** and Co. (201, p. 287-290) show their machine for knitting, in which the stitches are taken up singly, as in hand-knitting. This machine (the principle only of which is American) is remarkable as a specimen of English constructive propriety and skill. Somewhat similar in principle is a small machine for knitting seamless purses in the French Department, by M. **Laneuville** (287, p. 1190).

Of circular hosiery frames Mr. **Claussen** (86, p. 279) in the English Department exhibits two, and Mr. **Jacquin**, of Troyes (546, p. 1204), in the French Department, three. These machines, which are nearly identical, are remarkable for excellence of workmanship and beauty of arrangement. They have vertical sinkers, eccentric depressers, and tucking pattern wheels, and are calculated to produce fabrics of great variety and beauty, and to effect important and beneficial results in this branch of manufacture.

The circular frames of M. **Berthelot** (France, 422, pp. 1198, 1199) are more complex than the above; the sinkers are arranged in a horizontal position, and revolve with the frame; but these machines will produce fabrics of a finer description, and of flax and silk, materials which are intractable in the frames above mentioned.

In the Belgian Department (123, p. 1155) will be found a small circular hosiery frame, by M. **Jouvne**.

(8.) *Heald Machines, Sewing Machines, &c.*

Two machines for weaving healds for looms are exhibited in this collection.

That of Mr. **Judkins**, in the English Department (52, p. 1274), is an ingenious application of the principle of the common plaiting-machine to the production of a heald, combined on a new system, completely free from knots or other obstructions to its action, and to the passage of the warp.

The machine of M. **Dorey** (France, 823, p. 1220) is a beautiful piece of mechanical combination, and the heald, although different from the above, is also without knots.

Plaiting machines of the usual construction are shown by Mr. **Van Mierlo** (Belgium, 133, p. 1155), and M. **Dörffel** (Prussia, 54, p. 1081).

Under this head we may also notice three ingenious and useful contrivances in the French Department, namely, a small frame by M. Foucher (837, p. 1220) to enable poor workmen or cottagers to weave slippers with ease and rapidity; a frame for weaving wigs by M. Croisat (1574, p. 1252); and a large machine for sewing sacks by M. Senechal (373, p. 1194).

An effective and ingenious machine for sewing with two threads is exhibited in action in the American Department by Mr. Blodget (551, p. 1468). A somewhat similar one is shown by Mr. Judkin in the English Department (52, p. 274).

(C.) Paper and Printing.

(9.) *Paper-making, Cutting, and Folding.*

We now come to the curious and useful process by which worn-out and dirty rags, old ropes, and such-like apparently worthless matter, are wrought into paper. But unfortunately, as in many other cases already alluded to, the noise, damp, and heat with which the operations of paper machinery are inseparably connected, have prevented them from being shown, and indeed for the most part the machines are only represented by Models.

Messrs. Cowan and Son (166, p. 286) exhibit a model of a pulp-meter for regulating the supply of pulp to the paper machine so as to insure equality in the thickness of the sheets; Mr. Fourdrinier (100, p. 280) a model of his original patent paper machine; and Messrs. Donkin and Co. (130, p. 282) an elaborate and beautiful model of a complete series of machines, with their appurtenances, for making paper, containing all the latest improvements which he has introduced into this important and valuable branch of manufacturing mechanism; Mr. Marshall (137) also contributes a model of a paper-making machine.

Portions of the process are illustrated by other exhibitors, as in Mr. Watson's improved pulp-strainer (165, pp. 285, 286); and in the wove wire-cloth and dandy rollers of Messrs. Brewer (132, p. 282; and 144, p. 283); Mr. Sullivan (156, p. 284); and Mr. Marshall (137).

A machine for cutting the endless paper into sheets is shown in Mr. Donkin's model in connexion with the paper-making machine; and one of the full size is exhibited by Mr. Tidcombe (108, p. 280).

In the French Department (717) there is a complete suite of paper machinery of the full size and of excellent workmanship, containing all the appurtenances for moulding, drying, laying, and cutting the paper, by Messrs. Varrall, Middleton, and Elwell (p. 1213).

Mr. Wilson (112, p. 280) exhibits his admirably constructed and useful machines for cutting paper, card-boards, books, &c. In one of these the knife descends vertically, and in the other, which is more especially intended for mill-boards, it descends diagonally. In the French Department, M. Bottier (1101, p. 1230) has a small cutting-press for bookbinding, in which a knife moves diagonally in a horizontal plane.

Two machines for gumming and folding envelopes are exhibited in operation in the English Department. One, beautifully finished by the original inventor of such machines, Mr. De La Rue (Class XVII., No. 76, pp. 541-543), is distinguished by great ingenuity and perfect operation; the other, by Mr. Remonde, contains a novel application of currents of air and exhaustion to produce the motions of the paper in folding, and the transference of the envelopes.

Mr. Black (138, p. 283) has an effective machine for folding printed sheets, whether 8vo., 12mo., or 24mo., newspapers, &c. with precision and rapidity; and Mr. Taylor (136, p. 283) a machine by which flat circular discs of paper are neatly moulded into hemispherical lamp shades.

Messrs. Church and Goddard (135, p. 283) exhibit a machine which cuts sheets of card-board into packs of cards.

The machine of Mr. Adorno for making cigarettes (448, p. 303) is principally employed in cutting, wrapping, and folding the ends of the paper envelopes in which the tobacco is enclosed, and may therefore be included under the present head. In this beautifully contrived mechanism an endless sheet of paper is supplied at one end, together with the requisite tobacco, and after passing through fourteen operations those materials are delivered at the other end in the shape of complete cigarettes.

(10.) *Type Printing.*

An excellent machine for founding type is exhibited in the Zollverein section by M. Leonhardt, (55, p. 1050) by which 4,000 types can be made in an hour; and similar machines by Messrs. Hoffmann (12, p. 1105) and Brockhaus (13, p. 1105), in Saxony, for founding and and justifying type.

In the English part, Messrs. Harding, Pullein, and Johnson (102, p. 280) exhibit the patent *apyrotype* machinery, of which they are the proprietors. By this apparatus type is formed from copper, zinc, or other metals without heat, by means of dies and pressure, and is also dressed and regulated by the machinery.

The Gutta Percha Company of London (424, p. 301) contribute stereotype plates of gutta percha (with specimen impressions), in connexion with a large unfinished machine intended for printing therewith on endless paper, which is also to be cut and folded before it leaves the machine; the gutta percha types not requiring the paper to be damped.

Mr. Cooke (118, p. 280) shows a new arrangement of type-boxes for compositors; and M. Sörensen, in the Danish section (13) exhibits an ingenious machine for composing and subsequently distributing type—this machine has not, however, had the advantage of experience.

Of printing-presses worked by hand, the following are exhibited:—By Messrs. Cowslade and Lovejoy (91, p. 279), with self-inking apparatus; by Messrs. Sherwin, Cope, and Co (104, p. 280); by Messrs. E. and W. Ullmer (121, p. 280), also with self-inking apparatus; by Messrs. Clymer and Dixon (124, p. 282); by Messrs. Hopkinson and Cope (162, p. 285); and in model by Messrs. T. Nelson, jun. (120, p. 280), and Cobb (150, p. 283).

Two forms of a hand printing-press, of novel arrangement and excellent workmanship, are exhibited by Messrs. Ransomes and May (640, Class V., pp. 246, 247), one of which has a self-inking apparatus.

Cylinder printing machines are exhibited by Messrs. Napier and Son (158, p. 285); by Messrs. Waterlow and Sons (164, p. 285); and in model by Mr. Cowper (134, pp. 282, 283).

The Scandinavian press of Messrs. Hopkinson and Cope (162, p. 285) is worked by power, but has a vertical pressure.

In the great machine by Mr. Applegath, exhibited (122, pp. 280, 281) by Mr. Ingram, by which the "Illustrated London News" is printed in the Exhibition, the printing cylinder is placed in a vertical direction. Four frames for supplying the paper are fixed in a radiating position from the centre, thus allowing four sheets to be printed in each turn of the cylinder.

Another printing machine, in which a stereotype plate is curved to fit the circumference of a cylinder, is exhibited by Mr. Nelson (120, p. 280).

(11.) *Numbering, Paging, and Ruling Machines.*

Messrs. Church and Goddard exhibit (135, p. 283) an elaborate machine, which prints, numbers, cuts, and packs railway tickets; and a smaller machine for numbering and printing tickets is shown by Messrs. Harrild and Sons (157, p. 284). In the French division, Mr. Baranowski (15, pp. 1171, 1172) has a neat and ingenious machine for the same and other purposes, in which the chance of error in the numbering apparatus is well provided against. Paging machines for ledgers, cheque-books, &c., are shown by Messrs. Waterlow and Sons (164, p. 285), and by Schlesinger and Co. (Class XVII., 38, p. 539).

Machines for ruling paper are exhibited by Mr. Shaw (110, p. 280), and, in the French section, by M. Bauchet-Verlinde (413, p. 1198), the latter is arranged (in the manner of cylinder printing machines) so as to rule the paper on both sides before it quits the machine.

(12.) *Lithographic, and Copper-plate Presses.*

In the English section the following Lithographic Presses are exhibited:—By Mr. SHARWOOD (103, p. 280), in which a mangle wheel is used for producing the motion of the stone; by Messrs D. and J. GREIG (114, p. 280), with side lever and registering apparatus; by Mr. STRAKER (142, p. 283), with similar appendages; by Messrs. M'CLURE and Co. (160, p. 285), for a zinc plate, which is arranged over the leather cover; and by Mr. UNDERWOOD (473, Class V.), which is chiefly adapted for printing in colours. In the French section we also find a press, by Messrs. LACROIX and SON (283, p. 1190), and another by M. BRISSET (440, p. 1199), in which the top lever is turned sideways instead of being raised upwards as usual.

In the English section Messrs. D. and J. GREIG (114, p. 280) exhibit a copper-plate press, and Mr. FOURDRINIER a press (100, p. 280) to be worked by steam, and intended to print impressions, which are to be transferred to earthenware or china. This is accompanied by a specimen of his pottery tissue paper, in one continuous length of more than two miles and a half, manufactured from old coal-pit ropes and hawsers.

(D.) WORKING PARTS OF MACHINES.

In all machines there are certain parts which actually do the work for which the machine is constructed, the mechanism serving merely to produce the proper relative motion of these parts to the material upon which they operate, and these working parts being the tools with which the machine operates.

Accordingly, in machinery for spinning and its preparatory processes, for weaving of all kinds, and for paper-making, there are a variety of such working tools, as, for example, spindles and flyers, fluted rollers, heckles, gills, all the variety of card-clothing for cotton, flax, wool, and silk, weavers' reeds and shuttles, the wire cloth employed by paper-makers, &c., the making of each of which articles constitutes a distinct branch, and is carried on by a different set of workmen from those who make the machines. For the machine-makers usually purchase these parts from their proper makers when they fit up their machines for sale, as the manufacturers and their workmen do when such parts are worn out.

Specimens of all these working parts have been transmitted to the Exhibition, and placed in Class VI.; although it might fairly be questioned whether they ought not rather to have been submitted to the judgment of the manufacturers, whose daily experience teaches them the qualities necessary to enable these working tools to perform their office well, and last the longest time—qualities which are quite independent of the merits of the machinery which sets them in motion; for as the best lathe will make bad work with a bad tool, so a good carding-engine, and a good loom, will fail, if fitted up with imperfect card-clothing, or ill-made reeds and shuttles; and reversely, the best tools are useless if attached to a bad machine. However, we may proceed to direct attention to the principal specimens of this kind, premising that many exhibitors have transmitted glass cases containing a few such articles that can be looked upon in no other light than as pattern-cards.

In the English Department we would select, for particular attention, the spindles of Mr. PRESTON (5, p. 268); the reeds of Mr. DE BERGUE (45, p. 274); heckles by Mr. J. Taylor (51, p. 274); and a wool-comb by Mr. JOHN PERRY, of Bradford (suspended against the wool-combing machine of Mr. DONISTHORPE) (40, p. 273). Besides these there are others, apparently very good, but so few of each as not to afford an equally good criterion of merit. In the French section Messrs. PAPAVOINE and CHATEL, of Rouen (339, p. 1193), the exhibitors of a machine for making card-clothing, already mentioned, also exhibit some samples of its work. Messrs. SCRIVE BROTHERS, of Lille (1005, p. 1227), contribute excellent samples of card-clothing for cotton and wool, some having the teeth set in leather, others in Horsfall's patent card-cloth. Messrs. MIROUDE BROTHERS, of Rouen (645, p. 1207), also send excellent specimens of cards for cotton, tow, silk, and wool. Mr. HARDING COCKER, of Lille (864, p. 1221), furnishes a large number of capital heckles, gills, porcupines, and combs. Messrs. DANDOY, MAILLARD, LUCQ, and Co., of Maubeuge (491, p. 1201), exhibit well-made spindles, rollers, bolsters, steps, &c. Many other exhibitors in this class are to be found in France, Belgium, Spain, Switzerland, and the Zollverein. Some reeds, by Madame CUYERE, from Tuscany (72, p. 1296), merit notice.

(E.) ENGINEERS' TOOLS FOR METAL, WOOD, AND OTHER MATERIALS.

13. *Lathes.*

Amongst the machine tools, lathes, as might be expected, appear in the greatest number and of every variety of size and arrangement, from the powerful machines, which are capable of turning wheels 7 or 8 feet in diameter, or shafts 36 feet in length, down to the delicate lathes used by amateurs, or the makers of small machines and apparatus. However, it must be remarked, that in this collection, complete as it is, several important machines are not represented, as, for example, the colossal lathes which are employed for boring cylinders.

A magnificent railway-wheel lathe, with two opposite headstocks and face plates, and two compound slide-rests to correspond, capable of turning wheels above seven feet in diameter, is exhibited by Messrs. SHARP (204, p. 291), and one of smaller dimensions by Messrs. WHITWORTH and Co. (201, pp. 287-90), who also contribute two of their patent duplex lathes, in which the work is acted upon simultaneously by two tools cutting at the opposite extremities of the same horizontal diametrical line. Thus vibration and deviation of the work in shaft turning is wholly prevented. The beds of these lathes are 18 feet and 36 feet in length respectively, and the latter is provided with two duplex slide-rests, which can be made to travel simultaneously by self-action, either in the same or opposite directions at pleasure, so as to economize the time required for finishing the work. They also exhibit a 5-inch self-acting foot-lathe, with complete arrangements for sliding, screwing, and surfacing. Large lathes of excellent workmanship, each having some peculiar facilities in the details, and adapted for sliding, screwing, and surfacing by self-action, are exhibited by Messrs. SMITH, BEACOCK, and TANNETT (230, p. 295), PARR, CURTIS, and MADELEY (213, p. 292), SANDFORD, OWEN, and WATSON (223, p. 294), and SHEPHERD, HILL, and SPINK (220, p. 293). Mr. MUIR (206, p. 291-2), contributes a well-made small foot lathe, with a variety of screw stocks and other tools.

In the American Department, a lathe sent by the LOWELL MACHINE SHOP (447, p. 1464), of 12-inch centre and 13-feet bed, with the usual arrangements for self-action, will be looked on with great interest, as a specimen of first-rate transatlantic workmanship in this branch, and as offering various peculiarities of form and distribution of metal, the latter being employed as sparingly as possible on account of the great cost of iron. Hence a lightness of construction carried to the extreme point consistent with strength and stiffness, which presents a singular contrast to the solid proportions adopted by our own engineers.

In the smaller class of lathes Messrs. HOLTZAPFFEL and Co. (232, p. 295) take the lead, by exhibiting a first-rate amateur lathe, provided with all the apparatus required for ornamental turning, such as oval, excentric, and drilled work, and a variety of tools and contrivances appertaining thereto, of the most elegant and perfect workmanship. Mr. DALGETY (226, p. 294), has a highly-finished lathe, to which is appended, amongst other things, his useful chuck, which is capable of fixing perfectly central a wire of any size not larger than ¼-inch. Other lathes are contributed by Mr. WILLIAMS (234, p. 295), with a new tool-holder and self-acting screw cutting apparatus; by the Messrs. KNIGHT (614), who have fitted up a complete amateur-work cabinet, and by Messrs. EADES and SON (224, p. 294). Messrs. MORDAN, SAMPSON, and Co. (205, p. 291), send a new machine for tracing rose-engine patterns. M. Hamann (Prussia, 58, p. 1052) has a highly-finished amateur lathe, adapted for turning either in metal, or wood and ivory, and provided with a variety of the usual chucks and apparatus.

(14.) *Planing Machines.*

Six planing machines are to be found in the collection, amongst which, of course, those of the largest size are not sent, on account of their bulk and weight, and because their arrangements are the same as those of the medium size, of which excellent specimens are exhibited by Messrs. Sharp (204, p. 291), Parr and Co. (213, p. 292), and Messrs. Whitworth (201, pp. 287-290), the latter sending two, of which one is provided with his revolving reversing tool, which enables the machine to plane both ways. The varieties of construction by which these admirable machines are individually distinguished, although they are perfectly similar in general form and purpose, afford the most interesting studies for the engineer and mechanist. This remark may be applied with equal force to the slotting and shaping engines about to be described, and indeed to many other groups of machines in the present collection. Messrs. Whitworth also send a small planing machine (two feet six inches long) moved by a crank, arranged to give a slow cutting action and a quick return; and Mr. Shanks (210) a diminutive hand-machine for the use of opticians.

(15.) *Slotting Machines.*

Of slotting and paring machines we find one large specimen from Messrs. Sharp (204, p. 291), and two smaller ones by Messrs. Whitworth, (201, pp. 287-290). One of the latter is provided with a complex bed for sustaining the work, composed of four rectilinear slides, and one rotating disk, by means of which any form composed of a combination of excentric circular arcs, and straight lines, may be pared and finished upon the machine.

(16.) *Shaping Machines.*

The shaping machine, as it is called, is a kind of planing machine in which the tool is attached by proper slides and holders to the end of a horizontal bar, to which a reciprocating motion for cutting is communicated in the direction of its length, by a crank or excentric. The work is either fixed to a horizontal table with longitudinal and vertical adjustments, or to an arbour, and the machine is employed for shaping levers and cranks or curved and plane forms in general, and as it is susceptible of many varieties of construction and detail; the six specimens which are here exhibited by several leading engineers will be compared with great interest by mechanists. The largest is contributed by Messrs. Parr (213, p. 292), in which the tool has a stroke of twelve inches, and the bed is seven feet long; two lesser ones are sent by Messrs. Smith, Beacock, & Co. (230, p. 295), and one by Messrs. Whitworth (201, pp. 287-290). Messrs. Sharp (p. 291) exhibit one of a very neat and compact arrangement, but not possessing all the capabilities of those just mentioned, and there is also one sent by Mr. Shanks (210, p. 292).

(17.) *Drilling and Boring Machines.*

There are six drilling machines of various sizes and capabilities; amongst them Messrs. Whitworth again appear, as the exhibitors of a large radial drill, the framing of which may be selected as an admirable specimen of casting in iron. The arm of this machine is moveable through an arc of 190°. Messrs. Hick (218, pp. 292, 293) contribute a large radial drilling machine, the pillar of which is formed into a screw that allows the arm to be turned completely round, and raised to any required altitude.

Excellent self-acting vertical drilling and boring machines, with various arrangements of the table, are exhibited by Messrs. Whitworth (201), Smith & Co. (230, p. 295), Parr & Co. (213, p. 292), and Williams (234, p. 294).

(18.) *Other Machine Tools for Metals.*

The remaining specimens of machine tools may be enumerated as follows:—

Engines for wheel-cutting and dividing by Messrs. Whitworth (201, pp. 287-90), and Lewis and Sons (209, p. 292); a small machine for forming circular cutters by Messrs. Smith (230, p. 295); bolt-screwing machines by Messrs. Whitworth (201), Glasgow (219, p. 293), and Shanks (210, p. 292); a bolt-head and nut-shaping machine, with two machines for punching and shearing, by Messrs. Whitworth (201, *ut suprà*).

From the above description of engineers' tools, it will be seen that Mr. Whitworth has contributed one or more specimens of first-rate excellence under each head. In addition it is necessary to direct particular attention to his measuring machine (which, however, properly belongs to the Class of Philosophical Instruments), and to the admirable collection of apparatus, by the employment of which a uniformity of system in the dimensions and fitting of machinery, and in the sizes and arrangements of screw-threads, is rendered practicable amongst engineers in general. The confusion and delay occasioned in the repair of machinery and apparatus of all kinds by the want of such a system have long been felt; and the attention of engineers was directed to the subject by a paper communicated to the Institution of Civi Engineers in 1841, by Mr. Whitworth. His system has already obtained great extension, and he has contributed to the present Exhibition a complete set of the apparatus required to carry it out. This includes different sizes of guide-stocks, and the several dies, taps, &c., for producing the corresponding screws which he has selected as the standard forms of his system, and also sets of standard gauges, by the use of which corresponding parts of machines may be prepared separately, with sufficient accuracy to fit without trial. He also exhibits specimens of surface-plates, prepared without grinding, according to the method described in his paper (read at the meeting of the British Association in 1840).

In the American Department, Mr. Dick (79, p. 1438) exhibits a variety of powerful machines for producing pressure with small friction, by means of a peculiar combination of levers whose surfaces act by rolling contact, and which are formed into curves that enable them either to produce a constant or a varying pressure according to the nature of the machine. One of these is arranged to act as a boiler-plate shearing and punching machine. Messrs. Fairbairn and Sons (200, pp. 286, 287) contribute their important and original machine for rivetting boiler-plates by pressure; and Messrs. W. J. and J. Garforth (208, p. 292) an improved machine for the same purpose, in which the pressure is produced by the direct action of the piston rod of a steam cylinder.

The admirable steam hammer of Messrs. Nasmyth and Co. (236, p. 295) is too well known to require any lengthened notice in this place. It is only to be regretted that the nature of its operations forbids it to be put in action in the Exhibition. The effective and useful forging machine of Mr. Ryder (222, p. 294) is, however, shown in motion, its action being exhibited upon rods of lead.

In the French Department, M. Schwerber (1475, p. 1246) has placed a forging machine in which the hammer is raised and thrown up by a cam; piles of vulcanized caoutchouc are employed to diminish the shock to the cam, and also to produce a rebounding blow.

Two large coining presses are placed in the Exhibition, the one by Messrs. Maudslay, Sons, and Field (228, p. 294); the other (in the Zollverein Department), by M. Uhlhorn (476, p. 1078). In each, the screw is dispensed with, and they may be considered as examples of the best style of design and workmanship by which their respective countries are characterized.

Mr. Morrall, of Studley (240, p. 295), maintains, in action, a series of the simple apparatus employed in making needles, especially those which he terms "grooveless needles," of his own invention.

There is an abundance of small fly-presses in the building. Mr. Mansell (502, p. 305) has one with peculiar arrangements for cutting on an even surface of steel, without injuring the tools; and in the Swiss Department M. Darier (Switz., 61, p. 1270), exhibits a press with many delicate adjustments for cutting out watch-hands. The remainder of these presses are of a highly ornamental character, and intended for the library table, or shop counter, as copying-presses, or for seals, book-stamps, &c., and in this character they properly belong to "ornamental furniture," or "stationery," as their chief claim to attention consists in the beauty of their form or decoration.

In the Foreign Department we may mention a highly-finished rolling-mill, of most accurate workmanship, adapted for a mint, by M. Krupp (Prussia, 649, p. 1086); an excellent machine, for forming hooks and eyes, by M. Hue (France, 269, p. 1189); and three ingenious machines, of very similar construction, for making the nails called "points de Paris," of which one is exhibited by M. Frey (1607, p. 1254), the other two by M. Stoltz (1494, p. 1248).

Messrs. R. Johnson and Brothers, of Manchester (212, p. 292), have placed in the collection a wire-drawing bench of the best construction, being the only machine for this purpose that has been forwarded.

Mr. Felix Abate exhibits in Class XXII., (265, p. 623) some machines intended for planing, polishing, burnishing, and ornamenting sheets, bars, tubes, &c., of metal.

Messrs. Vine and Ashmead contribute, from America (196, p. 1449), a gold-beating machine.

Messrs. Stewart and Co. (238, p. 295) exhibit a model of their machine for forming the moulds in which iron pipes are cast. Several excellent specimens of large pipes, that accompany the model, show the perfection which the machine imparts to the mould, and the machine itself would have been sent, but it was found to be too large for the building.

An elaborate machine, for making and charging percussion caps, is exhibited in the Department of the Netherlands, by Mr. Goossens (77, p. 1116). This machine, which is worked by two men and three children, does the work (according to the inventor's statement) of twelve machines and twenty-five men required in the system commonly employed.

(19.) *Machines for Working in Wood (excepting Lathes.)*

From the above sketch it will be seen that the Exhibition presents a tolerably fair picture of the present style of English engineer tool-making for metal-work, and that very few specimens have been sent either from the Continent or from America. When we turn to the machines for working in wood the case is altered. It certainly cannot be said that such machines are not employed in England; for, from the period of setting up the Portsmouth block-machinery, such contrivances have been gradually making their way into English practice, and our saw-mills, dockyards, and similar establishments, abound with mechanism for sawing, veneering, planing, grooving, mortising, tonguing, cutting mouldings, cask-making, carving, and every branch of wood-work: but, from some cause or other, probably the magnitude or roughness of such mechanism, and the noise, chips, and dust it creates, only a few models have found their way into the English Department of the Exhibition; nevertheless, the wood-work of the very building in which they are contained was itself almost entirely wrought into form by such machines. In America, however, machinery for working in wood is even more largely employed than with us, and their machines find their way into workshops of a smaller character. The much greater value of manual labour in that country is shown by the fact, that as little work as possible is done by hand, and that more attention is paid to economy of time and labour, and to the production of rapid results with the least possible expenditure, than to great durability and finish. Where so many natural obstacles are to be contended against by a scattered population, we must not look so much for elegance of workmanship as for boldness of design. These remarks are illustrated by a series of machines for working in wood, which, although exhibited in operation by the English importer and patentee, Mr. Furness, of Liverpool (401, p. 298), are of American origin, and some of them are well known to have been largely employed there for ten years or more. The style of framing and designing these machines will at once betray their Transatlantic origin, and exhibits great ingenuity, simplicity, and fitness for the purpose. They are principally framed of wood, not only for cheapness, but because iron frames are liable to bruise the highly-finished wood-work which the machines are intended to produce. This series comprises a most effective foot-mortising machine; a tenoning machine, to be worked by hand or power; and power-machines for mortising, planing, moulding, and sash-making. Mr. Woodbury, of the United States (443, pp. 1463, 1464), exhibits a powerful machine for wood-planing, tonguing, and grooving rough boards of 2 feet, or less, in width. The boards are driven under a series of eight fixed cutters or plane-irons, each cutting in succession, and may be planed at the rate of 90 feet per minute. A working model of an effective machine for dressing the staves of casks, patented by Messrs. Wells and Thompson, of America, was placed among the English machines in motion, after the dispersion of the Jury.

In the French Department, Mr. Sautreuil (1574, p. 1246) contributes a powerful planing and moulding machine, in which revolving cutters are employed, with some important improvements in their form and mode of action.

In the English Department, Mr. Birch (406, p. 299), exhibits a model of the machine by which the sash-bars of the Exhibition building were entirely formed at a single operation, as described in the Illustrated Catalogue; and Mr. Barker (417, p. 201) shows models of his machinery for curvilinear sawing of ship timbers (patented in 1845). An American machine, for the same purpose, by Mr. Cochran (patented in 1847), is also exhibited in model (United States, 297, p. 1453). Messrs. Prosser and Hadley (456, p. 304) have a large and well-made buhl sawing machine, capable of executing pierced work for furniture on a large scale; and Mr. Coats (25, p. 271) a machine for the rapid manufacture of bobbins. In the Belgian Department (472, p. 1166) Mr. Wynants exhibits a small machine for carving in wood. Although not placed in our department, we may be permitted to mention Mr. Burrel's apparatus (Class IX., 37), by which a framed hurdle may be completely constructed by one man in twelve minutes.

(20). *Working in Stone, Coal, Clay, Leather, &c.*

Stone.—Mr. Hunter (312, p. 297) exhibits a model of his well-known stone-planing machine, which has been so long and effectually employed in Scotland and elsewhere. Messrs. Randell and Saunders (324) have sent several models of stone-sawing machines, which they have in operation in quarries at Corsham, near Bath: one of them is employed for cutting the stone from its natural rock in the quarry itself. It works eight saws, 24 feet long in the original.

A machine for dressing or shaping stone, by Mr. Eastman, of the United States (460, p. 1464), is exhibited, in action, amongst the English machinery in motion. In this engine, rolling cutters of chilled cast iron are employed, which crush and rapidly wear away, in the form of scales and dust, the granite, sandstone, marble, millstone, or other material which is subjected to their action. Mr. Cochran, United States (297, p. 1453), also exhibits a model of a machine for stone planing.

Coal.—Two machines, with revolving cutter-wheels, intended for cutting coal, are shown by Mr. Waring (305, p. 295), one to cut in vertical planes, the other in a horizontal plane.

Glass.—Messrs. Claudet and Houghton (306, p. 295) exhibit two neat contrivances for cutting and trimming glass shades to any required height.

Leather.—In the French Department Messrs. Dumery (487, p. 1201) exhibit a collection of specimens of boots and shoes in which screws are employed in lieu of stitches, and some of the machines which they use for blocking boots, cutting-out soles, &c. These machines, however, are not completely fitted up.

In the English section Mr. Mansell (502, p. 305) has a boot-blocking machine; and Mr. Wait (504, p. 305) a kind of printing machine, intended to print the outlines of the parts of shoes or boots upon cloth or leather, as a guide to the cutter-out.

M. Senechal, France (373, p. 1194), has a press for cutting-out gloves.

Clay.—The Exhibition contains twelve or fourteen brick and tile machines of various kinds, most of which have been placed in the "Agricultural Department," which is their proper location—agricultural gentlemen being usually qualified by practice and experience to judge of the performance of such machines. Of the few that have accidentally found their way into Class VI. we may mention Mr. Beart's machines for making hollow bricks (301, p. 295), and a machine of Messrs. Randell and Saunders (324, p. 297), in which the clay is forced through the mould by the continuous action of two revolving spirals instead of the usual reciprocating piston.

In the French Department, Messrs. Borie Brothers (417, p. 1198) exhibit an excellent machine for making hollow bricks, in which the plugs of the mould are supported with great skill, in such a manner as to obviate the splitting of the bricks, which, in the common construction, is apt to result from the position of the bridges by which the plugs are carried.

(F.) Grinding and Cleaning Flour and other Vegetable Products.

(21.) *Mills for Grinding.*

In the first place we may direct attention to the stones, steel, and iron plates, &c., by which the grain or other material is to be crushed; many specimens of these are exhibited, detached from the machinery by which they must be maintained in motion when used.

Messrs. Toms and Co. (457, p. 304) exhibit French millstones made at La Ferté-sous-Jouarre, and fitted with Hanon-valck's patent aërator, for introducing fresh air between the stones.

Messrs. Hughes and Sons (459, p. 304) have also a pair of stones with channels for the introduction of air, and Mr. Clayton (440) a pair of French stones.

Mr. Hurwood (414, p. 301) specimens of grinding plates in steel and cast iron formed in concentric rings.

In the French section, burr-stones of different sorts and qualities are exhibited by Gaillard, Son (226, p. 1187), Petit and Co. (345, p. 1194), Bouchon (431, p. 1199), Guevin-Bouchon and Co. (532, p. 1204), Montcharmont (650, p. 1209), Roger (1448, p. 1245) Thibault Boilesve (1502, p. 1248), Touaillon (1508, p. 1248); and in the Zollverein section, M. Landau (321, p. 1069), stones of lava quarried near the Moselle.

Mills, fitted up for grinding grain, ores, &c., are shown under the following numbers:—Messrs. Fairbairn (405, p. 298) a corn-mill on a cast-iron frame with gearing: showing their improvements in the modes of driving, adjusting, and feeding the mill-stones.

Messrs. Corcoran and Co. (416, p. 301) a portable corn-mill with French burr-stones, intended for the use of emigrants; and Messrs. Tootal (446) a small hand-mill.

Mr. Bouchon (France, 431, p. 1199) also exhibits a small mill complete with bolting machine, for emigrants.

Messrs. Westrup and Co. (442, p. 303) a mill of a peculiar and compact arrangement, consisting of two pairs of conical stones, one above the other, but attached to the same spindle; between them is a conical wire sieve, with brushes fixed to the spindle, by which the fine flour detached by the upper stones is separated from the grain before the coarser parts fall to the lower stones.

In the American section, Mr. Ross (213, p. 1450), a model of a portable mill.

Messrs. Mesnier and Cartier (France, 635, p. 1208) exhibit a small portable mill complete, in which the lower stone is the runner, and there is an arrangement for the introduction of atmospheric air between the stones.

In the Belgian section M. Houyet (125, p. 1155), and M. Debeaune (131, p. 1155), exhibit each a model of a small mill, with a ventilator to drive atmospheric air between the grinding surfaces.

A little machine to enable a workman to cut and sharpen mill-stones with great precision, and without danger to his eyes from chips, is exhibited in the English section by Mr. Parsons (Class V. 642, p. 247); and in the French section a similar contrivance by M. Touaillon (1508, p. 1248).

Mr. Crosskill (404, pp. 298, 299), Mr. Hurwood (414, p. 301), and Messrs. S. and C. Adams (429, p. 302) have exhibited a variety of mills fitted with metal plates for grinding wheat and other vegetable substances, bones, minerals, &c.

Coffee-mills are shown by W. Muir (206, pp. 291, 292), Fieldhouse and Co. (443, p. 303), Savage (458, p. 304), and Vandenbroucke (France, 711, p. 1230). A handsome silver apparatus for roasting coffee is exhibited by Messrs. Dakin and Co. (408, pp. 299, 300).

In the French section M. Hermann (873, p. 1221) has fitted up a complete and admirable set of machines largely employed for the manufacture of chocolate, by which the cocoa beans are crushed after being roasted, mixed with sugar, and the chocolate fully prepared for use. Also an apparatus for mixing and grinding greasy matters for perfumes, soaps, &c. A mixing machine for chocolate is also exhibited by Messrs. Gatti and Bolla (450, p. 303); and a set of excellent machinery for crushing and grinding potatoes, and for making potato flour by a cylinder with saw blades, by M. Huck (France, 541, p. 1204).

(22). *Machines for Cleaning and Separating the Products.*

We will now proceed to enumerate the machines for cleaning grain and separating the finer particles from the coarser after grinding, for which a variety of arrangements are shown, differing in the position of the revolving sieves, in the material and disposition of the brushes and beaters, and in other particulars.

Mr. Hunt (422, p. 301), vertical flour-dressing machine, with hair brushes.

Mr. Bedford (426, p. 302), inclined wire cylinder, with external revolving hair brushes.

Mr. Blackmore (428, p. 302), model of a bolting machine, having cloths without seams and revolving gutta percha flaps outside for cleaning the cloth.

Mr. Spiller (436, p. 302), flour-dressing machine; Mr. Shore (438, p. 302), flour-dressing machine, with cylindrical wire sieves, having revolving wings inside, with steel plates in lieu of brushes; Messrs. Coombe and Co. (444, p. 303), models of inclined and vertical cleaning and dressing machines; Mr. Weatherley (441, p. 302), a small machine for cleaning currants, with whalebone brushes; Messrs. B. and E. Millington (462, p. 305), a cleaning, or smut machine, with revolving wire brushes; Messrs. R. and J. Rankin (466, p. 305), a vertical smut machine, having an exhauster above to remove the dust; and, finally, Mr. Ashby (470, p. 305), an upright flour-dressing machine.

In the French section, machines are exhibited by M. Huck (541, p. 1204), for extracting and separating flour from ground potatoes; Messrs. Vachon and Co. (705, p. 1212), for cleaning grain; and M. Hennecart (1266, p. 1237), for bolting flour,—having a silk cover, and accompanied by various excellent specimens of silk gauze for bolting.

In the Belgian section we find machines for cleaning and glazing rice, by M. Houyet (125, p. 1155); and a cylindrical machine for cleaning grain, by M. Danneau (507, p. 1167).

Under the present head may be mentioned a set of effective machines by Messrs. Barrett and Co., of Reading (410, p. 301), for manufacturing biscuits. In the French section an elegant machine for kneading dough by means of a revolving spiral, by M. Boland (428, p. 1199). A model of a machine for making biscuits, termed "Critcherson's cracker machine," was placed in the American Department after the Jury had concluded their labours.

Other machines, for similar purposes with the above, are placed in the class of Agricultural Implements, and have therefore not been submitted to our inspection. Indeed, it may fairly be questioned whether the greater part of those already enumerated might not have been also placed in Class IX. with advantage.

(G). Manufacture of Sugar.

The sugar-cane mill of Messrs. Robinsons and Russell (418, p. 301), a magnificent specimen of mill-work on the largest scale, with horizontal cylinders, is shown in partial action. Messrs. Collinge and Co. (432, p. 302) also exhibit a horizontal sugar mill, and Messrs. Graham, West and Co. (445, p. 303) several beautifully constructed models of different forms of sugar mills, &c.

Three superb sets of vacuum apparatus, for the manufacture of sugar, are exhibited; each from a different country, and each remarkable for magnitude, perfection of workmanship, and excellence of arrangement, as well as for peculiarities characteristic of the nations that have produced them. The English machine of Messrs. Pontifex and Wood (602, p. 305) is of great manufacturing power; and its enormous dome, formed from a single piece of copper, is a very wonderful specimen of the coppersmith's art. The French machine, by Messrs. Cail and Co. (1557, p. 1251), is similar in its general form and magnitude, of admirable workmanship, and considered by French practical chemists to be even superior in its arrangements to that of Messrs. Pontifex. The machine of M. Heckmann (Prussia, 52, p. 1050, and see 'Illustrated' 1051), although not equal in magnitude, nor perhaps in workmanship, to the two already mentioned, must be regarded as a contribution of first-rate merit.

The hydro-extractor or revolving machine, by which water is driven out of goods by centrifugal force, was invented by Mr. Seyrig many years since, and its great merit, utility, and economy, have been the means of extending it throughout the manufacturing world. Its application to the separation of sugar from molasses was the subsequent suggestion of another party. Several specimens of this engine are exhibited, of various degrees of merit, of which we may mention those of the original inventors and proprietors, Messrs. Manlove, Alliott, and Seyrig (454, pp. 303, 304); a well-made machine by Mr. Bessemer (400, pp. 297, 298); and one by Messrs. Rotch and Finzel (405, p. 299). In the French Department, one by Messrs. Bezault and Co. (425, p. 1199); and in the Belgian, one by Mr. Vangoethem (124, p. 1155).

(H). Apparatus for Brewing, Distilling, and Manufacturing Chemistry.

Mr. Lawrence's distributor (604, p. 305) has the advantage of an equal distribution of heat throughout the wash, either by steam or water, and facility of cleansing the false bottom. He also exhibits a good refrigerator and a store cask, for preserving beer in store, and preventing accidents in bursting. Mr. Tizzard (630, p. 307) has a model of a brewery, exhibiting several novel and useful arrangements of the backs, mash tun, refrigerator, fermenting and cleansing tuns, and employing steam for heating the liquor back, &c. Mr. Wheeler's refrigerator, exhibited by Mr. Hulls (618, p. 307), is said to be very rapid in its action. Refrigerators are also sent by Messrs. Askew (611, p. 307), Coffey (615, p. 307), and Thomson, Younger and Co. (623, p. 307).

Carbonating or aërating machines, for making soda water, Seltzer water, &c., are exhibited by Messrs. Coxe (608, p. 307), in which pumps may be employed to exhaust the atmospheric air from the water, previously to carbonizing it, or to force the carbonic gas into the water, when so deprived of the common air. Other machines are exhibited by Messrs. Tyler and Co. (605, p. 306), and by Messrs. Cooper and Bursill (624, p. 307).

Of apparatus for other chemical manufactures we may direct particular attention to Bourra's colour extractor, (610, p. 307); Dawson's new distillers' and rectifiers' recording close safe (612, p. 307), for the Excise; Halliday's apparatus for the manufacture of pyroligneous acid (617, p. 307); and Hill, Evan, and Co's. patent vinegar apparatus (619, p. 307).

As partly connected with the above subjects may be mentioned J. and T. Masterman's apparatus for corking bottles (621, p. 307); and in the French Department (651, p. 1209), a machine for the same purpose, by the Marquis Alfred de Montebello.

AWARDS, CLASS VI.

THE COUNCIL MEDAL.

Nation.	Number in Catalogue.	Names of Exhibitors.	Objects Rewarded.
United Kingdom	82	Barlow, A.	Double-action Jacquard Loom.
France	1557	Cail and Co.	Vacuum Sugar Apparatus.
United Kingdom	40	Donisthorpe, G. E.	Wool-combing Machinery.
United Kingdom	130	Donkin, B., and Co.	Paper-making Machinery.
United States	79	Dick, D.	Antifriction Engineers' Tools and Presses
United Kingdom	200 & 403	Fairbairn, W., and Sons	Rivetting Machine and Corn Mill.
France	873	Hermann, G.	Chocolate-making Machinery.
United Kingdom	218	Hick, B., and Son	Mill Gearing, Radial Drill Mandrils, and Portable Forges.
Prussia	52	Heckmann, C.	Vacuum Sugar Apparatus.
United Kingdom	1	Hibbert, Platt, and Sons	Cotton Machinery.
Prussia	649	Krupp, F.	Flatting Rollers (Awarded also by Class I.)
United Kingdom	75	Lawson, S., and Sons	Flax Machinery.
United Kingdom	10 & 46	Mason, J.	Cotton and Woollen Machinery.
United Kingdom	228	Maudslay, Sons, and Field	Coining Press.
France	632	Mercier, A. and Co.	Woollen Machinery.
United Kingdom	236	Nasmyth, J.	Steam Hammer.
United Kingdom	77	Parker, C. E., and Co.	Sailcloth Power Loom.
United Kingdom	602	Pontifex and Wood	Vacuum Sugar Apparatus.
United Kingdom	85	Reed, T. S., and Co.	Fringe Power Loom.
France	1438	Risler, G. A.	Epurateur for Cotton.
United Kingdom	204	Sharp Brothers and Co.	Engineers' Machine Tools, and Throstle.
Prussia	476	Uhlhorn, H.	Coining Press.
United Kingdom	201	Whitworth, J., and Co.	Engineers' Machine Tools, Measuring Machine, Knitting Machine, &c.

THE PRIZE MEDAL.

Nation.	Number in Catalogue.	Names of Exhibitors.	Objects Rewarded.
France	399	Acklin	Jacquard, employing paper instead of cards.
United Kingdom	448	Adorno, J. N.	Cigarette Machine.
United Kingdom	90	Ball, Dunnicliff, and Co.	Warp Lace Machine.
United Kingdom	48	Berry, B. and Sons	Various Machinery for manufacturing Worsted.
France	422	Berthelot, N.	Circular Hosiery Frames.
United Kingdom	400	Bessemer, H.	Centrifugal Machine for separating Molasses.
United Kingdom	406	Birch, J.	Machine for cutting Sash-bars.
United Kingdom	94	Birkin, R.	Bobbin-net Lace Machine, with Jacquard.
United Kingdom	138	Black, J.	Folding Machine.
United States	551	Blodget, S. C.	Sewing Machine.
France	428	Boland, A.	Kneading Machine.
Prussia	53	Bonardel Brothers	Jacquard, and Punching Machine for Jacquard Cards.
France	417	Borie Brothers	Brickmaking Machine for Hollow Bricks.
France	15	Baranowski, J. J.	Machine for Printing and Numbering Tickets.
United Kingdom	144	Brewer, C. and W.	Rollers of Wire Cloth for Paper-makers.
United Kingdom	27	Calvert, F. A.	Wool-burring and Cotton-cleaning Machines and Cylinders.
United Kingdom	135	Church and Goddard	Machine for Cutting Cardboards, and Printing and Preparing Railway Tickets.
United Kingdom	86	Claussen, P.	Circular Hand-loom for Hosiery.
United Kingdom	78	Crawhall, J.	Machine for manufacturing Ropes.
United Kingdom	35	Crichton, D.	New Taking-up Motion for a Loom.
Tuscany	59	Cuyere, Mrs.	Weavers' Reeds.
United Kingdom	80	Davenport, J. L.	Various Machines for manufacturing Silk.
United Kingdom	226	Dalgety, A.	Small Lathe, with Self-adjusting Chuck.
United Kingdom	45	De Bergue, C.	Reeds made by Machinery.
United Kingdom	76	De la Rue and Co. (Class XVII.)	Machine for folding and gumming Envelopes.
France	491	Dandoy-Mailliard, Lucq., and Co.	Rollers for Spinning Machinery.
Switzerland	61	Darier, H.	Press for cutting-out Watch Hands.
France	823	Dorey, J. F.	Machine for weaving improved Healds.
United States	456	Earle, T. K., and Co.	Card Clothing.
France	1607	Frey, jun.	Machine for making nails.
United Kingdom	84	Frost, J.	Improved silk Machinery.
United Kingdom	401	Furness, W.	Machines for working in wood.
Austria	109	Gambe, P., the Heirs of	Jacquard Cylinder.
United Kingdom	208	Garforth, W. J. and J.	Steam Rivetting Machine.
Prussia	58	Hamann, A.	Turning Lathe.
United Kingdom	102	Harding, Pullein, and Johnson	Machinery for making Printing Type.
France	864	Harding-Cocker	Heckles
United States	386	Hayden, W.	Drawing Regulator for Cotton.
United Kingdom	14	Higgins and Sons	Cotton Machinery, and Long Line Flax Machinery.
United Kingdom	232	Holtzapffel and Co.	Amateur Foot Lathe, with various Apparatus and Tools.
United Kingdom	20	Hornby and Kenworthy	Sizing and Dressing Machine, and Self-acting Backing-off Motion to a Warping Machine.
France	541	Huck	Apparatus for grinding and preparing Potatoes, &c.
France	269	Hue, J. B.	Press for Bending and Cutting Hooks and Eyes.
United Kingdom	122	Ingram, H.	Applegath's Vertical Printing Machine.
France	546	Jacquin, J. J.	Circular Hosiery Frames.
United Kingdom	212	Johnson, R., and Brothers	Wire-drawing Benches.
United Kingdom	52	Judkins, C. T.	Heald Machine, and improved Heald.
United Kingdom	21	Kenworthy and Bullough	Stopping Motions to a Power Loom.
United Kingdom	604	Lawrence, J. sen.	Refrigerator, Store Cask, &c.
France	283	Lacroix and Son	Fulling Machine for Cloth.
Prussia	55	Leonhardt, J. E.	Type-founding Machine.
United Kingdom	209	Lewis, F., and Sons	Wheel-cutting Engine and Roving Spindle.
United States	447	Lowell Machine Shop	Self-acting Lathe and Power Loom.
United Kingdom	454	Manlove, Alliott, and Seyrig	Centrifugal Washing and Drying Machine.
United Kingdom	206	Muir, W.	Small Lathe and various Tools.
France	330	Mareschal, J.	Machine for Mincing Meat.
France	645	Miroude Brothers	Card Clothing.
United States	460	Morey, C.	Eastman's Stone-cutting Machines.
France	664	Nicolas, P.	Machine for Engraving Cylinders.
United Kingdom	158	Napier and Son	Letter-press Printing Machinery.
United Kingdom	40	Perry, John	Wool-comb.
United Kingdom	5	Preston, F.	Spindles and Flyers.
United Kingdom	456	Prosser and Hadley	Ornamental Sawing Machine.
United Kingdom	74	Plummer, R.	Scutching, Heckling, and other Flax Machines.
United Kingdom	6	Parr, Curtis, and Madeley	Various Machines for Carding and Spinning Cotton; Three Self-acting Mules; also various Engineers' Machine Tools.
United Kingdom	128	Remond, A.	Machine for folding and gumming Envelopes.
United Kingdom	640	Ransomes and May (Class V.)	Leggatt's Queen Printing Press.
United Kingdom	418	Robinsons and Russell	Steam Sugar-cane Mill.
France	1454	Roswag, A., and Son	Wire-cloth for Paper-Makers.
United Kingdom	222	Ryder, W.	Forging Machine.
France	1474	Sautreuil, jun.	Machine for Planing and Moulding Wood.
France	1475	Schwerber, J.	Forging Machine.
France	1601	Schneider and Legrand	Shearing Machine.
France	1605	Scrive Brothers	Card Clothing.

THE PRIZE MEDAL—*continued.*

Nation.	Number in Catalogue.	Names of Exhibitors.	Objects Rewarded.
United Kingdom	22	Smith, M.	Various Power Looms.
United Kingdom	220	Shepherd, Hill, and Spink	Self-acting Slide-lathe.
United Kingdom	230	Smith, Beacock, and Tannett	Self-acting Slide-lathe, Drilling and Planing Machines.
Belgium	134	Société du Phœnix	Soft Bobbin Frame.
France	1021	Stamin and Co.	Spinning Frame.
United Kingdom	238	Stewart, D. Y., and Co.	Mould-making Machine for Cast-Iron Pipes.
United States	88	Star, C.	Bookbinding Machine.
United Kingdom	51	Taylor, J.	Heckles.
United Kingdom	136	Taylor, W.	Machine for forming Hemispherical Paper Shades from flat discs of Paper.
Prussia	57	Thomas, H.	Shearing Machine.
United Kingdom	630	Tizard, W. L.	Model of Brewery.
France	1508	Touaillon, C.	Dressing Machine for Millstones.
Belgium	128	Troupin Brothers	Shearing Finishing Machine.
France	717	Varrall, Middleton, and Elwell.	Machinery for manufacturing Paper.
United Kingdom	442	Westrup, W. and Co.	Corn Mill.
United Kingdom	112	Wilson, G.	Paper and Mill-board Cutting Machines.
United States	443	Woodbury, J. P.	Wood-planing, Tonguing, and Grooving Machine.

R. WILLIS, REPORTER.

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CLASS VII.

CIVIL ENGINEERING, ARCHITECTURE, AND BUILDING CONTRIVANCES.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

I. K. BRUNEL, F.R.S., *Chairman and Reporter*, Duke Street, Westminster; Civil Engineer.
CHARLES COMBES, *Deputy Chairman*, France; Member of Institute and of Central Jury.
Dr. NEIL ARNOTT, F.R.S., Bedford Square; Doctor of Medicine.
F. W. CONRAD, Holland; Engineer, Chairman of Royal Institute of Engineers at Delft.
J. M. RENDEL, F.R.S., 8 Great George Street, Westminster; Civil Engineer.
Count A. E. DE ROSEN, Sweden and Norway; Swedish Royal Navy.
Dr. J. V. C. SMITH, United States; Doctor of Medicine.
WILLIAM TITE, F.R.S., 17 St. Helen's Place, Bishopsgate; Architect.

THE works of the civil engineer and architect embrace, generally, combinations of many branches of the science of mechanics, as well as the proper application of raw materials to the various purposes of construction; and architecture, especially, includes, besides these, design in sculpture, modelling, and colour. When each of these different branches of science and of art is classed under a separate head, and the objects which illustrate any of them are removed to their separate classes, there can remain but little belonging exclusively to architecture or civil engineering. As might have been anticipated, therefore, the objects comprised in the Official Catalogue under Class VII. are not numerous, and generally speaking, are not important, although the classification of "Building Contrivances," under this head, has admitted a very great variety, including many details of construction, of every degree of importance, from the bolt of a garden-gate, and the apparatus for sweeping of chimneys, to the construction of lighthouses and the means of moving large ships.

Another circumstance has tended, also, very much to limit the extent and the importance of the contributions to this class. The works of the architect and engineer can, generally speaking, be exhibited only by drawings or models, and consequently, with few exceptions, it is the model, and not the work it represents, which has been brought before us; and the modeller, more frequently than the architect or engineer, is the exhibitor. From these causes the labours of the Jury have been comparatively light, and might have been somewhat devoid of interest but for the circumstance of two remarkable objects, one of them not included in the Catalogue, having been brought under their consideration subsequent to the commencement of their proceedings, viz., the great building in which the Exhibition is placed, and the model dwelling-houses (pp. 111, 112) which are erected near it. With respect to the first, it has been so pre-eminently successful in every respect, and by universal consent reflects such credit upon all concerned in its design and in its execution, that it is left to this Jury only to be the formal agents of recommending to the Council the awarding of the highest prize, the Council Medal, to Mr. JOSEPH PAXTON, who originated the design, and to Messrs. FOX, HENDERSON, and Co., who most ably carried it into execution.

As regards Mr. Paxton's claim, amidst the competition of the whole of Europe, he proposed that mode and form of construction of building which appeared on first sight, and which has since proved to be, the best adapted in every respect for the purpose for which it was intended. The design possessed this peculiar merit of fitness for its object in a singular degree—there was no startling novelty in any one point which could lead astray the judgment of those who had to determine upon the choice of plan, or which could in the first instance obtain, still less permanently secure, the good opinion of the public. As regards the form of outline, which is most simple, several designs nearly resembling it had been submitted in the general competition. As to the materials, several proposals had been previously made to cover the whole area to be inclosed with glass, and iron would, of necessity, be employed for the framing. But in the combination of form and materials, in the particular mode of applying those materials, and in the adaptation of the forms to be selected to their convenient use, as well as in the various details by which the whole was rendered perfect, the design was entirely distinct in character from all that had been proposed, and appeared at once to have the one single merit of being exactly that which was required for the purposes in view. The design, as realized, has completely fulfilled every condition of utility. It has equally proved to be capable, by simple but judicious decoration, for which we are indebted to Mr. Owen Jones, of being rendered most elegant and brilliant in effect; and although very novel in its construction, it has been found, from the ingenuity and mechanical fitness with which all the details have been carried into execution, to be susceptible of rapid and moderately economical construction.

To Mr. Joseph Paxton, to whom the merit of this design is due, the Jury have recommended, and the Council have adopted the recommendation, the award of the Council Medal.

By a fortunate coincidence the execution of the design thus ably conceived was undertaken by parties peculiarly well fitted to do it justice. Considerable experience and skill were required in every detail of mechanical construction, great method in carrying out to the fullest extent a system of repetition of similar parts, and strict habits of business and of order, for organizing a system by which vast quantities of materials or of manufactured parts could be obtained with certainty from several quarters, and large bodies of workmen kept regularly employed in the rapid application of these materials and the putting together of the parts. There was also required a command of an extensive establishment, and of a staff of able assistants and superintendents. All these requisites and conditions were necessary, and in a high degree, for the purposes of rapidly determining upon all the details of construction, preparing all the working drawings, insuring the construction of the numerous parts in large quantities, and ready to be fixed with perfect accuracy in their several places; and lastly, in executing without any delay or accident, resulting from miscalculation or error of construction, or defective arrangements, a work of unusual magnitude in an unusually short space of time. All these conditions and qualifications for success, and in the requisite degree, were found combined in the persons and in the establishment of the contractors, Messrs. Fox, Henderson, and Co. To them accordingly the Jury also recommended a Council Medal.

Strongly contrasted with this building in its magnitude and in every one of its principal features, and in all its ostensible objects and uses, stands the Model Dwelling-house. But though contrasting in pretension, it is in importance second neither to the building itself, or to anything within the Exhibition. And in respect to the number of those whom it seeks to benefit, and the extent to which their physical and moral condition may be ameliorated, and the amount of additional comfort and happiness to be created by the simple means thus suggested of improving the dwelling of the working man, no object in the Exhibition yields to it in value, or suggests more weighty considerations for the political economist and the philanthropist.

To place within the reach of all a large proportion of those comforts most conducive to health, to habits of cleanliness and decency, which have hitherto been enjoyed as luxuries only by the few; to remove that painful necessity under which the poor man now labours of submitting to privations and inconveniences, which are destructive of moral habits and utterly inconsistent with domestic comfort, and to place at his command a certain degree almost of luxury, which tends to refine the mind, and substitutes a comfortable home for a miserable and barely efficient shelter from the elements, is the ambitious but wise and benevolent design of those who, with the example and under the leadership of His Royal Highness Prince Albert, have of late actively promoted the improvement of the dwellings of the working classes.

Separate dwellings for a few families, and many large lodging-houses have been built at the expense of private associations and individuals, as specimens of what is desirable, and examples of what may be done. These examples have already produced a marked effect upon the demands of the tenant, and upon those who have to supply the demand. But in order to secure permanently and sufficiently these benefits to the million, for whom they are intended, they must be provided at a price which the occupier can afford to pay, and which shall at the same time induce the builder to erect the houses. This has been the principal difficulty, and one which Mr. Roberts, the architect, who designed the houses now under consideration, has long laboured to overcome. The present example has been erected under the direction and at the expense of His Royal Highness, and contains all the latest improvements of general arrangement, material, and workmanship. It is fair to assume that in a new branch of industry such as this, great improvements may be made; and if so, we may hope in a very short time that the houses of the labouring classes may excel in cleanliness, equality of temperature, and perfect ventilation, the best houses now constructed for the wealthier classes.

In the houses exhibited, accommodation is afforded for a sufficient number of separate sleeping-rooms for average families. By the use of hollow bricks the walls are made to be less perfect conductors of heat and sound; and the rooms are more economically heated, and are rendered more equable in temperature. By the use of brick and stucco floors, and glazed bricks in the side walls, the whole building is rendered fire-proof, and the walls and floors cannot harbour insects, and may be kept perfectly clean at the smallest possible expenditure of time and trouble. The hollow bricks are used for air-passages in the cornices and around the upper part of the room and communicating with the chimney, in the manner practised by Dr. Arnott, and thus excellent ventilation is easily obtained. A supply of water is provided upon each floor; and the whole is stated to have been constructed at an expense which allows a set of rooms, capable of affording a really comfortable home, being let at as low a rate as is now paid for the wretched lodgings from which the poor man escapes to the street or the public-house, and to which he cannot return without disgust.

It is difficult to over-estimate the magnitude and importance of the effects of such a change upon the population of the country, whether as adding to their individual happiness, or improving their physical and moral condition, and thus rendering them more valuable and useful members of society.

The Jury have unanimously recommended to the Council that they should award the Medal reserved to their gift to His Royal Highness Prince Albert, as the exhibitor of this most useful and interesting contribution to the Exhibition, and to whom the nation at large is so deeply indebted for the promotion of this important subject.

The views of the Jury upon the merits of the two important objects for which they have recommended the Council Medal, have been stated at some length; but it will be desirable, in order to avoid any invidious distinction, to refer more generally and less in detail to those contributions for which, after the approval of the Council, it is proposed to award the Prize Medal. The order in which they will be mentioned must not be considered as indicating an attempt to classify them according to their respective merits, but as resulting from a pre-arranged classification, according to the circumstances under which the objects might be supposed to be sent. Thus models of works executed, and which were contributed by the designer and executor, and as explanatory of the design, and not as a specimen of workmanship in the model, are classed before models contributed by the modeller or by others than the authors of the works, or which are distinguished principally by perfection in the art of modelling, and both as connected more or less directly with the construction of important works in architecture and civil engineering, have been mentioned before amongst "Building Contrivances."

Amongst the limited number of models of works successfully executed, contributed by the authors of the original works, and explanatory of their designs, that which happens to fulfil most completely all the conditions of the proposed classification, is one which also well deserves mention for its merit. It is the model of the dome of the Observatory of Paris, constructed by M. P. L. Travers, of Paris (1044, p. 1228). The difficulties to be overcome in this work were serious. It was desired to establish on the top of an existing cylindrical wall of masonry, of about 40 feet in diameter, and having no sufficiently solid central support, a steady centre for an equatorial of large dimensions, and a revolving floor and dome of the diameter above stated, the motion of which should not affect the steadiness of the instrument. Mr. Travers has for this purpose fixed the instrument upon a small central floor, resting on a conical framework of strong iron ribs radiating from the centre and fixed into the inner surface of the cylindrical wall: a second series of radiating ribs also fixed to the wall and placed intermediately to the former, carries a ring concentric to the small floor, and which serves as the centre of motion for the revolving floor and building. The building, with its dome and floor 40 feet in diameter, and weighing about 40 tons, revolves round the central guiding circle before mentioned, and upon a series of rollers working upon a ring bedded upon the wall. The attempt was a bold one: the design shows sound mechanical knowledge and skill in construction: the model illustrates the design clearly, and the result of the attempt is said to have been eminently successful.

Mr. Travers (p. 1228) also exhibits a model of an excellent iron roof of 120 feet span, constructed by him for the Custom-house, Paris.

Captain Sir Samuel Brown, R.N. (No. 334, pp. 331, 332), exhibits models of slips for hauling-up ships, as designed by himself, and which have for many years been successfully employed; also numerous models of works which he has executed, and of projects for various contrivances connected with the construction and moving of ships.

Messrs. S. and H. Morton (24, p. 311), have exhibited a model of the patent slip which has so long borne their name.

Of the models exhibited under circumstances approaching nearest to the condition above named, are the models of railway drawbridges, constructed upon the Dutch railways, and sent by the Railway Company, by whose engineer they were designed and executed, and—

The model of the Britannia Bridge, contributed by Mr. E. Clarke (107, p. 321), a gentleman engaged in its construction, and whose name is closely identified with the work as the principal assistant to whom the investigation of many of the scientific questions involved in its construction, and the superintendence of the work, were intrusted. Of the first named, the works have been executed some years, and have well answered the purposes for which they were intended. The peculiar mode of opening the bridges is well worthy the study of the engineer, and the application of the principles on which they are constructed may prove highly useful. The models are perfectly well made. Of the Britannia Bridge it is unnecessary to do more than to name it. It is universally recognised as one of the finest works of the age; but the object here exhibited can be considered only as a model of the work, and is classed accordingly. In workmanship it manifests the perfection of the art of modelling, and reflects great credit upon Mr. J. James, who is stated in the Catalogue to have executed it.

Under very similar circumstances may be classed an excellently executed model of that great work, the Plymouth breakwater, contributed by Mr. W. Stuart (28, pp. 311, 312), who has personally superintended the execution of the whole of these works, from the commencement in 1810.

To the exhibitors of the two models adjoining that of the Britannia Bridge, Medals have also been awarded. That of the Kief Suspension Bridge is contributed by the engineer, Mr. C. Vignoles (105, p. 321); but the work is not executed, and therefore, although in course of construction, can be considered only as a design. The model is by the same workman as that of the Britannia Bridge, Mr. J. James, and is a most elaborate and beautiful piece of work, exhibiting every minute detail.

The model of the bridge erecting over the Wye at Chepstow, is exhibited by the contractors for the work, Messrs. Finch and Willey (9, p. 310). It illustrates well the construction of the bridge, but is not highly finished.

In the American Division there is a full-sized model, or rather a portion of a bridge, illustrative of the principle of construction on which several large bridges have been erected in America. The principle is a modification of the "lattice bridge," in which iron is skilfully introduced. The design, which is by the Messrs. Rider, exhibits that ingenuity and skill in construction for which the Americans are celebrated. It is sent by the New York Iron Bridge Company (147, p. 1446).

Prize Medals have been awarded to Mr. Salter (p. 851) as the exhibitor of several most beautiful models of engineering and architectural works; and to Mr. J. W. Leeman (257, p. 1282), who has exhibited a very beautiful model of the Cathedral of Strasbourg: and of Mr. G. Michel, of Berne (248, p. 1282), for an exquisite model of a Bernese farm-yard, with every detail both of interior and exterior, the Jury make Honourable Mention.

Of geographical modelling, a most perfect specimen is exhibited by Captain Ibbetson (p. 851), being the model of the Undercliff, Isle of Wight, from a trigonometrical survey, with every detail minutely and accurately given.

Mr. F. A. Carrington also exhibits several excellent models of various parts of England.

Before mentioning designs for mechanical construction not yet executed, it will be right to notice Mr. W. C. Wilkins' revolving floating-light (157, pp. 326-328), in which excellence of workmanship is combined with judicious contrivances for meeting the various difficulties of obtaining a large steady burning revolving light, attached to the mast of a floating-light vessel. These lights are in use and work well.

The designs for novel construction in engineering are not numerous. Of these two have been selected as worthy of a Prize Medal, the breakwater and lighthouse of Mr. W. H. Smith (165, p. 328), and a bridge by Mr. J. T. Rose, of Leith (180, p. 329), in which an elegant and mechanical arrangement of timber is suggested.

Amongst building contrivances it is to be regretted that more numerous examples of heating and ventilating have not been found. But these having been generally connected with branches of manufacture, are considered in other Classes. Of the contrivances more or less connected with building, which have remained in Class VII., Major Pratt (16, p. 311) has exhibited a model of a very simple and ingenious system of steps, for landing from boats, which rise and fall with the tide, keeping at all times a complete set of steps, with a vertical rise and tread, and with a landing at the bottom, and the parts, being never covered by the water, may remain clean and dry. The model is small and unpretending, but the object is by no means unimportant, and the idea promises to be successful and inexpensive in construction. No greater merit can be ascribed to any plan, and the Jury have considered it well worthy of a Prize Medal.

To both Mr. C. E. Heinke (53, p. 315) and Mr. A. Siebe (1, p. 309) the Jury have awarded Prize Medals for complete sets of diving-dress apparatus, alike excellent in construction and well studied in detail; each has some peculiarities, but both are good in workmanship and well designed.

In contrivances for more domestic purposes to Messrs. J. Bunnett and Co. (152, p. 326), who have exhibited a specimen of their metal shutters, and several excellent water-closets; and to Mr. T. H. Wilson (113, p. 328) for a very ingenious contrivance for a bolt for double road-gates, which gets rid of the objectionable stop that is now used, which, rising in the middle of the road, is both dangerous for horses and very unsightly, and for a system of bolts and slides for doors, which renders them almost air-tight, and adds to their security against violence, the Jury have also awarded Prize Medals.

Amongst several objects which were allotted at a late period to Class VII., the Jury wish to draw particular attention to two sets of boring-tools from the Continent, one contributed by Mr. J. F. Laué, of Wilderz, Switzerland (65, p. 1270), constructed on a principle that has been eminently successful, in which water is introduced by means of hollow rods, and mixing with the powder or small dust formed in the boring, is discharged through the tool by the blow of the latter, in descending or by other means, and thus carries with it the produce of the boring, keeping the bottom clear and fresh to receive the full effect of the tool. A boring of 1,300 feet in depth has been made with these tools, and with a facility of which the old tools are not susceptible.

Messrs. Mulot and Son, of Paris (658, p. 1209), have also exhibited a set of powerful boring-tools, similar to those with which they effected the celebrated "Puit Artésien," of Grenelle, which exceeds 1,800 feet in depth. This result is sufficient proof of the excellence of the apparatus.

Among contributors of other objects, worthy of Honourable Mention, but to which prizes have not been awarded, the Jury desire to record the names of—

Mr. T. Bouch (73, p. 317), the exhibitor of a model of a railway ferry-boat.

Messrs. Bremner and Sons (95, p. 318) for their models of various apparatus for working in situations exposed to the sea, and of that used to assist in getting off the "Great Britain" steam-ship.

Mr. J. Dobson (114, p. 323), for his model of a fine roof at the Newcastle Railway Station.

Mr. G. Hurwood (31, pp. 312, 313) for a simple apparatus for shutting and securing ships' lights.

Mr. J. Leemann (258, p. 1283) for a model of a fountain in the Market-place of Nuremberg, by the Sculptor Sebald Schonhofer. (Honourable Mention in Class XXX. also).

Alice Lowe and Co. (62, p. 316) for stink-traps.

Mr. T. G. Newnham (170, p. 329) for models of ornamental roofs for churches and other similar buildings, of terra cotta, and also of timber, and for a construction of window-sashes, showing much ingenuity.

From Saxony some excellent models of roofs have also been sent, which deserve mention.

Westminster, October 1851.

I. K. BRUNEL, Reporter.

CLASS VIII.

REPORT ON NAVAL ARCHITECTURE AND MILITARY ENGINEERING; ORDNANCE, ARMOUR, AND ACCOUTREMENTS.*

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Baron Dupin, *Chairman and Reporter*, France; formerly Minister of Marine, Member of Institute and President of the Central Jury, &c.
Major-General Sir John Burgoyne, K.C.B., *Deputy Chairman*, 87 Pall Mall; Inspector-General of Fortifications.
Lieut.-Col. Colquhoun, R.A., F.R.S., Royal Arsenal, Woolwich.
Ch. Lesoinne, Belgium; Member of the Chamber of Representatives, late Merchant.
Major Micheels, France.
Sir Baldwin Walker, K.C.B., Surveyor-General of the Navy; Admiralty, Somerset House.
A. Whitney, United States; Merchant.
Isaac Watts, Somerset House; Assistant Surveyor-General of the Navy.

Associates.

Capt. F. W. Beechey, R.N., Naval Department, Board of Trade.
Lieut. Creyke, R.E., Hon. Secretary.
Col. Hall, R.E., Ordnance Survey Office, Southampton; Director of Ordnance Survey.
Capt. James, R.E., 34 Ladbroke Square, Notting Hill.
George Lovell, 12 Ely Place, Holborn; Inspector of Small Arms.
Col. Morin, France (Juror Class V.)
Capt. Yolland, R.E., Ordnance Map Office, Southampton; Assistant Director of Ordnance Survey.

PART I.

Naval Architecture.

It is not unworthy of remark, as being a singular feature in the maritime history of Great Britain, that whilst, during a period of war, vast improvements were being made in its military service, very little was effected for its navy until after the Treaty of Peace.

It was not until a general pacification in 1814 had freed Europe from a severe and terrible military struggle, that Sir Robert Seppings, then Surveyor of the Navy, brought forward his improved method of naval construction. The lower parts of the frames of ships of war were then for the first time filled in, and no longer afforded interstices for the accumulation of dirt and putrid water; and the frame-timbers of the bottom presented a compact mass of wood from the keel up to about the light water-line. Besides this great improvement, the whole fabric was further strengthened by means of a system of diagonal trussing, which, together with the solid bottom, opposed such resistance to the forces due to the weight of the hull and its contents acting downward, and to the forces due to the displacement or pressure of the water acting upward, as effectually to prevent the keel from shortening, and consequently the ship from hogging or breaking down in the direction of her length, as it was liable to do formerly, or otherwise yielding to the forces of pressure under sail, or those of pitching and rolling in a tempestuous sea.

In addition to these first great steps in the progress of ship-building, the upper parts of men-of-war were much improved in form and strength; the stern, instead of remaining open to the fire of an enemy, has been more strongly built, in a semicircular or rather elliptical shape, better fitted for defence in every direction. The upper decks have also been enlarged, and space gained for working the guns.

The building of ships of war has been further improved in many ways which cannot be explained here. More solidity has been obtained by greater precision in joining the various masses of wood constituting the ship. By such means *the working* of the timbers in a heavy sea is greatly prevented; and both solidity and greater durability are obtained.

Instead of firing the great guns by the same mechanism as old muskets, caps and hammers have been adapted to them.

Advantages of still higher importance have been obtained by the introduction of guns of very large calibre, mainly due to General Paixhans, which were introduced nearly twenty years ago, and called *canons à la Paixhans*. At first very few such guns were placed in each ship; but now we find complete batteries of 68-pounders, the effect of which cannot fail to be tremendous.

The combination of large masts has been rendered more economical, easy, and solid, by the employment of coaks or cylinders of hard wood, inserted one-half of their length into each of the pieces of the masts, brought into contact.

Sir W. Symonds, who succeeded Sir Robert Seppings in 1832, as Surveyor of the Navy, turned his attention toward an improved form for ships of war, and designed them of such figure and dimensions as to require very little ballast; this he in great measure accomplished by a considerable increase of the breadth. This system had many advantages; it gave greater stability, and in sharp ships more space below for stowage, besides a larger field or deck for working the guns; and although many talented naval constructors and officers considered this form unfavourable to an easy motion at sea, and liable to distress the spars; we have, nevertheless, great cause to be thankful to this talented and meritorious officer for his laudable and unwearied endeavours to improve the construction of ships of war.

We are further indebted to Mr. J. Scott Russell, the distinguished Secretary of the Royal Commission, for a series of valuable experiments and researches on the form of least resistance at high velocity; this form being determined by examining the form of waves produced by drawing vessels through a canal at different degrees of speed. Further experiments are being made by this gentleman in the application of his deductions to sea-going ships, and he has our best wishes for their ultimate success.

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* This Report was written in English by Baron Dupin.

The theory of stability, so important to the navy, and which we considered in a geometrical point of view, has been examined, both successfully and ingeniously by the Rev. H. Moseley, the President of Jury V.

The stowage of ships has been much improved, of late years, both in the form and disposal of stores; thus water-casks are replaced, at the suggestion of General Bentham, by iron tanks. The cubic or prismatic form of these tanks insures a great economy of space as compared with the cylindrical form of casks; they also preserve the water perfectly pure, during long voyages; casks, on the contrary, have the soluble part of their wood dissolved by the water, causing putridity, which produces various diseases, especially in hot climates.

Equally important with the improvements in keeping water free from taint, must be considered the modes invented by M. Appert for preserving all kinds of meat.

The preservation of gunpowder free from humidity, so necessary for ships of war, is now rendered perfect by the employment of hermetically sealed metallic cases, or wood cases with metallic lining; an improvement due to the British navy.

In the French navy, great improvements have been made by separating passages for the conveyance of cartridges from the magazine up to the various batteries of the ship. These arrangements were particularly remarked by the English during their visit to the French fleet at Cherbourg in 1850.

We now come to a series of improvements of the highest importance to the safety of ships. The hemp cables formerly employed were very objectionable, being liable to rapid decay, particularly in hot climates. When the anchor was cast on a rocky bottom, the cable was frequently cut by the rocks, and very often parted, so that the ship was greatly endangered.

A captain of the British navy, (Sir Samuel Brown,) introduced cables made of iron links, so arranged as to be easily worked. These chain-cables are now in general use, not only in ships of war, but also in the commercial shipping of every maritime nation. We should have been happy if so vast an improvement had been recent enough to have received the highest of our awards, as being one of the greatest effected for the shipping interests and the preservation of life and property.

The first method for stopping iron cables is due to the English; the last and best belongs to the captain of the French frigate "Legoff." A high encomium is due to M. Barbotin, *capitaine de vaisseau* in the French service, for having devised the means by which the chain-cable can be worked on the capstan. The various links as they succeed each other fall into grooves, on the periphery of a large polygonal prism forming the body of the capstan. When the capstan is put in motion, the links of the chain-cable have in succession half their thickness lodged in these grooves, and successively disengage themselves with mathematical precision.

The improvement in cables naturally leads us to speak of anchors.

Very remarkable improvements have been recently made by Lieut. Rodger, R.N., insuring a better distribution of the metal in the direction of the greatest strains. The palm of the anchor, instead of being flat, presents two inclined planes, calculated for cutting the sand or mud instead of resisting perpendicularly; and the consequence is, that these new anchors hold much better in the ground. The Committee of Lloyds', so competent to judge of every contrivance likely to preserve ships, have resolved to allow for the anchors of the ships they insure, a sixth less weight, if made according to the plan of Lieut. Rodger, to whom we have given a Prize Medal.

Another source of safety, most important to ships, is an efficient application of metallic conductors by which they are secured against the destructive element of lightning. Franklin made the immortal discovery of the identity of artificial electricity and that from the thunder-cloud, and through the instrumentality of the lightning-rod, devised a happy application of his discovery to the preservation of buildings and ships in thunder storms. The variable and complicated circumstances, however, under which ships are necessarily placed, rendered the use of such rods on ship-board difficult and apparently impossible. The masts—the only parts to which they could be well applied—consist of many distinct portions; these it is often requisite to move one upon another, and sometimes to remove altogether; they are also liable to injury from wind and other forces acting on them. The defence of ships from lightning had hence been confided to a small chain or rope of wire temporarily applied along the rigging; but which, from the very nature of the case, fails to afford the full amount of security to be derived from a more powerful conductor permanently fixed along the mast. Sir W. S. Harris conceived the idea of making capacious metallic conductors an integral part of the masts and hull of the vessel, so as to bring the general fabric into that perfect conducting or non-resisting state it would assume, in respect of the matter of lightning, supposing the whole mass to be metallic throughout; this he has effected by incorporating with the masts and hull a series of copper plates, so arranged as to meet all the varying conditions of the spars, and so tied together that an electrical discharge, striking upon any part of the vessel, cannot enter upon any circuit of which the conductors do not form a part, and thus the ship is preserved from the effects of lightning at all times and under all circumstances, without the officers and crew being in any way concerned in the matter. Sir W. S. Harris has shown, by original researches in science, that in whatever position the sliding masts may be placed, a line or lines of conductors pass through the ship to the sea, affording less resistance to the passage of the electrical discharge, than any other arrangement which can be devised. The most perfect security is derived from the plan thus introduced. Sir Baldwin Walker, one of our fellow jurors, has himself experienced the great advantages of this system in a large frigate commanded by him, which was struck, both on the fore and main-masts, by heavy discharges of lightning on the coast of Mexico. In this case, the force of the discharge was such as to partially fuse the metallic point aloft on which the lightning struck, and leave spots of fusion on the surface of the conducting plates, but without the least damage being done to the spars or hull; and this, too, while the top-gallant-masts were housed.

We have given our highest award to this, which we consider as the best apparatus for the preservation of ships against the terrible effects of lightning.

Another source of safety in the construction of ships is the substitution of iron for wood. In a country like Great Britain, where iron is so abundant, cheap, and well adapted to various purposes, it was natural to use it instead of wood for ship-building. Iron ships have the great advantage of not being liable to that rapid decay to which wooden ships are subject, especially in hot climates; and to the dry-rot which attacks them in moist climates; iron, likewise, cannot be attacked by the worms so destructive to wood under water. Iron ships can also be made lighter, with the same bulk, as compared with wooden ships; and they resist better in case of being driven on shore or upon a bank of sand. Such are the advantages which justify the employment of iron in ship-building. In ships of war, however, the iron sheets of the hull are liable to be rent by cannon-balls in such a way as, in many cases, to render it impossible to stop the leak and save the ship. Maritime countries have, therefore, after expensive experiments, abandoned the idea of wholly substituting iron for wood, in the building of ships of war.

The rigging, blocks, and sails of ships have been improved both in their combinations and materials. The construction of blocks is managed with remarkable economy since the invention of the admirable block machinery by the late Sir J. Isambard Brunel, in his youth a French naval officer. We have awarded Prize Medals to improvements in the construction of large blocks composed of several pieces of wood, by which are obtained economy in material and a better fitting of their hooks and rigging. Rope-making is likewise improved. We owe to British ingenuity the obtaining of equal tension amongst the threads of which the largest ropes and cables are now made, and the operation of laying the ropes, by mechanical power, with mathematical precision. The commercial marine of France exhibit cordage made in this manner, which is certainly much better than any shown on the English side of the Exhibition. Both countries have improved the texture of their sail-cloths, as will be seen by the Report of the Jury entrusted with their examination.

We shall conclude these general remarks upon Naval Architecture, with some interesting documents relative to various classes of ships, which we have before adverted to.

The Admiralty and merchant builders having contributed a large number of models of ships to the Exhibition, for the purpose of illustrating the forms and other characteristics of ships of the most recent construction: we conceived that some record of those ships should be preserved, in order to indicate the present state of naval architecture in Great Britain.

With this view we present a series of tables, containing the principal dimensions, and such other mathematical elements, relating to the construction of these ships, as could be obtained.

Table I. (page 212), contains the dimensions and calculated elements of a complete series of sailing-ships, from a first-rate man-of-war to a small brig.

Within the last twenty years, ships in the navy have been constructed with greatly increased width, or breadth of beam. To some extent, this increase of breadth may have been necessary, to enable them to sustain,—without too great inclination under sail,—the increased weight of armament now placed on board ships of war by most naval powers. But the general opinion, founded on the result of experimental trials of these ships, with those of former years, is—that breadth of beam, when carried to excess, contributes to make the ships roll quickly, and in some cases deeply also.

As this is a most serious evil in ships of war, materially affecting their efficiency in the use of their guns, ships of more recent construction have had increase of length as well as of breadth given them; but the latter to a less extent;—thereby obtaining the requisite amount of stability without rendering them liable to those sudden impulses produced by great breadth at the water's surface alone, which causes the side to round greatly inwards, both above and below the water-line. The ships referred to are, nevertheless, a very fine class of ships; and in the "Queen" we see a first-rate ship, combining with great speed, stability, easy motion, and every other essential property of a man-of-war.

Table II. (page 213), contains the principal dimensions and other elements of a number of frigates constructed by different persons with a view to competition. Several of these frigates have been attached to the late experimental squadron under the command of Commodore Martin, for the purpose of fully testing their sailing and other properties as ships of war. The results of these trials, in so far as they have as yet been determined, have been indicated in a Report ordered to be printed by the House of Commons, on the 1st July, 1851. The superiority of sailing was in favour of the "Phaeton" over other frigates similarly fitted. Her superiority was maintained notwithstanding various changes in the trim of the rival frigates, the "Leander" and "Arethusa;" but the "Arethusa" had the advantage over the two others in respect of stowage, and she sailed better than the "Leander."

Table III. (page 214), gives the principal dimensions and other elements of several brigs which have been tried together at sea for the purpose of ascertaining their relative merits in regard to sailing and other necessary qualities for vessels of this class.

The results of the trials of the brigs, in Table III., are given in Captain Corry's Report, published in Parliamentary Paper, No. 394 (A), Session 1845.

Naval architecture, as far as it concerns ships moved by wind and sails, has thus presented to us many improvements. But we have now to speak of progress, by far more complete and important, in ships moved by the power of steam.

A. PADDLE-WHEEL STEAM SHIPS.

Many persons, in various countries, claim the honour of having first invented small boats propelled by steam. But it is to the undaunted perseverance and exertions of the American, Fulton, that is due the everlasting honour of having produced this revolution, both in naval architecture and in navigation.

When the general peace took place in 1814, there was not a single steam-ship in the ports of England; Scotland, however, had one small vessel of this kind. For several subsequent years, *steam-boats*, of small size and with very insignificant engines, were employed in rivers or along the coasts, but the idea of going far out to sea with them was considered very presumptuous.

In 1818, however, an American captain traversed the Atlantic in a steam ship, the "Savannah," touching first at England, and then proceeding up the Baltic to St. Petersburgh.

About seven years after this steam was applied to railway travelling on shore; and then it was that most important attempts were made to extend the power of steam to long voyages by sea, and to the passage across the Atlantic from England to the United States. In accomplishing this, however, far more powerful engines, and much larger ships than had yet been built, were absolutely requisite. The examination and judgment of such engines will be found under the Report of another Jury (Class V.).

Steam was soon applied very generally, both to the commercial navy and to ships of war; a main object being—the application of such velocity combined with economy and safety as would induce persons to travel by sea.

To procure such a velocity, it was not enough to increase the propelling power; it was also indispensable thoroughly to modify the forms of the vessels, to diminish the bulk of the prow and stern, to reduce the breadth, and proportionally increase the length. In this way the forms of steam-ships have been made very similar to those of the galleys of ancient times; when, instead of steam power, human labour was applied to propel the vessel by means of oars; whereas, now, the mechanical force is transmitted by the paddles of wheels or screws acting longitudinally.

Such is, at present, the empire of man upon the sea, that calms, contrary winds, and adverse currents, formerly so detrimental to speedy navigation, are quite overcome. Periodical steam-ships start and arrive on fixed days, and almost fixed hours, at the ports of Liverpool or Havre and New York; as well as from London or Marseilles to Constantinople and Alexandria; and from Suez to Bombay, Ceylon, Calcutta, Singapore, and Hong Kong. Contracts are made between the Admiralty of Great Britain and steam Navigation Companies, obliging the vessels of the latter to cross the Atlantic and the Mediterranean, at the rate of at least 9 miles an hour, taking all the chance of contrary winds. Great Britain, ever attentive to the preservation of her maritime power, looks upon the great steam-ships, built by private Companies, and under contract with the Government, as a valuable reserve in case of war; with this view, special articles of the contracts with the Companies oblige them to build their ships of wood and not of iron, because, with the latter material, they would not be so fit for defence, as we have already explained. At the first signal of war, the Admiralty would, from this source alone, have an auxiliary steam navy of 20,000 horse power! The exertions of private speculators, and of the English Government, during the last fifteen years, in securing the conveyance of letters, valuable goods, and passengers between Europe, America, Africa, and Asia, are deserving of the highest admiration. The many rich and powerful Companies engaged in promoting similar undertakings, by ordering steam ships to be built of great dimensions, either of wood or iron, so as to be at once very solid and sufficiently light, have greatly advanced

TABLE I.—PRINCIPAL DIMENSIONS and CALCULATED ELEMENTS of a Series of SAILING SHIPS of the ROYAL NAVY.

Specification of the Dimensions, and other Elements.	Royal Albert, 120 Guns.	Queen, 116 Guns.	Albion, 90 Guns.	Hannibal, 90 Guns.	Cæsar, 90 Guns.	Superb, 80 Guns.	Cressy, 80 Guns.	Cumberland, 70 Guns.	Emerald, 60 Guns.	Narcissus, 50 Guns.	Diamond, 18 Guns.	Arachne, 18 Guns.	Siren, 16 Guns.	Pilot, 12 Guns.	Britomart, 10 Guns.
Length on the load water-line from the fore part of stem to after part of post, in feet and inches	222 3	204 7	205 0	207 7	209 10	191 0	200 9	181 6	186 7	181 7	140 9	114 8	109 6	104 6	92 0
Breadth on the load water-line to outside of planking, in feet and inches	60 10	59 2½	59 4	58 0	56 0	56 3	55 0	53 6	52 0	50 10	41 4	35 0	34 0	33 0	28 8
Relation of length to breadth at the load water-line	3·65	3·45	3·45	3·577	3·734	3·395	3·652	3·392	3·588	3·576	3·405	3·276	3·220	3·166	3·241
Load draught of water, in feet and inches forward	23 9	24 6	23 5	23 6	23 6	23 11	23 3	22 10	21 0	21 0	16 6	14 6	13 9	13 8	12 3
Load draught of water, in feet and inches aft	25 3	26 0½	25 3	24 6	24 6	25 4	24 3	24 2	21 9	21 9	17 6	15 0	14 6	15 3	13 6
Mean draught of water in relation to the extreme breadth at load-line	0·402	0·426	0·410	0·413	0·428	0·438	0·431	0·439	0·411	0·424	0·411	0·421	0·415	0·439	0·449
Height of the lower port-sill from the load water-line, in feet and inches	7 0	6 8	6 2	7 3	7 0	6 3	6 6	6 6	9 0	9 0	7 2	5 9	4 6	4 2	4 7
Depth of the keel and false keel below the rabbit of the keel, in feet and inches	1 6	1 9	1 0	1 6	1 6	1 7	1 6	1 9	1 5	1 5	1 6	1 1	1 2	1 0	0 9
Distance of the greatest transverse section before the middle of the load water-line, in terms of its length	0·069	0·057	0·061	0·041	0·026	0·029	0·066	0·057	0·087	0·069	0·052	0·043	0·062	0·097	0·065
Distance of the centre of displacement before the middle of the load water-line, in terms of its length	0·015	0·003	0·003	0·009	0·017	0·008	0·014	0·006	0·016	0·016	0·010	0·014	0·028	0·029	0·011
Circumscribed rectangular parallelopipedon contained by the length of the load water-line, breadth on water-line, and mean draught of water, in cubic feet	331227	305836	296017	288951	282011	264565	262229	228191	207357	197261	98892	59193	52593	49996	33961
Displacement, in terms of the said parallelopipedon	0·529	0·538	0·516	0·516	0·527	0·497	0·490	0·489	0·469	0·469	0·409	0·382	0·370	0·390	0·383
Area of the circumscribed rectangle contained by the breadth of the water-line, and depth from the water-line to the lower side of the rabbit of the keel, in square feet	1399	1391	1348	1305	1260	1294	1224	1164	1048	1025	640	478	442	445	348
Area of the greatest transverse section, in terms of the said rectangle	0·763	0·760	0·713	0·753	0·729	0·700	0·693	0·704	0·678	0·675	0·632	0·618	0·578	0·595	0·600
Area of the circumscribed rectangle contained by the length and breadth of the water-line, in square feet	13519	12112	12166	12039	11750	10744	11041	9710	9703	9231	5817	4013	3723	3448	2637
Area of the load water section, in terms of the said rectangle	0·857	0·873	0·864	0·847	0·883	0·860	0·857	0·854	0·829	0·833	0·804	0·762	0·782	0·816	0·796
Depth of the centre of gravity of the greatest transverse section, in terms of the mean draught of water	0·390	0·382	0·374	0·375	0·349	0·363	0·367	0·360	0·345	0·346	0·322	0·326	0·321	0·335	0·334
Distance of the centre of gravity of the load-water section from the middle of the load water-line, in terms of its length	Abaft 0·002	Abaft 0·002	Abaft 0·004	Before 0·003	Before 0·008	Abaft 0·006	Abaft 0·006	Abaft 0·005	Before 0·003	Before 0·001	Abaft 0·058	– – 0·000	Before 0·007	Before 0·005	Abaft 0·248
Height of centre of effort of sails above the load water-line, in feet	95·7	91·4	86·6	89·0	88·3	85·26	85·7	81·66	76·8	76·9	63·66	53·0	58·0	49·5	44·4
Distance of centre of effort of sails before or abaft the centre of gravity of displacement, in relation to the length of the load water-line	Before 0·121	Before 0·011	Before 0·014	Before 0·012	Before 0·006	Before 0·008	Before 0·007	Before 0·012	Before 0·002	Before 0·005	Abaft 0·014	Abaft 0·023	Abaft 0·016	Abaft 0·020	Abaft 0·006
Relation to the moment of sails abaft the centre of gravity of displacement to the moment of the sails before the said centre	0·864	0·920	0·914	0·918	0·959	0·942	0·988	0·916	0·968	0·965	1·022	1·24	1·052	1·144	1·045
Area of sail in relation to the area of the greatest transverse section	28·9	27·75	30·48	32·55	32·97	30·57	32·67	30·19	34·13	35·04	37·68	40·16	41·73	36·3	36·25
Area of sails, in square feet, in relation to the displacement	0·176	0·178	0·198	0·216	0·203	0·211	0·215	0·221	0·249	0·261	0·376	0·516	0·546	0·493	0·580

TABLE II.—PRINCIPAL DIMENSIONS and CALCULATED ELEMENTS of the EXPERIMENTAL FRIGATES of the ROYAL NAVY.

Specification of the Principal Dimensions and Calculated Elements.	Arethusa, 50 Guns.	Indefatigable, 50 Guns.	Leander, 50 Guns.	Phaeton, 50 Guns.	Raleigh, 50 Guns.	Nankin, 50 Guns.	San Fiorenzo, 50 Guns.	Thetis, 38 Guns.	Inconstant, 36 Guns.	Eurydice, 26 Guns.	Spartan, 26 Guns.
Length of the load water-line from the fore part of stem to after part of post, in feet and inches	182 2	182 4	182 8	185 8	181 6	197 2	189 10	165 8	161 7	143 3	133 6
Breadth of the load water-line to outside of planking, in feet and inches	52 2	51 6	50 6	49 4	49 6	50 8	50 6	46 6	45 4	38 2	40 0
Relation of length to breadth at the load water-line	3·49	3·54	3·615	3·763	3·66	3·695	3·759	3·562	3·56	3·75	3·337
Load draught of water, in feet and inches forward	21 9	20 4	20 3	21 0	20 8	21 0	20 9	18 10	18 8	15 11	16 10
Load draught of water, in feet and inches aft	23 2	21 4	21 6	22 11	21 8	22 6	21 9	20 4	19 3	16 7	18 0
Mean draught of water in relation to the extreme breadth, at load line	0·431	0·404	0·413	0·446	0·428	0·431	0·420	0·421	0·417	0·425	0·435
Height of the lower port-sill from the load water-line, in feet and inches	8 6	9 4	9 2	8 2	9 7	8 10	9 0	8 2	7 3	6 0	5 9
Depth of the keel and false keel below the rabbit of the keel, ditto	1 8	1 3	1 8	1 8	1 6	1 3	1 6	1 6	1 4	1 2	1 0
Distance of the greatest transverse section before the middle of the load water-line, in terms of the length of the load water-line	0·073	0·070	0·024	0·063	0·086	0·030	0·039	0·032	0·072	0·042	0·097
Distance of the centre of displacement before the middle of the load water-line, in terms of the length of the water-line	0·010	0·012	0·013	0·022	0·016	0·005	0·013	0·014	0·020	0·027	0·030
Circumscribed rectangular parallelopipedon contained by the length of the load water-line, breadth on the water-line, and mean draught of water, in cubic feet	213594	195593	192556	201104	190106	206230	203711	150828	138448	88829	93023
Displacement, in terms of the said parallelopipedon	0·436	0·481	0·427	0·457	0·473	0·451	0·469	0·447	0·440	0·403	0·398
Area of the circumscribed rectangle contained by the breadth of the water-line, and depth from the water-line to the lower side of the rabbit of keel, in square feet	1085	1008	970	1001	973	1038	997	841	797	576	657
Area of the greatest transverse section, in terms of the said rectangle	0·649	0·716	0·651	0·739	0·670	0·662	0·698	0·659	0·665	0·625	0·621
Area of the circumscribed rectangle contained by the length and breadth on water-line, in square feet	9511	9390	9224	9158	8984	9482	9586	7703	7325	5466	5340
Area of the load water section, in terms of the said rectangle	0·819	0·809	0·824	0·797	0·851	0·814	0·842	0·846	0·820	0·803	0·810
Depth of the centre of gravity of the greatest transverse section, in terms of the mean draught of water	0·343	0·356	0·332	0·369	0·349	0·345	0·386	0·318	0·370	0·327	0·344
Distance of the centre of gravity of the load water section from the middle of the load water-line, in terms of the length	Abaft 0·006	Abaft 0·005	Abaft 0·002	Abaft 0·009	Before 0·0204	Abaft 0·001	Before 0·005	Before 0·002	Before 0·006	Before 0·005	Before 0·001
Height of centre of effort of sails above the load water-line, in feet	75·93	77·63	77·75	76·20	78·70	76·94	77·33	70·70	70·50	61·70	61·50
Distance of centre of effort of sails before or abaft the centre of gravity of displacement in relation to the length of the load water-line	Before 0·008	Before 0·002	Before 0·016	Abaft 0·006	Before 0·011	Before 0·009	Before 0·004	Before 0·007	Before 0·015	Abaft 0·011	Abaft 0·024
Relation of the moment of the sails abaft the centre of gravity of displacement to the moment of sails before the said centre	0·943	0·977	0·897	1·025	0·922	0·933	0·976	0·954	0·904	1·064	1·180
Area of sails in relation to the area of the greatest transverse section	34·42	33·58	38·38	32·77	36·60	35·30	34·85	36·65	37·85	39·40	34·78
Area of sails, in square feet, in relation to the displacement	0·264	0·257	0·270	0·263	0·270	0·273	0·254	0·292	0·326	0·396	0·382
By whom designed	Sir W. Symonds	Mr. Wm. Edye.	Mr. Rd. Blake.	Mr. Joseph White.	Mr. Fincham.	Mr. W. O. Lang, junior.	MM. Read, Chatfield, Creuze.	MM. Read, Chatfield Creuze.	Admiral Hayes.	Admiral Elliot.	Sir W. Symonds.

TABLE III.—PRINCIPAL DIMENSIONS and CALCULATED ELEMENTS of the EXPERIMENTAL BRIGS of the ROYAL NAVY.

Specification of the Principal Dimensions and Calculated Elements.	Flying Fish, 12 Guns.	Espiègle, 12 Guns.	Daring, 12 Guns.	Osprey, 12 Guns.	Mutine, 12 Guns.	Water Witch, 20 Guns.	Pantaloon, 10 Guns.
Length on the load water-line from the fore part of stem to after part of post, in feet and inches	102 2	105 3	104 2	100 10	101 4	91 0	89 0
Breadth on the load water-line to outside of planking, in feet and inches	32 0½	31 6½	31 0½	31 6½	31 6	28 10	28 6
Relation of length to breadth at the load water-line	3·18	3·34	3·35	3·20	3·21	3·191	3·123
Load draught of water, in feet and inches { forward	13 6	12 9	12 5	12 2	12 8	10 6	11 7
Load draught of water, in feet and inches { aft	14 7	14 9	16 9½	15 1	14 2½	14 2	13 3
Mean draught of water in relation to the extreme breadth at water-line	0·440	0·434	0·474	0·431	0·427	0·427	0·435
Height of the lower port-sill from the load water-line, in feet and inches	4 4	5 0	4 5	4 6	4 9	4 8	4 4
Depth of the keel and false keel below the rabbit of the keel, ditto	1 0	1 3	1 4	1 0	1 1	1 3	1 4
Distance of the greatest transverse section before the middle of the load water-line, in terms of its length	0·027	0·010	0·072	0·075	0·061	0·031	0·093
Distance of the centre of displacement before the middle of the load water-line, in terms of its length	0·012	0·013	0·018	0·013	0·016	0·016	0·029
Circumscribed rectangular parallelopipedon contained by the length of the water-line, breadth on water-line, and mean draught of water, in cubic feet	46112	45456	47115	43193	42800	32348	31478
Displacement, in terms of the said parallelopipedon	0·374	0·377	0·396	0·395	0·394	0·356	0·355
Area of the circumscribed rectangle contained by the breadth of the water-line, and depth from the water-line to the lower side of rabbit of the keel, in square feet	419	394	410	397	387	319	315
Area of the greatest transverse section, in terms of the said rectangle	0·606	0·592	0·685	0·633	0·622	0·605	0·595
Area of the circumscribed rectangle contained by the length and breadth on water-line, in square feet	3270	3318	3227	3176	3194	2623	2536
Area of the load-water section, in terms of the said rectangle	0·761	0·781	0·770	0·785	0·801	0·751	0·769
Depth of the centre of gravity of the greatest transverse section, in terms of the mean draught of water	0·333	0·296	0·346	0·322	0·322	0·318	0·326
Distance of the centre of gravity of the load-water section from the middle of the load water-line, in terms of its length	Abaft 0·006	Abaft 0·002	Before 0·001	Before 0·002	Before 0·003	Abaft 0.0031	efore 0·0095
Height of the centre of effort of sails above the load-line of water, in feet	48·9	49·8	48·2	48·7	49·2	44·9	44·7
Distance of the centre of effort of sails before or abaft the centre of gravity of displacement in relation to the length of the water-line	Abaft 0·007	Abaft 0·026	Abaft 0·035	Abaft 0·019	Abaft 0·009	Abaft 0·013	Abaft 0·011
Relation of the moment of the sails abaft the centre of gravity of displacement to the moment of the sails before the said centre	1·112	1·195	1·375	1·016	1·016	1·028	1·072
Area of sails in relation to the area of the greatest transverse section	34·07	38·3	32·0	37·3	37·35	39·13	40·3
Area of sails in square feet, in relation to the displacement	0·493	0·521	0·477	0·527	0·527	0·655	0·675

the science of naval architecture. We have to award Medals to several eminent shipbuilders who have presented the Exhibition with models of the excellent steam-ships which they have lately designed and constructed.

We should have been glad if the great maritime nation of America, instead of sending incomplete and imperfect models or drawings of their steam-ships, had furnished us with the requisite data for estimating the degree of perfection arrived at by their best shipbuilders, so as to have enabled us to recognize their incontestable merit. The United States cannot, at present, compete with Great Britain in the number of their great and regular communications by steamers, although on the lines opened by them, they are nothing inferior to their mighty rivals. The depth and vastness of the rivers of the United States, such as the Mississippi—the greatness of their lakes, which are indeed so many inland seas, have enabled the Americans to build steamers which may be considered as floating cities, and which satisfy the wants of the greatest way-faring nation of the world. The Americans, however, are to be reproached for their recklessness, and the little care they take to avoid evident peril. Catching fire, blowing up, or foundering from the effects of the latter—accidents which a little foresight might have prevented—are considered and accepted by them as casualties very little to be regarded. They brave these dangers knowingly, and to meet competition with a rival ship. Hence the accidents which occur are frequent and dreadful, and still they do not teach the commercial navigators to be more circumspect. The steam-ships of war, however, reserving danger for the time of battle, exhibit, on the contrary, a prudence which makes velocity subservient to security.

In the British navy much has been done, experimentally, for the best application of steam power to naval architecture. We shall notice, in our reports, the results of these experiments, which are well worthy of attention. The experiments we allude to are mainly relative to navigation with recently adapted screw propellers. This method of propulsion has the advantage of acting entirely under water, and is consequently protected from the fire of an enemy, an advantage not possessed by paddle-wheels. Paddle-wheels, also, by the large space they occupy on both sides of the ship, do not permit the use of guns along the whole length of the deck.

Several French professors, engineers, and naval officers, have made some interesting experiments on steam propulsion, with ships varying in form and size. The researches and experiments of Messrs. Bourgois and Moll have been already proclaimed and recompensed by the National Institute of France. These gentlemen are still pursuing their inquiries at the great manufactory of steam-engines for the French Marine at Indret.

We much regret that the maritime nations of the Continent did not contribute examples of their naval architecture to the great Exhibition. The Norwegians and Swedes, those excellent and bold navigators, have not sent any models or designs of the ships they employ either on the ocean or the Baltic. Their shipbuilders, inheritors of the science and art of the celebrated Chapman,* would have figured honourably, even in comparison with the most advanced seafaring people.

Since the last change in the navigation laws of Great Britain, the Anglo-Maltese purchase merchant-ships of the Greeks, and have them registered with those of the United Kingdom—finding these ships of very little cost, and well adapted to the navigation of the much intersected seas of the Cyclades and other parts of the Levant. The Greeks, however, did not send us models of any of their ships. The Venetians, the Genoese, and even the Dutch, a maritime people both by nature and necessity, failed also to send models. Finally, we regret that the French shipbuilders of Havre, of Nantes, of Bourdeaux, and of Marseilles, who do not want either ingenuity, learning, or experience, have not contributed in any way to this Exhibition. We had only from that country a model of the great iron steamers which are built for the navigation of the Rhone, the most rapid and dangerous of the French rivers. M. Schneider,* of Creuzot, constructed these ships and their machinery.

In twelve years there have been built at Creuzot, for the Rhone, under the direction of M. Schneider, 18 steamers, the first of 89 horse-power, and the last of 300, to carry 620 tons, and to overcome a mean velocity of the Rhone equal to at least two metres per second, ascending from Arles to Lyons in 36 or 38 hours. Other steamers, built for passengers, make still quicker voyages. Machinery for war steamers has been constructed for the French Government, at Creuzot, of 453 and of 609 horse-power, with remarkable success.

Screw-propeller Steam Ships.

The application of the screw-propeller to ships of war is of comparatively recent date, but has, notwithstanding, been so successful as to lead to the expectation that it will ultimately be generally applied to ships in the navy, either with full or auxiliary steam-power. The first ship in the navy to which the screw-propeller was applied was the "Rattler," of 888 tons, in which, with engines of 200 horse-power, a speed of 10 knots per hour was obtained.

The results of the trial of the "Rattler" with the "Alecto," a ship built from the same lines, and having engines of the same nominal horse-power, but fitted with paddle-wheels, proved so highly favourable to the screw-ship, that the Admiralty, in the year 1845, were induced to order four old ships of the line of 74 guns, and four old 46-gun frigates, to be fitted with screws, with a view to their being employed as block-ships, or harbour guard-ships. The "Blenheim," "La Hogue," and "Ajax," three of these ships, were therefore fitted with screws and with engines of 450-horse power, and have been recently tried at sea. The speed obtained so greatly exceeded anything contemplated, whilst their efficiency as men-of-war, for general service, became so fully established, that they are no longer regarded as fit only for harbour service, but are considered as sea-going ships, possessing powers and capabilities far exceeding those of ordinary sailing ships.†

The speed obtained by steam-power alone, varies, in these ships, from 6½ to 7½ knots per hour; and by sail and steam combined, a speed of about two knots more than that which sail alone would give, is frequently obtained, with the power of sailing closer to the wind.

The forms of "La Hogue," "Blenheim," and "Ajax," although more or less altered abaft, to adapt them for the screw-propeller, cannot be regarded as altogether well suited for its effectual operation. Daily experience shows that much greater comparative length than these ships possess, combined with a bow or entrance, as well as a fine run, is necessary to ensure the best results from the screw.

By comparing the dimensions of ships in the mercantile navy with those of the royal navy, it will be seen that screw-ships, for this service, are of still greater comparative length than in the royal navy; and that, in consequence, still better results have been obtained.

The following table (see p. 216,) contains the dimensions and some of the calculated elements of a series of screw-ships of the most recent construction.

Enumeration of the Awards for Naval Purposes.

Council Medals.

1. To the Admiralty of Great Britain (p. 344), for a magnificent set of models of ships moved either by sails

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* The eminent author of *Architectura Navalis Mercatoria*, Stockholm.

* To M. Schneider, when minister, we are indebted for the selection of the thirty-six French Jurors and Associates sent to the Exhibition.

† As soon as the conditions of this new problem of naval architecture were known to the public, Baron Charles Dupin, in a report to the French House of Peers, announced in positive and strong terms, the great success to be expected from men-of-war so fitted. He pointed out the new services which they could fulfil, not merely as harbour guard-ships but as a squadron of attack, for the remotest points of the European seas, and even farther.

TABLE IV.—PRINCIPAL DIMENSIONS and CALCULATED ELEMENTS of SHIPS-OF-WAR fitted with SCREW-PROPELLERS.

Specification of the Dimensions, Elements, &c.	St. Jean d'Acre, 100 Guns.	Agamemnon, 90 Guns.	Imperieuse, 50 Guns.	Arrogant, 46 Guns.	Tribune, 30 Guns.	Highflier, 20 Guns.	Archer, 12 Guns.	Cruizer, 16 Guns.	Reynard, 10 Guns.
Length on the load water-line from the fore part of stem to after part of post, in feet and inches	240 6	231 6	214 8	202 4	192 10	191 3	180 6	160 4	147 6
Breadth on the load water-line to outside of planking, in feet and inches	55 4	55 4	50 0	45 6	43 0	36 0	33 10	31 10	27 7
Relation of length to breadth at the load water-line	4·346	4·184	4·293	4·446	4·484	5·312	5·335	5·037	5·348
Draught of water, in feet and inches, to load line { forward	23 6	23 6	21 0	19 0	17 3	15 6	13 11	12 0	11 3
{ aft	25 0	24 0	21 9	20 0	18 9	16 0	14 5	14 0	12 6
Mean draught of water in relation to the extreme breadth at the load-line	0·438	0·429	0·427	0·428	0·418	0·437	0·419	0·408	0·430
Height of the lower port-sill from the load water-line, in feet and inches	6 6	6 6	9 6	9 6	7 6	11 2	9 4	8 9	6 11
Depth of the keel and false keel below the rabbit of the keel, ditto	1 0	1 0	1 0	1 4	1 0	0 9	1 0	1 0	0 11
Distance of the greatest transverse section before the middle of the load water-line, in terms of the length of the load water-line	0·082	0·049	0·055	0·061	0·059	0·031	0·039	0·055	0·033
Distance of the centre of displacement before the middle of the load line, in terms of the length of the load water-line	0·034	0·023	0·025	0·013	0·033	0·034	0·012	0·024	0·015
Circumscribed rectangular parallelopipedon contained by the length of load water-line, breadth on the water-line, and mean draught of water, in cubic feet	322692	304211	229686	179517	149250	108439	86526	66343	48323
Displacement in terms of the said parallelopipedon	0·595	0·598	0·497	0·504	0·498	0·560	0·506	0·502	0·500
Area of the circumscribed rectangle contained by the breadth of the load-line, and depth from the load-line to the lower side of rabbit of keel, in square feet	1286	1259	1020	827	731	540	446	382	304
Area of the greatest transverse section, in terms of the said rectangle	0·857	0·858	0·725	0·733	0·756	0·862	0·838	0·828	0·834
Area of the circumscribed rectangle contained by the length and breadth on load-line, in square feet	13307	12809	10733	9206	8292	6885	6106	5103	4071
Area of the load-water section in terms of the said rectangle	0·858	0·865	0·831	0·823	0·821	0·825	0·777	0·798	0·782
Depth of the centre of gravity of the greatest transverse section, in terms of the mean draught of water	0·426	0·413	0·364	0·363	0·377	0·412	0·395	0·315	0·415
Distance of the centre of gravity of the load water section, from the middle of the load water-line, in terms of its length	Before 0·0073	Before 0·0001	Before 0·009	Before 0·008	Before 0·011	Before 0·013	Before 0·011	Before 0·008	Before 0·0095
Height of centre of effort of sails above the load water-line, in feet	88·75	88·75	76·8	73·6	70·1	58·6	53·4	52·6	43·8
Distance of the centre of effort of the sails before or abaft the centre of gravity of displacement, in relation to the length of the load water-line	Before ·0037	Before ·008	Before ·0018	Before ·0197	Abaft ·005	Abaft ·014	Before ·011	Abaft ·0056	Before ·0075
Relation of the moment of the sails abaft the centre of gravity of displacement to the moment of sails before the said centre of gravity	0·912	0·929	0·987	0·877	1·038	1·109	0·905	1·047	0·947
Area of sails in relation to the area of the greatest transverse section	27·1	27·5	33·2	36·9	36·5	31·6	31·8	34·4	32·8
Area of sails, in square feet, in relation to the displacement in cubic feet	0·154	0·163	0·212	0·248	0·271	0·232	0·271	0·327	0·343

or by steam, of the most recent construction, some of them not yet finished; consisting of—

1. A series of sailing ships of all classes, from the "Queen"—a first-rate man-of-war—to a brig of 10 guns (146, p. 344, and illustration).
2. A series of screw-ships of various classes, from the "St. Jean d'Acre," of 100 guns, to a sloop of 12 guns.
3. A series of experimental frigates.
4. A series of experimental brigs.
5. Models of bows and sterns.
6. Transverse sections.

The Admiralty, by the comparative trials they have ordered, have contributed in a very high degree to the most recent progress of naval architecture. They have equally contributed to the progress of hydrography, as I shall explain when speaking of the maps presented to the Exhibition, which are included in this award of the Council Medal.

2. To Sir William Snow Harris (150, pp. 345, 346, and illustration). Science and humanity proclaim the merits of Sir W. Snow Harris's inventions. He has exhibited practical models of his system of attaching lightning conductors to the masts or hulls of ships, which has been for several years in general use in the British Navy.

As a means of preserving life and property from the effects of lightning, nothing has proved more completely successful and effectual than these conductors. The transmission of the electrical discharge from mast to mast, and finally from the conductors in the hull to the water, is perfectly effected under all circumstances, and in every position of the spars or of the ship when pressed by sail, and without demanding any care or attention on the part of the officers or crew. The mechanical arrangement of the plates forming the conductor, which is of great capacity, is such as to admit of their accommodating themselves to any flexure the spars can sustain, whilst at the same time they preserve a fair and continuous conducting line. The various branches or subdivisions in the hull allow of a free dispersion of the electrical agency in all directions to the bottom of the ship, and into the sea, by which the tension in any one point is so reduced that explosive action is next to impossible. For these reasons a Council Medal is awarded to Sir W. Snow Harris.

3. To His Grace the Duke of Northumberland (136, pp. 342, 343).—To the humanity of His Grace the Duke of Northumberland, to his unbounded liberality and generous encouragement of practical science, we owe the numerous efforts of able men to construct life-boats calculated to meet the perils of an ocean tempest. They must be easy to manage, in order to accomplish the great object for which they are designed, viz., the saving of life and property endangered by shipwreck. His Grace, with this philanthropic view, has expended some thousands of pounds in obtaining for the coasts of Northumberland, an improved class of life-boat, designed and built in consequence of the premiums the noble Duke has offered. Models of these very boats figure amongst the most valuable contributions to the Great Exhibition, and furnish a splendid example of liberality in the cause of humanity and practical science never surpassed, if ever equalled. Such are the motives under which we have judged His Grace the Duke of Northumberland worthy of receiving the Council Medal.

Prize Medals.

A. Ship-Building.—*British Department.*

The Honourable the Corporation of London, for illustrations of the art of ship-building for the commercial marine, almost all showing the greatest and most important improvements in strength, symmetry, and efficiency; and mostly coming from establishments within the jurisdiction of the port of London.

Mr. T. I. Ditchburn (30, p. 434), for models of paddle and screw steam-vessels, both wood and iron, designed and built by him for various services, including yachts.

Messrs. Green (131, p. 342), at Blackwall, for a model of the fine merchant vessels designed and built by them for the East India trade.

Messrs. C. J. Mare and Co. (149, p. 344) for models of fine sailing and steam vessels, both paddle and screw, designed and built by them for various merchant services, including yachts.

Messrs. Robinsons and Russell (193, p. 349), for fine models of steam-boats, designed and built by them.

The Royal Thames Yacht Club (294, p. 359), for models of the vessels belonging to their Club, which are of a most interesting character.

Messrs. Thomas and William Smith (305, p. 360), for a model of the fine merchant vessel designed and built by them for the East India trade.

Mr. Joseph White (36, p. 336), for fine models of vessels, designed and built by him for the merchant service, including yachts.

Messrs. T. J. and R. White (36a, p. 336), for models of fine sailing and steam-vessels, designed and built by them for the merchant service, including yachts.

Messrs. Money Wigram and Sons (56, p. 336), for models of fine classes of sailing and steam-vessels, both paddle and screw, built by them for various merchant services.

French Department.

M. Bardotin, captain of the French Navy (1083, p. 1230), for his improved capstan for ships of war, adapted to the use of chain cables.

M. Lahure, of Havre, Seine Inférieure (285, p. 1190), for an insubmersible boat for the use of the military and commercial services, combining very ingenious arrangements.

M. Le Goff, captain of a frigate in the French Navy (1083, p. 1230), for his powerful stopper in the management of chain cables.

M. Schneider, of Creuzot (1475a, p. 1246), for a large specimen of the machinery of the steam-boat "L'Ocean," built by him, for the River Rhone, by which great speed and convenience have been obtained.

M. Sochet, engineer of the French Navy (1478), for his valuable apparatus for distilling salt-water on board ships of war.

M. Rocher, of Nantes (991, p. 1226), for his large apparatus for distilling salt-water on board ships of war, and for his inexhaustible submarine condenser.

American Department.

Mr. S. M. Pook (446, p. 1464), and Mr. W. Darton (449, p. 1464), exhibiting through the National Institute of Washington, for several models of ships of war and large merchant vessels.

B. Various Objects connected with the Naval Service.

Mr. C. Ansell (185, p. 348), for a gunning punt, on a new principle, for fowling purposes.

The Rev. E. L. Berthon (104, p. 339), for models—1st. Of his patent perpetual log, for indicating the speed and leeway of ships. 2nd. Of his patent clinometer, for showing the inclination and trim of ships. 3rd. Of a collapsible life-boat, combining in its construction, strength, capacity, and lightness; and which under many circumstances might be found most serviceable, more especially in travelling over-land in a country where rivers have to be crossed.

Sir Samuel Brown, Capt. R.N. (334, pp. 331, 332), the inventor of the chain cables introdced in sea service, for suspension bridges and piers, and for a model of ingeniously disposed slips for the purpose of hauling up ships to repair.

Mr. Alfred Fox, for fine specimens of nets, seines, &c., for pilchards.

Mr. J. J. Groom, for fine specimens of deep sea fishing-lines and hooks.

Messrs. Jeffery, Walsh, and Co. (188, pp. 348, 349), for the marine glue, most successfully used as a substitute for pitch in the seams of decks, as well as for uniting large timbers for naval purposes.

Lieut. James Rigmaiden, R.N. (291, p. 359), for the model of his plan of lanyard plates for setting-up the standing rigging of ships.

Lieut. W. Rodger, R.N. (336, p. 361), for his very remarkable improvements in the form and proportions of anchors.

Mr. J. E. Saunders (Class XXIX.) for the model of a smack for fishing, fitted with an auxiliary screw propeller, being a new application to vessels of this description.

Messrs. J. and T. W. Simmens (124, p. 340) for the model of a "Mount's Bay" fishing-boat, which is a very fine description of boat for its purpose.

Mr. S. Smith (125, p. 340), for a model of a spring machine for modelling ships of any dimensions, offering an ingenious and ready means for setting up a design in model.

Mr. G. Tutt (Class XXIX., 185), of Rye, for the model of a "Hastings" fishing-lugger, which is also a very good description of boat for its purpose.

The following competitors for the prize of one hundred guineas, offered by His Grace the Duke of Northumberland, to mark our sense of the excellence of the models they furnish:—

Mr. James Beeching (136, p. 342), Mr. Henry Hinks (136, p. 343), Mr. William Teasdel (136, p. 343), Mr. J. Plenty (p. 343), Mr. E. Pellew (p. 342).

Pecuniary Rewards.—Mr. Joseph Bothway, for improvements in the construction of blocks combining strength with much less weight, and other advantages, 50*l*.

Mr. David Harvey (159, p. 346) for the excellent execution of the small model of the "Victoria and Albert," royal yacht, 40*l*.

Mr. Alexander Birnie, of Peterhead, for nets, lines, and hooks, 50*l*.

Mr. H. Dempster (174, p. 348) for an ingenious system of signals for merchant ships, 20*l*.

Messrs. Thomas Bibbs and Co., of Rotherhithe, exhibit a model illustrative of a novel arrangement of the frame timbers, with a view to increase the strength of the fabric of merchant ships, and add materially to their durability.

Mr. Joseph Weld (186, p. 348), of Lulworth Castle, shows a model of a 12-gun brig of war, with a view to obtain, scientifically, the advantages of speed.

Messrs. J. and J. Long and Co. (71, p. 337), present several plans of steering wheels of very simple construction, giving to the helmsman a perfect control over the rudder.

C. Nautical Instruments.

This Jury had but a part of the collection of "Philosophical instruments in use for the navy," left to its examination, the other portion being retained by Jury X.

We would particularly refer to an azimuth compass, coming from the Compass Department of the Admiralty (p. 344). This instrument, for making observations at sea, combines improvements in workmanship, suggested by long experience; the centering and adjustments are very good. This excellent piece of art merits a Prize Medal, but being a Government instrument no award has been made to it.

We award a Prize Medal to Mr. E. J. Dent (Class X. 55, pp. 413, 414), for his marine compass. It has long been a desideratum to construct a compass that should not be disturbed by the motion of the ship, or by the firing of the guns. One of Mr. Dent's compasses has been, by order of the Admiralty, repeatedly tried at sea, and particularly on board the "Excellent," as to the effect of cannon upon it. Even during heavy weather, with the sea any where *before the beam*, the reports are highly favourable. The firing of heavy cannon within nine feet of the compass had no visible effect upon it; whilst the ordinary compasses deviated several points. In boats, the same instrument has also been found particularly steady.

The particulars of this instrument are—first, excellent workmanship; its card is fixed upon a vertical spindle, instead of upon a pin resting in a cup, and it is retained in its horizontal position by the bowl having a pendulum action. The disturbing effect which both gravity and dip would have upon a magnet fixed on a spindle when out of the perpendicular, has been considered by Mr. Dent, and a compensating power applied. A second instrument of similar construction, but with a double needle upon gimbols in the centre of the spindle has been also presented by Mr. Dent, but it has not yet been tried at sea. Here the motion given to the needle, if duly balanced, seems to be an improvement.

A third instrument of Mr. Dent's, a portable azimuth compass, is worthy of notice as an ingenious invention to overcome errors in the centering of the needle, and in the direction of the magnetic axis as placed by the maker, by a method of inverting the box, not hitherto in use.

The Prize Medal is also given to Messrs. Napier and Son of Lambeth (Class VI., 158, p. 285), for an instrument for registering the magnetic course of a vessel as actually steered. The card, as usual, is placed upon a cup centred in a brass pillar; but this pillar, instead of being attached to the bottom of the bowl, protrudes, and is attached to machinery which partakes of the motion of the bowl. Every three minutes the pillar carrying the card is raised by the machinery, and the card receives a puncture from a fine point placed above it, in the direction of the ship's head, and attached to the bowl inside the glass cover, after which it descends immediately to its former position. In the course of twenty-four hours the point is drawn from the circumference of the card towards its centre, passing over twenty-four concentric circles which mark the hours; so that not only is any alteration of the course detected, but the hour at which it occurred is also shown by the card. This compass, with the aid of the log, may be said to form a traverse table of the ship's route for the day.

Honourable Mention is given to Mr. Hughes (Class X., 691, p. 472*), for his compass in spirits. Such an instrument has been found valuable in heavy seas during the firing of cannon, and especially in boats; but hitherto the necessity of leaving a space in the bowl (which has, until now, been of metal), has produced an injurious effect upon the needle and upon the steadiness of the fluid. Mr. Hughes has overcome this evil of the air-bubble by an elastic bottom. His instrument is further recommended by its cheapness.

American Department.

Mr. St. John* of Buffalo (95, p. 1439), deserves the Prize Medal for his compass, which, to the ordinary one, adds two small needles placed upon pivots over the east and west points, with indices pointing towards the centre of the card, and each having a graduated circle marked *E.* and *W.*, on either side of their zero points. These small needles are called *satellites*: their object is to show the presence of any disturbing force upon the needle, and also to indicate, by the mean of their readings, the amount of the deflection; but this last desideratum is not yet obtained. The invention is, however, new and ingenious, and if it could be improved in this respect, it would become an instrument of great practical importance on board vessels, especially in those of iron.

D. Instruments for Measuring the Rate of a Vessel through the Water.

One instrument of this kind is mentioned for an award in the section of Naval Architecture, and belongs to the Rev. E. L. Berthon.

Two other instruments for measuring the rate of a vessel through the water are due to Mr. St. John (542, p. 1468), who received a Prize Medal for his compass. One of his instruments consists of a rotator, which acts upon a spindle protruding through the bottom of a vessel by means of a copper cylinder in the hold rising above the water-line of the ship. The other consists of a small instrument connected with and disengaged from the ordinary log-line, by the turning of the glass which measures the interval.

Messrs. Elliot and Sons, of the Strand, London (320, p. 443), exhibit two small convenient instruments for measuring the rate of running water. They are very portable, and have been used by civil engineers with success.

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* This exhibitor has been awarded a Prize Medal by the Jury of Class X., in whose list his name appears.

E. Instruments for Measuring the Depth of the Sea.

A Prize Medal is given to Mr. **Ericsson**,* of New York (Cl. X., 146, pp. 1442—1446) for his instrument for measuring depths, by the compression of atmospheric air. It is a modification of the one known in the British Navy as *Ericsson's Sounding Lead*. Capt. Beechey, R.N., one of our fellow-jurors, made use of it for several years in a ship under his command; and experience has shown him that it was a good instrument when the depths were under 50 fathoms. Mr. Ericsson attributes the idea of his instrument to Mr. Agden. But seventeen years before it came out, Sir Humphry Davy's *water-bottle* was in use in the polar expeditions; an instrument upon the same principle, although greatly inferior to Mr. Ericsson's in the extent of its scale.

			Fathoms.
In 51 casts, extreme difference of Ericsson's lead from the truth			+2¼ −¼
In 47 ditto	ditto	ditto	+2¼ −1¼
In 49 ditto	ditto	ditto	+2½ −¾
In 47 ditto	ditto	ditto	+2 −1
In 48 ditto	ditto	ditto	+2¾ −0
In 51 ditto	ditto	ditto	+1¾ −½
In 51 ditto	ditto	ditto	+1½ −¼

All the depths here mentioned were under 50 fathoms.

F. Apparatus for Saving Life.

Having already awarded medals to the inventors of boats for saving men's lives and property, we have here to consider other means for effecting the same object.

1. *By effecting a communication to and from a Ship in peril and the Shore.*

We must, in the first instance, mention here Capt. W. G. **Manby**, R.N. (22, p. 335), so long known as the introducer and zealous promoter of the object of saving life from shipwreck, by means of firing a projectile, with a line attached to it, from the shore to the ship, which has been used with great success along the coasts of Great Britain, and has rendered remarkable service.

M. G. **Delvigne**, of France (473, p. 1200), employs a howitzer to obtain the same result as Captain Manby. This invention involves this new principle, that a portion of the line to be carried is contained *in the projectile*. The idea seems capable of successful application.

Captain **Jerningham** (21, p. 335), of the British Navy, has an anchor of a particular form, which he proposes to fire from a Manby's mortar, in sufficient numbers to afford the means of hauling a life-boat through the surf.

Prize Medals have been awarded to the above three Exhibitors.

Mr. **Greener** (59, pp. 336, 337) exhibits a method of discharging a rocket, with a line attached, from a harpoon gun. When discharged the rocket ignites, and is said to prolong the range to a greater distance than would be effected by either the gun or the rocket alone. The gun is distinguished for its lightness and efficient construction.

Mr. A. G. **Carte** (29, p. 335). This exhibitor has been distinguished by his great zeal in carrying out the object of saving life by means of a rocket. His plan is, to employ a war rocket, instead of the well-known rocket of Dennett.

2. *By means of Rafts, &c.*

Mr. W. G. **Rhind**, of Ross, Herefordshire (290, p. 359), presents various models of deck-seats and benches for steamers, so constructed as to be readily formed into rafts, each one sustaining eight persons. A Prize Medal is awarded to Mr. Rhind.

3. *By means of Buoyant Air tubes.*

Mr. S. W. **Silver** (195, p. 350), exhibits buoyant mattresses, manufactured according to Mr. Laurie's invention. Mr. Silver connects numerous waterproof tubes, partly distended with horse-hair, woollen flocks, or cocoa-nut fibre, in such a manner, that in case of accident happening to one or more of these tubes, the others may be sufficient to sustain the required weight on the water. The tubes are made up into mattresses, pillows, and also into floats, to be placed under the thwarts of boats.

A mattress, weighing only 17 lbs., sustains in the water 284 lbs. A pillow sustains 28 lbs. Mattresses for emigrant vessels, sold at 9s., sustained 96 lbs. in the water for five days, without being in the least affected. A Prize Medal is awarded to Mr. **Laurie** as the inventor (195).

Mr. A. G. **Carte** (29, p. 335), already mentioned, exhibits a very simple, cheap, and efficient life-buoy, which has been in general use since 1838, and is reported to have preserved 400 persons from drowning. A Prize Medal is awarded to Mr. Carte.

Messrs. **Esdailes** and **Margrave** (126, p. 340) exhibit floating mattresses, filled with cork shavings; worthy of praise.

PART II.

Military Engineering, Ordnance, Armour, and Accoutrements.

When I first visited Great Britain, very soon after the general peace in Europe, I found a very strong prejudice against the value of military institutions, and everything belonging to the army of this country. It may be easily conceived that foreigners would be anxious to learn everything connected with the navy; but nobody imagined that the land forces could present models deserving the closest attention of military observers. Having visited, however, the great arsenal of the Ordnance at Woolwich, the schools for the engineers and their troops at Chatham, and the school of the general staff at Farnham, I was deeply convinced that, on the contrary, Great Britain merited the most attentive observation in order to appreciate duly the high value of her land military forces, institutions, and exercises. At this period she possessed the best system of land-artillery, a system which united solidity, simplicity, security, and rapidity. The carriages for field-pieces allowed the gunners to be carried along with the guns, as rapidly as light cavalry, as well as the caissons which contained the necessary ammunition. All the wheels, before or behind, of every kind of carriage for the field batteries, being equal and identical, could be replaced most easily; the draft being more easy, and the overthrow of the carriage more difficult.

Such were some of the rare qualities, due to the exertions of General Congreve, of an artillery which all the military powers adopted very soon after a description of it had been published.* To General Congreve also is due the employment of rockets, in the army, as projectiles.† They wanted at first the most important quality of precision in the direction. A better construction by degrees overcame this difficulty. The French, the Germans, the Prussians, &c.; have studied this new kind of weapon, and tried the use of them in warfare; but not with very great effect.

Fortifications did not present novelties of so high a value, but still they deserved to be studied in Great Britain. Models of the ancient and new fortifications in Great Britain were presented to the Exhibition. No

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* This exhibitor has been awarded a Prize Medal by the Jury of Class X., in whose list his name appears.

* In the *Force Militaire de la Grande Bretagne*, Paris, 1820, 2 vols. 4to., with atlas.

† There were two Congreves, father and son: the former introduced great improvements in the construction of artillery carriages and *indicated* rockets. The son (the late Sir W. Congreve), undertook to develop their construction and application.

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inventions relating to the attack or defence of places have been sent in; so that we cannot speak of the merit either of officers or workmen employed in military engineering, however eminent they may be. We have, from other nations, some remarks to make on the subject of ordnance.

A. Cannon, and their Carriages.

The articles exhibited under this head are few in number. It has, apparently, been felt, that since it is the main object of the Exhibition rather to make known the progress and to promote the arts that add to the comforts and enjoyments of life, than the powerful and destructive engines employed in war, such engines are not in place here. Thus it is that France, so capable of illustrating all that relates to this branch of the art of war, contributes nothing, nor have the public departments of Great Britain sent anything. If from other countries we have received some articles that seem to belong to military warfare, they appear to have been sent rather as samples of manufacture and of materials, than for their original merits as instruments of war.

These observations are specially applicable to the very remarkable specimens of wrought-iron guns, presented by Spain and Turkey, not as the best pieces of ordnance that can be produced, but as very extraordinary samples of energy and ingenuity of production under circumstances of necessity and difficulty, where recourse could not be had to ordinary manufactories, and where these serviceable substitutes were provided with very imperfect means.

Spain has presented three pieces of cannon. 1st, a heavy brass 9-inch howitzer, weight 6,730 lbs., 8 feet long, cast at Seville, in 1849. 2nd, a 16-pounder field howitzer, of wrought iron, in weight 535 Spanish pounds, 4 ft. 8¼ inches English in length, manufactured in Biscay, in 1837, during the civil war. 3rd, a 9-inch mortar (à la Gomer), of wrought iron, in weight 475 lbs., also made in Biscay, in 1838. The second article is most worthy of notice, on account of the excellency of its materials and manufacture, though it is inferior to gun-metal, from its liability to oxidation at common temperature, and the action of the residuum of gunpowder, which is greater upon it than upon cast iron or on bronze.

Turkey has presented two wrought-iron field-guns, sufficiently light to be carried upon camels. Both these guns are forged iron damasked bars, in the manner of a gun-barrel. The execution of the work appears to be perfect, and the development of fibre upon the surface is very beautiful. Both are gold-vented; the smaller is circular in section; that of the larger is a polygon of 16 sides. They were forged at Erzeroum, in 1841, with many others, by order of Abbas Pacha, the Turkish Commander-in-Chief, after the loss of the greater part of his artillery at the battle of Nezib. They can only be regarded as a substitute, in time of necessity, for the proper material. But the skill necessary to produce the articles, and the workmanship, are remarkable.

Belgium has sent from its celebrated foundry at Liège, seven pieces of ordnance of cast iron, of the models of the following countries:—

	Pounder.		Kilog.	When cast.
Holland – –	30	of the weight of	2,746	1843
Prussia – –	24	,,	2,710	1849
Belgium, short	24	,,	900	No date.
Belgium – –	12	(model of the Marine)	1,670	1834
Belgium – –	6	,,	886	1830
Belgium – –	6-inch howitzer	–	520	1832
Belgium (Eprouvette mortar, cast on bed at 45°) – – – – – –			198	No date.

The 1st, 3rd, 5th, and 6th of these guns have been subjected to continued firing, and the number of rounds sustained by each is marked upon them, viz., the

		Rounds.
30 pounder (Holland) – – – – –		2,000
hort 24 ,, (Belgium) – – – – –		3,649
6 ,, (Belgium) – – – –	2,302	
After which the vent was renewed –	3,700	
Making in all – – –		6,002
6-inch howitzer – – – – – –		2,118

The vents exhibit a greater or less enlargement; but there is no description of the internal figure, nor are the particulars given of the charges or rate of firing. All these pieces appear to be well manufactured, and of very good material, and they are clean from the sand, without being turned.

Prussia has presented a 6-pounder field-gun, 5½ feet long, of a new material—native cast steel, forged by the hammer, mounted on a carriage of 3 feet size, and manufactured by Mr. **Krupp**, of Essen, near Dusseldorf. The merits of Mr. Krupp, and his ability in working iron and steel, are proclaimed, and will be enumerated in common with that kind of manufacture, as also his steel cuirasses; we merely mention here the remarkable beauty of the workmanship of the piece of ordnance alluded to.

Besides the above the Jury have noticed the following:—

Captain **Tylden**, R.A. (275, p. 358), has presented a series of fine models of the constructions of guns for the English service, on the scale of 1½ inch per foot, with a sea-service 13-inch mortar, a 10-inch howitzer, and 32-pounder gun, on garrison carriages, and a light 6-pounder field-gun and limber. These are all well executed, but without any novelty of construction.

Munro, J., Jun. (282, p. 358), two very correct and finely-finished models of a 9-pounder field-gun and limber, and a 24-pounder gun.

The Honourable East India Company (pp. 911, 912) have exhibited a series of models showing the construction of artillery used in the East Indies for siege and field service, on the scale of 1½ inch per foot. These models are well executed; but they do not appear to present any particular object of preference.

There are also several camel-guns, as well as some brass field-guns, of Indian construction, proper to illustrate the modes of Indian warfare.

The Hon. Captain **Fitz Maurice** (283, p. 358) exhibits two models to illustrate his mode of pointing, applied to a carriage-gun and a mortar, by means of a horizontal endless screw, acting at the segment of a wheel.

Messrs. C. A. and T. **Fergusson** (84, p. 338), of Mill Wall, Block and Gun-carriage Manufactory, two pieces of ordnance, mounted for sea-service, with particular dispositions.

B. Small Arms.

A great number of nations have sent small arms to the Exhibition; several of them such as are used for war, but by far the greater number being for sporting purposes. Three nations are prominent for the construction of small arms, the English, the French, and the Belgians. Small arms for war and for the chace, are manufactured at Birmingham, the one with due solidity, the others with refinements of workmanship. This last class is, however, sparing of ornaments.

Liège is the Birmingham of Belgium, and has a large manufactory of both kinds of guns. The Belgians, on account of cheapness, combined with good execution, sell a great quantity of small arms to other nations, particularly to Russia.

France, for the manufacture of small arms for war, is now perhaps more advanced than any other nation. St. Etienne, the town principally employed in the manufacture of muskets, has not sent anything of consequence to the Exhibition; in this it was very wrong. Paris is the best place for the fabrication of arms; here are combined all the perfection that could be desired for precision of firing, with beauty of ornament; the ornaments are very often designed by the best artists, and are executed with remarkable delicacy. We cannot enter into the details of the merits peculiar to each of the exhibitors who presented small arms, and shall confine ourselves to saying a few words under the names of each exhibitor to whom a Medal is awarded.

United Kingdom.

Prize Medals:—

Brazier, J. and **Son**, Wolverhampton (246, p. 352). Excellent locks for best guns.

Deane, Adams, and **Deane**, London (223, p. 352). Double and single guns and pistols, perfectly finished.

William Greener, of Birmingham (59, pp. 336, 337). Guns very well made, harpoon guns, for whale fishery, &c.

Col. P. Hawker (205, p. 352), for improvements and perfection in punt-guns.

Lang, J., London (226, p. 354). The same merit in the fabrication of their arms.

Mr. T. E. Mortimer, Edinburgh (267, p. 358). The same kind of arms, equally well executed.

Mr. Henry Needham, London (260, p. 358). Guns, rifles, and pistols, carefully executed.

Mr. W. Parson, of Swaffham (270, p. 358). The same merits as the two preceding gentlemen.

Reeves, Greaves, and Reeves, Birmingham (244, p. 355). Beautiful collection of swords and other field arms, admirably embellished.

Richards, Westley, & Son, Birmingham (240, p. 355.) Best guns and sporting guns, of excellent quality.

W. and J. Rigby, Dublin (236, p. 354). The same merits as Trulock.

E. Trulock and Son, Dublin (222, p. 353). Best guns and pistols, of good workmanship, highly ornamented and finished.

Wilkinson and Son, London (200, pp. 350-352, and illustration). Best guns and rifle pistols, of good workmanship, and swords highly ornamented and finished.

Honourable Mention has been accorded to—

Thomas Fletcher (255, p. 357). Guns, rifles, and pistols.

William Grainger (278, p. 358). Locks for guns.

Manton and Son (217, p. 353). Guns, rifles, and pistols.

Robert Mole (248, p. 356). Swords, side-arms of all kinds, and sword-blades.

T. H. Potts (207, p. 352). Guns, pistols, and rifles.

Powell and Son (249, p. 356.) Guns, rifles, and pistols.

Tipping and Lawden (247, p. 356). Guns, pistols, and rifles, and collection of trade arms.

Witton and Daw (203, p. 352). Guns and rifles.

United States.

Honourable Mention is awarded to—

Rifles and pistols, of very good quality, by Mr. Samuel Colt, Hartford (321, pp. 1454, 1455, and illustration); Messrs. Robbins and Lawrence (328, p. 1456); and Mr. W. R. Palmer (347, p. 1457).

Austria.

Honourable Mention is awarded to—

Deutscher (114, p. 1013), for a Tyrolean target rifle; and A. C. Kehlner's Nephew (116, p. 1013), for pistols mounted in carved ivory stocks, with accessories.

Belgium.

The undermentioned are deemed worthy of the Prize Medal:—

MM. Ancion and Co., Liège (143, p. 1156). A complete and varied collection of arms, very meritorious in a manufacturing and commercial point of view.

MM. N. Bernimolin and Brother, Liège (150, p. 1156). The same exhibition as the two former gentlemen.

M. A. Jansen, of Brussels (139, p. 1156). Collection of sporting and ornamental guns.

M. N. C. Lardinois, Liège (151, p. 1156). A target rifle, of first-rate workmanship, with accessories of every kind, unusually well fitted and adjusted.

M. Lepage, Liège (145, p. 1156). The same exhibition.

M. N. Plomdeur, Liège (146, p. 1156). Best guns, rifles, and pistols, of faultless manufacture.

M. Renkin, Brothers, Liège (141, p. 1156). Numerous collection of sporting and ornamental guns.

M. H. Tourey, Liège (155, p. 1156). An ornamental double gun, the master-piece of a gun-maker; guns and arms of excellent workmanship.

Honourable Mention is accorded to the following:—

Falisse and Trapmann (154, p. 1156), for specimens of military fire-arms; collection of nipples.

L. Malherbe (147, p. 1156), for collection of ornamental and sporting guns.

J. Thonet (144, p. 1156), for a double gun.

J. M. Tinlot (152, p. 1156), for a double gun.

France.

The Prize Medal has been awarded to the following Exhibitors:—

M. Bertonnet, Paris (58, p. 1174). Sporting guns and arms, carefully executed.

M. F. Claudin, Paris (1057). Best guns, rifles, and pistols, of faultless execution.

M. Devisme (166, p. 1181). Sporting guns and arms, executed remarkably for taste and goodness of workmanship.

M. Gastinne-Renette (1611, p. 125). Guns, carabines, and pistols, of very good workmanship.

M. Gauvain, Paris (1612, p. 1254). Pistols, admirable in form and execution; sporting guns of excellent quality.

M. H. Houllier Blanchard, Paris (1628, p. 1255). Pair of pistols, with accessories, chased and encrusted with gold, with a case richly sculptured, in boxwood, showing an extraordinary degree of perfection in workmanship.

M. Leopold Bernard, Paris (1547, p. 1250). Double and single-barrelled guns of beautiful damask, and of excellent workmanship throughout.

M. Lepage-Moutier, Paris (1364, p. 1241). Sporting guns, of excellent quality, ornamental guns of exquisite workmanship, swords and side-arms of the Duc de Luyne's damask, of remarkable novelty; bucklers and objects of art.

The under-mentioned have received Honourable Mention:—

M. F. Berger, St. Etienne (418, p. 1198). Fancy fowling pieces, of various kinds, of excellent workmanship.

M. B. Beringer, Paris (1546, p. 1250), for good fowling-pieces.

M. Albert Bernard (1075, p. 1229). Excellent Damascus gun and pistol barrels.

M. Delacour (1582, p. 1252). Swords and sabres, imitated from various countries, &c.

M. Prelat, Paris (1681, p. 1257). For collection of pistols, ornamented.

Zollverein.

Prize Medals are bestowed on the following:—

Messrs. A. and E. Holler[*], of Solingen (637, p. 1085). Large and varied collection of swords, blades, and side-arms, of great excellence.

M. Carl August Fischer, Lübeck (5, p. 1141). Double-barrelled rifles and fowling-pieces.

The under-noted exhibitors are Honourably Mentioned:—

Schnitzler and Kirschbaum, Solingen (480, p. 1078). Infantry and cavalry swords, &c.

Schmolz, Wm., and Co.[*], Solingen and Berlin (673, p. 1087). Collection of swords.

W. and G. Pistor (481, p. 1078), for a rifle for carrying pointed balls.

M. C. V. Heinlein, Bamberg, Bavaria (20, p. 1099). A rifle, carved and ornamented in the old German style.

J. A. Kuchenreuter (21, p. 1099), for pistols.

MM. Weber and Schultheis, Frankfort-on-the-Maine (6, p. 1121). Single and double-barrelled rifles.

M. I. Schmidt, Mecklenburg-Schwerin (2, p. 1134). Guns of good workmanship.

Spain.

Don E. Zuloaga, of Madrid (264a, p. 1346), is rewarded with the Prize Medal for his fire-arms and pistols, most magnificently chased, engraved, and incrusted with gold ornaments of very graceful designs.

Royal Manufactory of Toledo (266, p. 1346) is honourably noticed for sword cutlery, richly ornamented.

Switzerland.

M. V. Sauerbrey, of Bayle (68, pp. 1270, 1271), obtains a Prize Medal for a large rifle, mounted, fitted, and furnished in the most perfect manner.

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[*] These exhibitors have been awarded Prize Medals by the Jury of Class XXI., in whose list their names appear.

Honourable Mention is made of—

M. **Jeannet**, of Locle, Canton of Neufchâtel (5, p. 1265), for a rifle with steel barrel.

M. **Fischer**, of Chur (265, p. 1283), for a double American rifle.

J. **Vannod** (69, p. 1271). Target rifle.

C. Tents.

A Prize Medal is given to Mr. B. **Edgington** (302, pp. 359, 360) for the tents exhibited by him. One is 12 feet by 8, with poles 6 feet high, proposed for officers or emigrants. Another is for troops, travellers, or emigrants, 12 feet square, supported on one centre pole, like the round tent of the British service; but its figure is a pyramid, instead of being a cone. The angles are strengthened from the head of the tent by 1-inch tarred rope, to which the canvass is bolted, and which, being secured to strong pegs in the ground, constitutes the principal support of the tent. In the middle of two opposite sides a sort of porch is formed, sustained by a light 6-foot pole, giving entrance to the tent, and affording the great advantage of a thorough draught of air. It is also ventilated at the top, and the orifices secured against the entrance of rain. The centre pole, which is 9 feet 10 inches long, divides into three parts, the small ones into two, and the whole packs into a valise 40 inches long, by about 13 inches in diameter, the weight of which is 86½ lbs. The two porches and the very complete ventilation they afford are improvements of great value, particularly for the sick, when the large hospital tents are not carried.

Mr. Edgington proposes, for military use, to employ bleached canvass, and to tan it, for preservation from mildew, a measure deserving of consideration. To his larger tent he has attached a portable stove and cooking apparatus, well adapted and arranged for the use of emigrants, but not so portable as necessary for military service.

D. Defensive Arms.

A Prize Medal is given to M. **Fried Krupp** (677*, p. 1087), of Essen, for having exhibited a cuirass of German native cast steel, the material of which is so much improved by manufacture as to attain a high degree of resistance to the balls of fire-arms, though it has not yet been determined whether this resistance exceeds that which would be afforded by cast steel made from cemented steel. M. Krupp's success, however, is deserving of reward.

PART III.

Military, Naval, and other Maps.

This Jury has been charged with the care of examining the various kinds of maps executed in consequence of surveys made for naval, military, or geological purposes.

The Council Medal is awarded to the **Admiralty** of **Great Britain** (p. 344), under whose superintendence and directions accurate surveys have been executed, not only of the coasts and ports of the three kingdoms, but of the coasts of the greatest part of the globe.

Drawings of great accuracy are executed, according to these surveys, by the Hydrographical Board under Admiral Beaufort. Afterwards, maps confined to the indications that are indispensable for navigation are published and sold at a very cheap rate to the officers of the merchant service.

It is understood that the Council Medal granted to the Admiralty for models and improvements in ship-building, with the combination of the forces of wind and steam,—and for the improvements of the azimuth compass,—shall be united with the same award for the eminent services rendered by the surveys, calculations, drawings, and publication of hydrographic maps, under the direction of the learned and liberal Hydrographical Department of the Admiralty.

French Department.—The science and practice of hydrography owe much to France, having been brought to perfection by the celebrated Beautemps Beaupré. Hydrographic maps were undertaken from surveys made by the celebrated hydrographer, M. Beautemps Beaupré, in the time of the Emperor Napoleon, along the coast of Flanders. For thirty-five years afterwards that undertaking was continued along the French coasts of the ocean, and the Mediterranean, including Corsica and Algeria. The French survey presents the most complete description of the shores, and of the ground under water, for a great distance, with the configuration of any existing danger. The calculations were carried on, as well as the survey, with the help of the hydrographers' staff, under the direction of M. Beautemps Beaupré, and with the utmost precision; the drawings, as well as the engravings, are worthy of this notice. It was in this way that the magnificent Atlas, or "Neptune of the Coasts of France," was produced, the finest specimens of which have been presented to the Exhibition.

The Council Medal to be delivered to the **Dépôt Général de la Marine** (128, p. 1177, France) in Paris, as an acknowledgment of the scientific labours evinced in the hydrographic surveys of France, and also of those of M. Beautemps Beaupré, and the engineers associated with him.

M. C. E. **Collin** (426, p. 1177), the engraver of the Hydrographic Dépôt of France, has exhibited maps in his own name, very remarkable for the skilfulness and accuracy of their execution. The Prize Medal is granted to him.

The Ordnance Department of Great Britain, having the command and direction of the scientific bodies of artillery and military engineers, was, very properly, charged with all the operations necessary for the survey, calculations, and drawings of the land map of the three kingdoms. This vast enterprise is now in a state of great forwardness, and is one of the scientific monuments most worthy of the British nation. For the copperplate etchings, and for the use of electrotype process in reproducing the plates, our eulogium is justly due to the establishment at Southampton, where they are executed.

The Council Medal is granted to the **Ordnance Department** (128, pp. 341, 342), who exhibited the maps, as a just and honourable tribute to the meritorious and scientific officers of that department who prepared them.

A map of England and Wales, engraved by himself, is exhibited by Mr. **Cruchley** (74, p. 541). The map is on a scale of half an inch per mile.

The French Minister at War has presented numerous sheets of the new map of France.

The French map of Cassini was as perfect and complete as such an undertaking, by a single person, could be; this map, already more than a century old, no longer represents the superficies of a country in which such enormous changes have taken place. As early as 1816 a scientific commission, under the presidency of the illustrious Laplace, planned the undertaking of a new and improved map of France; combining the most precise astronomical observations with an accurate general triangulation. Two parallel lines were measured, the one from Brest to Hungary, through Strasbourg; the other, following upon the globe the *parallèle moyen*, was carried to the south of France, and continued through Italy to Fiume. These lines, accurately calculated, spread new light upon the figure of the earth.

In the French map each place of importance is given with three elements, necessary to determine its complete geometrical position, the longitude, the latitude, and the altitude above the level of the sea.

The operations were at first executed by the body of Military Geographers; but this body having been united to the Corps Royal d'Etat Major, they continued, under a new title, their scientific undertakings; some of them going upon the ground, each summer, and returning to the Dépôt de la Guerre, to complete the calculations, and execute the drawings.

The map of France is justly admired for the beauty of the engraving, and the system of etching, by horizontal lines, which prevents all confusion to the eye, and gives the best idea of the form of the ground.*

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* This exhibitor was awarded a Council Medal by the Jury of Class I, in whose list his name appears.

The Council Medal is granted to the DÉPÔT DE LA GUERRE (804, p. 1219), in Paris, for the scientific body employed in executing the land map of France.

Austria has presented maps of Italy and of the Duchy of Austria, equal to the best of England and France. Indeed, the maps of Italy were undertaken by the French when they were possessors of that peninsula.

The Council Medal is granted to the MILITARY GEOGRAPHICAL INSTITUTE (363, p. 1028, Austria), Vienna, which presents the maps.

Geological Maps.—Some years ago, Mr. Greenough, a distinguished geologist, executed a geological map of England upon a scale not larger than that of France. Sir Henry De la Beche had the courage to undertake a new geological map upon the great scale of an inch per mile. This large size rendered it possible to add scientific information in the ordinary map, to present in great detail the nature of the stratifications, to apply his map to agricultural, metallurgical, and mining studies, and to give the delineation of the metalliferous and other veins. Sir Henry De la Beche, alone, executed the geological maps for Cornwall, Devonshire, and a part of Glamorganshire. An official *corps des mines* was subsequently created, under the direction of Sir Henry De la Beche, with the name of "Geological Survey," which directed and continued the great geological survey of the three kingdoms. Sir Henry De la Beche being the superintendent of Jury I., to whom this subject naturally belongs, the adjudication on the merits of the geological maps was transferred to Jury VIII. at our request.

The Council Medal is given to the GEOLOGICAL SURVEY (159, Class I., p. 137), in honour of the excellence of the work and of the staff of officers charged with the execution of the map, under the direction of Sir Henry De la Beche.†

The geological map of France, a public undertaking, has been executed by the "Corps National des Mines," and we must add, principally, by two members of the Institute of France, both General Inspectors of this body, MM. Dufrenoy and Elie de Beaumont. M. Dufrenoy, one of our French Jurors, was charged with the north-eastern part, and M. Elie de Beaumont with the south-western part of France. Both employed thirteen years in exploring the ground, and four years in the labour of the cabinet, as well as in the classification of more than 30,000 specimens of minerals which they collected in their local investigations, for which they travelled more than 40,000 miles on foot.

The French geological map, executed on a scale of $\frac{1}{500000}$th, is an excellent reduction of the great official map of France. The Geological Society of London, considering the great importance of such a scientific undertaking, granted their quinquennial Wollaston Medal to its authors.

The Council Medal is granted to the ECOLE DES MINES, in honour of the Corps National des Mines, whose engineer executed the map of France.

M. DE RÉNÉMEUIL, the ingenious foreman of the Lithographic National Press of France, was the inventor of the excellent process for colouring maps. He deserves the Prize Medal now granted to him.

The principal geological maps were coloured by the hand, but the *chef de la lithographie* at the National Press at Paris, has discovered so simple and ingenious a proceeding for colouring with the press, that all is done now by machine process. So perfect, indeed, is the operation, that, with a magnifying-glass, the colours are seen to follow rigorously the lines forming the limits engraved upon the map; and in no part do the colours exceed or remain behind that limit.

DUPIN, REPORTER.

Paris, November 1851.

APPENDIX.

SWEDISH GUNS.*

The articles belonging to this Class, recently sent from Sweden, comprise—

1. A cast-iron shell-gun, of 8·9 inches calibre (English), and 9 feet 6 inches long, made on the construction of Baron M. von WAHRENDORFF, to load at the breech, and mounted on a carriage and slide, also of cast iron, adapted to a casemate. The gun is in weight 9,671 lbs. Swedish (Victualie Vigt), or 81 cwt. 0 qr. 4 lbs. English, and is marked Aker, 1850, No. 4. The charge and weight of projectile are not stated, but the gun is understood to be intended for spherical projectiles, and is not rifled. According to English proportions, the solid shot would weigh about 94 lbs., and the shell 70 lbs.

2. A cast-iron Swedish 6-pounder field-gun, 5 feet 5¾ inches long, and in weight 856 lbs. Swedish, V. V., equal to 7 cwt. 0 qr. 19 lbs. English.

3. A Danish 6-pounder field-gun, also of cast iron, 5 feet 3½ inches long, and in weight 931 lbs. Swedish V. V., equal to 7 cwt. 3 qrs. 6 lbs. English.

Both these guns are from the iron-works of Aker, and bear the date of 1851.

4. Two models of 12-pounder and 6-pounder field guns, with limbers and ammunition-boxes, &c., complete, on a scale of one-eighth.

5. Lastly, the model of a 30-pounder long gun, on a carriage and slide of wood, for casemates, also on a scale of one-eighth.

Shell-Gun.—The chief condition on which this gun has been constructed (next to that of loading at the breech), appears to be that its recoil should be very limited, and that it should not require to be run up. It is accordingly mounted on a cast-iron carriage and slide well suited to those conditions, and of ingenious construction, traversing on a pivot placed about 18 inches in front of the head of the slide, and therefore in the throat of the embrasure. The axis of the gun is four feet from the ground, and the total length of slide from its head to its extremity (being the distance it would occupy in a casemate), is rather less than 10 feet, or from the pivot 11 feet 6 inches. The extreme breadth of carriage and slide is in front 2 feet 10½ inches, and in rear 3 feet 2 inches.

The weight of the carriage is 5,215 lbs. Swedish V. V., or 43 cwt. 2 qrs. 12 lbs. English, and that of the slide 3,537 Swedish V. V., or 29 cwt. 2 qrs. 6 lbs. English. The gun and carriage together being 124 cwt. 2 qrs. 16 lbs. English.

Though not requiring to be run up, the gun is not on a non-recoil principle, the slide being so constructed as to admit of a motion of the gun and carriage when fired, of about 3 feet 6 inches, which at first is horizontal, and then for about 3 feet on an inclination upwards of 12½°, by means of which the force of recoil (the weight moved be 6¼ tons nearly) is gradually resisted and overcome. From the point to which the gun and carriage is thus raised, it descends by its own weight, and, after a few inches horizontal motion, is received by an elastic cushion, formed of sheets of birch bark, placed vertically, and therefore perpendicularly to the direction of the force, making a thickness of 9 inches. By this cushion all the remaining motion is absorbed. The angle of resistance of cast-iron on cast-iron being about 9¼°, and the motion of the descent ending horizontally, the impression on the cushion is rendered moderate, and all shock is avoided. The surfaces or bearing points, on which the carriage rests upon the slide, are cylindric, of about 3½ inches radius.

A carriage and slide of the same description as that exhibited, but carrying a 32-pounder gun of Baron Wahrendorff's construction, was tried at Shoebury Ness, in 1850, with 30 rounds, at 5°, 10°, and 15°, and stood perfectly well. It is, however, probable, that the motion of so great a weight, on surfaces of very limited extent, would, in time, cause the latter to become disintegrated, and to require renewal.

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* Already 145 sheets are published, 63 are in the hands of the engravers, 52 more will conclude the work; so that it will present 260 atlas sheets when complete.

† The "Museum of Practical Geology" possesses rich and unique mineral collections, furnished by the three kingdoms, and put in the most excellent order by Sir Henry De la Beche, who opened the Institution to the public shortly after the opening of the Great Exhibition.

* The subjects introduced in this Appendix arrived after the dispersion of the Jury of Class VIII.

Altogether the arrangement of the carriage and slide, apart from the consideration of the material, and the strong objections to it which exist, is very ingenious; but its value is obviously entirely dependant on the question to which it is subordinate—whether or not there is any advantage in loading at the breech.

On this point a very decided opinion has been formed in this country. In 1842, trials took place of two 24-pounder guns of Baron Wahrendorff's construction, similar to that exhibited before the Select Committee at Woolwich, and on board Her Majesty's ship "Excellent," at Portsmouth; the result of which was the opinion that there would be no advantage in adopting such a gun into Her Majesty's service.

More recently, in 1850, the trial above mentioned, of a 32-pounder gun of Baron Wahrendorff took place, followed by an extended trial of another 32-pounder to load at the breech, proposed by Major Cavalli, of the Sardinian Artillery, and constructed at the works of Baron Wahrendorff, in Sweden, from whose method it differs in the mode of closing the breech by a flat, instead of a cylindric plug, transverse to the axis; in being rifled, and in carrying a hollow projectile of a cylindro-conical figure of 64 lbs. weight, or double that of the round shot of the same calibre. Major Cavalli's carriage and slide, like that of Wahrendorff's, were both of iron, but differed from one another in some details not necessary here to refer to.

The views of Major Cavalli are fully explained in his "Mémoire sur les Canons se chargeant par la culasse, et sur les Canons rayés," published in Paris, 1849. After a long course of experiments at Shoebury Ness, in 1850, with a gun of his construction, which showed by the increase in the weight of the projectile a very considerable increase of range might be obtained, but no other material advantage, the experiment came to an end by the whole breech of the gun flying off in one piece, giving way at the passage of the transverse plug by the explosion of the charge. In reference to this result, it should be observed, that the construction of Wahrendorff has greater solidity, and is superior in strength to that of Cavalli.

The Committee, after giving the whole subject a very careful consideration, adhered to the opinion expressed in 1842 on Baron Wahrendorff's 24-pounders; and with reference to those of Major Cavalli, they came to the conclusion that guns loading at the breech cannot be considered safe, and that those in question were in their essential qualities "greatly below the ordinary guns of the service."

It appears, however, that in Sweden, Baron Wahrendorff's construction has to a certain extent been adopted; and that the fortress of the island of Waxholm, which forms one of the defences of the approach to Stockholm, is armed with guns in casemates, similar in all respects to that sent to the Exhibition.

Without doubt, then, the Swedish artillery must have become satisfied that this construction possesses advantages over that in ordinary use. Yet it is not evident in what these consist, more particularly when, apart from the question of the resistance of the material, so great a danger is always present as the possibility that the breech has not been securely closed. To ensure this operation in the heat of action must demand great care and attention, for which *time* is necessary; and it would seem to be requisite that it should be performed by the man who fires. Looking at all the operations to be performed, it does not appear likely that any material advantage can be gained as to rapidity of fire. And in respect to the number of men required, they cannot well (making no allowance for relief) be less than three per gun, a number which is sufficient to keep in action a gun of the ordinary construction, and of similar weight.

Upon the whole, admitting the arrangements by which Baron Wahrendorff closes and opens the bore to be most ingenious, they undoubtedly render the gun to which they are adapted much more liable to derangement and interruption than can happen to those usually employed. And since the effect of heavy artillery depends infinitely more on *precision* than on *rapidity* of fire, it would clearly be preferable, supposing (which, however is not apparent) that there is an advantage in facility of service, to arrive at the same quantity of fire by an increase in the number of the guns, rather than to rely upon a mechanism liable to be put out of order, and that possibly may thus become fatal to those who use it.

In material, Sweden possesses advantages in the great strength and resistance in the cast iron produced from the pure and rich mineral, smelted by wood charcoal, that she employs, which no other country can command; and were we in England to attempt, with the cast iron from the coal formation, the same forms and dimensions as those employed in Sweden, we should, without doubt, encounter still more frequently the same result as attended the trial of Cavalli's gun.

This observation does not, however, in any way detract from the merit of Baron Wahrendorff's constructions sent to the Exhibition, which must be admitted to be of great ingenuity and interest; and taking it for granted that his guns have been submitted in Sweden to trials that have proved satisfactory, they solve an important problem.

Whether, however, these constructions, and that of the gun in particular on which they are dependant, are such as may be generally and advantageously applied, is another question, into which it does not seem necessary further to inquire.

No drawing or papers have been transmitted to show the construction of the casemate and embrasure in which the gun is mounted, but it may be presumed that they resemble, more or less, those of Cavalli's system.

Iron Field-Guns.—The Swedish and Danish cast-iron field-guns are excellent samples of those which are employed in their respective services, in which they are preferred to brass, and with good reason, so far as the more perfect preservation of the bore and consequent accuracy of fire, are concerned. The bore and vent, however, require to be carefully attended to and protected from oxidation. The weight of the Swedish gun is a hundred-weight and a few pounds more than that of the English brass light six-pounder; but the former is 5¾ inches longer, and the bore 16 inches larger than the English gun. The shot is consequently heavier, and the charge of 2 lbs. Swedish exceeds by 7 ounces that of the English gun. Cast-iron field-guns have been in use in the Swedish service since 1805, and recently their horse artillery, who were armed with brass guns, have exchanged them for iron.*

There seems no reason to doubt that cast-iron field-guns of so excellent a material as Sweden produces, may in many climates replace those of brass of the same weight; but within the tropics, and where they could not receive continued attention, the action of the atmosphere and of the sea-air would render them less durable in the vent and cylinder than brass.

Models of Swedish Field-Guns.—These models, extremely well executed by **Bergquist**, an artist of Stockholm, exhibit in wood and iron, and in full detail, the peculiar construction of the Swedish field-artillery, as established in 1831. They show all the arrangements of the draught, and the method of attaching to the limber which gives a power of locking round, or of altering the direction of the march, of 80°. They are very deserving of attention.

30-pounder Long Gun on a Carriage and Slide for Casemates.—This model, by the same artist, and on the same scale of one-eighth as above, is also very well executed, but presents no mechanical feature of importance. It is on a front pivot, and has ingenious mechanism for traversing by a small wheel and winch, within the hind trucks; but this refinement is not wanted, and there is altogether a character of complexity that does not properly belong to machines for military use. The gun appears to be 10 feet 2 inches long, and the whole length of slide is 14 feet 10 inches.

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* Jacobi, Etat actuel de l'Artillerie de Campagne Suédoise. Paris 1849.

CLASS IX.

REPORT ON AGRICULTURAL IMPLEMENTS.

[Her Majesty's Commissioners consented that this Report should be published in the "Journal of the Royal Agricultural Society," a Committee appointed by that body having acted as the English portion of the Jury. It accordingly appeared in the Number published in January 1852. The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE and ILLUSTRATED CATALOGUE.]

Jury.

P. PUSEY, M.P., F.R.S., *Chairman and Reporter*, Pusey, near Farringdon.
Col. CHALLONER, 11 Charles Street, Berkeley Square.
B. T. BRANDRETH GIBBS, Half-Moon Street, Piccadilly.
A. HAMMOND, Westacre, Swaffham, Norfolk.
BETHMAN HOLBEG, Zollverein.
B. P. JOHNSON, United States; Secretary of New York Agricultural Society.
JOSH. LOCKE, M.P., F.R.S., 6 Chester Terrace, Regent's Park.
C. M. LAMPSON, United States.
Professor HLUBECK,* Austria.
W. MILES, M.P., Leigh Court, near Bristol.
L. C. E. MOLL, France; Professor of Agriculture at Conservatory of Arts and Manufactures.
Baron MERTENS D'OSTIN, Belgium.
Professor RAU, Zollverein; Professor of Political Economy.
J. VILLIERS SHELLEY, Maresfield Park, Sussex.
H. S. THOMPSON, Moat Hall, near York.

* Chevalier DE KLEYLE, Proxy for Professor Hlubeck.

Associate.

Sir JOSEPH PAXTON, 36 Gloucester Place, Portman Square.

IN endeavouring to fulfil the command of your Royal Highness, that each Reporter should describe, as to its general state, the branch of industry which falls within his department, my task will lead me not to balance the claims of rival inventions, which are far better shown by the results of the trials given in the words of my colleagues, nor yet to portray their construction, which can hardly be conveyed in words, or even by drawings, but to state plainly, if I am able, the practical effect of agricultural machinery upon the soil or its products; and so, it may be, to further the designs of that Exhibition which your Royal Highness purposed not for a gorgeous spectacle only, but, as it has worked itself out, for a focus in which the various nations might combine and compare their scattered rays of realised knowledge.

As our implements are intended not to bring about new conditions of soil, nor to yield new products of any kind, but to do with more certainty and cheapness what had been done hitherto by employing the rude implements of former centuries, certainty and cheapness of action are evidently the standard by which their merits have to be tried, and chiefly the latter property, which forms the superiority of the spinning-jenny over the distaff, namely, economy.

The yearly shows and trials of the Royal Agricultural Society have certainly done more in England for agricultural mechanics in the last ten years than had been attempted anywhere in all former time. Yet, though the inventions are many, they may be reduced to a few simple classes: in reviewing those classes, it will be most convenient perhaps to follow the order of cultivation, beginning with the instruments of tillage, and, among these, with the plough.

I. INSTRUMENTS OF TILLAGE.

1. *Plough.*

It was found about twelve years ago that in many parts of England ploughs drawn by four horses were still used, while in the same neighbourhood, or even parish, other ploughs were at work equally easy for two horses. The cumbrous plough, resting on a heavy gallows and wheels, had been adapted to the clay soils when those soils were the chief source of corn to the country, and had been handed down from father to son, after the heavy lands had been widely laid down to grazing ground, and the former downs had become our principal arable land. Not only, however, did these obsolete monuments survive—it was also discovered by Mr. Handley, that the inventors of new ploughs, by rejecting the wheels as well as the gallows, had produced, especially in the north, a plough which, though fashionable under the name of swing plough, had little advantage in draught over the ancient one. It was Messrs. Ransome who furnished the modern English plough with two low wheels, and with mould-boards adapted to different soils. Messrs. Howard further improved the mould-board. The mould-board, indeed, which raising each slice of earth (furrow slice) from its flat position gradually through an upright one, lays it over half inclined on the preceding slice, is the essential acting part of the plough. It should perform this spiral transfer of a very rough material with an equal pressure both crossways and lengthways. The true shape is founded on mathematical laws, but, as in a somewhat similar case of displacement, that of water by the bow of a yacht, is doubtless best determined by actual trial. The test of perfection in the work of a plough is, that the furrow-slice shall lie, after being turned over, in a perfectly straight line, not only unbroken, but even uncracked. It is by patient attention to this point that Mr. Busby, with the aid of an excellent farmer, Mr. Outhwaite, produced the beautiful mould-boards of his prize-ploughs. This unbroken furrow-slice requires some length of mould-board; and it is urged, on the other hand, in behalf of short mould-boards, that they pulverise the soil while they turn it over. Practical farmers, however, know that to pulverise is not the immediate object of ploughing land; but as the length of the English mould-boards surprised foreigners, it may not be useless to state a further reason for that apparently excessive length. Ours also were, in fact, made short and hollow for our new ploughs, until at one of the Royal Agricultural Society's trials all the selected ploughs were brought to a stand in attempting to work a strong clay. The cause of the failure was this: the chief resistance to the horses in ploughing proceeds not from the weight of earth moved, which is insignificant, nor, unless the ground be unusually baked, from the act of severing the earth, but from two other causes, namely, friction, and on certain soils still more from cohesion. Now, if the soil contain sharp sand, there will be no cohesion; it will work freely off the mould-board, which will be kept bright, and the shorter its surface the less will the friction be. For such soils, therefore, as are common in Scotland short mould-boards may be the best. But most English soils contain so much clay as will adhere to and fill up the hollow of a short mould-board, so that the furrow-slice will have to work not upon an iron surface, but upon the most disadvantageous of all surfaces, one of rough loam, and the draught may thus be easily doubled by friction and cohesion together. Hence, our English mould-boards have been very properly lengthened, the more properly, I suppose, because the same soil will more often have to be worked in a moist state here than in continental Europe.* Many of the foreign ploughs, it should be said, behaved, under all disadvantages, exceedingly well, and were, no doubt, better suited than ours for their respective localities.

Ploughing, itself, is certainly a singular instance of great skill acquired by a body of men who scarcely, as was remarked by Lord Ashburton, receive the credit due to that skill. A good ploughman will set up a pole a quarter of a mile distant or more, and keeping this mark, almost invisible, steadily in his view, will, on land perfectly smooth, trace up to that goal, until his horses knock it down as they pass on each side, a furrow so true that no eye can detect any divergence from absolute straightness. If one saw for the first time a field of short green clover converted in a few hours into a surface of clean brown soil in regular ribs, it would be regarded as a triumph of art. I mention this, the rather because in speculative writing, the plough is sometimes depreciated, and the spade is extolled, though this very operation of preparing our wheat land could scarcely be executed at all by spade, since it is necessary that the existing sward should be perfectly buried. The caution seems more necessary, because, as we have seen in the Exhibition Building, ingenious attempts are being made at steam digging, as well as steam ploughing.

The result of the trial of ploughs will be found in the following report of Mr. Shelley.

RESULT of TRIAL of PLOUGHS at PUSEY, by WILLIAM MILES, Esq., M.P., and JOHN V. SHELLEY, Esq., assisted by Mr. T. P. OUTHWAITE.

The English and Scotch ploughs, eighteen in number, were put to work in the first instance at a depth not exceeding five inches—the land a young clover-ley, in excellent condition for the trial of light-land ploughs. The ploughs consisted of nine 2-wheel, three 1-wheel, and six swing-ploughs. The work of the 2-wheel ploughs was generally good; for the first test, not exceeding five inches, we found the following most deserving of commendation in the order in which they are placed:—

No. 1. Ball's.
No. 2. Howard's, marked XX.
No. 3. Howard's, marked XXX.

The same ploughs were then put to work at a depth not less than seven inches, when we found the following did the work best in the order in which they are placed:—

No. 1. Busby's.
No. 2. Howard's, marked XX.
No. 3. Howard's, marked XXX.

Ball's plough, which at five inches appeared No. 1, broke the land too much at the extra depth, owing to the formation of the mould-board pressing too heavily on the furrow. The work done by the whole of the swing-ploughs was moderate, especially that by the Scotch ploughs, which was decidedly bad. The three best ploughs, viz., Mr. Busby's, Mr. Howard's, and Mr. Ball's, were then taken to the heavy land, and were subjected to a very severe test. The work there was satisfactorily completed, and we place the ploughs according to the following order of merit:—

No. 1. Busby's.
No. 2. Howard's.
No. 3. Ball's.

Mr. Howard had one plough only tried on the stiff land. The ploughs were tested as before—first, at not less than five inches deep, and then at not less than seven inches, and the same result appeared at both depths. The objection observed in the plough of Mr. Howard was, that there appeared to be too much curvature in the tail of the mould-board, which caused the land to break up in turning, and a great advantage was thus given to the plough of Mr. Busby: at the same time, the work done by Mr. Howard's plough was very good; that of Mr. Ball's good; but that of Mr. Busby's was superior.

Three 4-horse ploughs were tried in the lighter land at a depth of from nine to ten inches; they appeared on that in the following order of merit:—

No. 1. Busby's; No. 2. Hensman's; No. 3. Howard's.

Six subsoil ploughs exhibited:

No. 1. Bentall's; No. 2. Grey and Sons; No. 3. Comins'; No. 4. Coleman's.

In the latter an improved system of adjusting the lever appeared, the construction of which we consider to be good.

In the turn-wrist ploughs we considered that none were exhibited deserving of remark. Lowcock's one-way plough could not be worked, owing to a portion having been lost on the railroad; but having tested it on former occasions, we recommended it as worthy of notice.

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* Since the above remarks were written, I have received the subjoined report from Baron Mertens; but from my own former experience in dynamometrical trials, I am bound to say that I should not draw from a single summer trial any inference even as to the lightness of a plough in ordinary work, still less as to its capacity for general work. When land is hard and dry, cleavage is the principal element of resistance; the friction is limited, and the cohesion, of course, null. Hence our English ploughs which seemed the lightest were brought in a former trial to a dead stand on moist clay. The American ploughs are very elegant and light, but seem hardly steady enough for breaking up an English clover-ley. The Belgian mould-board is good, though the framework would be as unsuited to our workmen as our own would be to theirs.—PH. P.

"*London, July* 29, 1851.

"The trial of the following prize ploughs with Bentall's dynamometer took place on the 25th instant, at Mr. Mechi's farm, near Kelvedon, Essex, before Colonel Challoner, Mr. Johnson, and myself. Morin's dynamometer (French) could not be tried, on account of the rain. The trials were attended with great success, as you will perceive by the following results:—

Ploughs.	Name.	Points of Resistance.	Remarks.
1. Belgian - -	Odeurs - - -	527	Land very hard going up hill; coming down in Ball's plough's furrow.
2. American -	Hale and Spear -	530	Land hard.
3. English - -	Busby - - -	540	Land worked well.
4. French - -	Bodin - - -	546½	- - - -
5. Dutch - -	Jenken - - -	550½	- - - -
6. Belgian - -	Delstanche - -	568	No ploughman to use them well.
7. English - -	Howard - - -	569	Hard land.
8. American -	Prouty and Mears -	579	- - - -
9. French - -	Talbot - - -	580	- - - -
10. English - -	Ball - - - -	646	Very hard ground; very good furrow.
11. English - -	Ransomes and May	659	Very hard piece of land.

BARON MERTENS D'OSTIN. C. B. CHALLONER. BARON MERTENS, for MR. JOHNSON."

The best of the six Belgian ploughs exhibited was that of Mr. Odeurs, which cut the side clean and left the sole level; worked steadily, and was easy to hold. In the turn-wrist ploughs of Mr. Vaumael, a new principle of turning at the ends of the land, and of the adjustment of the mould-board, is worthy of consideration. The turn-wrist plough of Mr. Dufour also worked satisfactorily. It is right to observe that Mr. Busby nad applied to his plough the moveable nose-piece invented by Messrs. Ransome. Upon the whole, it is considered by the Judges that the working of the ploughs was satisfactory.

John Villiers Shelley.

It should be remarked that ploughs suited for common and for deep ploughing distinctly have for some time been separately encouraged by the Royal Agricultural Society. There can be no doubt that on most soils it is useful once in four years, when the root crop recurs, to give the land a deep stirring: if that be thought too laborious, the farm should, in each field, get once at least, if only once for all, a thorough disturbance. But a common plough is not suitable for this purpose, since the soil crumbles back into the furrow. One such deep plough, therefore, as Busby's should be kept on most farms, to be worked at leisure in winter with four or even six horses.

2. *Harrow.*

The harrow has been made, I suppose, with square bars, and therefore straight-set teeth, for as many centuries as it has been used; but it is difficult to make the teeth of such a harrow work always in different tracks, although the harrows are dragged from the corner. This imperfection has been remedied within the last few years, in two harrows, to each of which prizes have been awarded. The teeth being set crosswise, the harrows themselves can now be drawn straight.

A third novelty has also been produced and rewarded—Mr. Coleman's expanding harrow. The bars at every point of crossing are united not by a screw, but by a loose pin, on which they work freely. Thus the width of the harrow can be increased or diminished, and the tines, according to the state of the land, be brought nearer together or spread wider apart, exactly like the mimic soldiers on the child's toy. It is true Mr. Coleman's harrow looks rather cumbrous; but on examination it is found to possess small, almost invisible, wheels, which are easily let down, and serve to move the harrows from one field to another. This is a further advantage; for a set of common iron harrows must first be separated, and even then are troublesome enough to convey.

3. *Rollers.*

Not many years since the landlord was often asked by his tenant for some old tree to convert into a roller. The tree roller, when manufactured, had its framework loaded with rough materials to give it weight. But it soon wore and cracked, so as to produce in a year a most ungainly instrument. Sometimes the tree was manufactured into what was called a cheek-roll, that is to say, a roll without framework, but with an iron peg driven into each end, to which pegs the horse's traces were fastened. We have now very excellent rollers with iron cylinders, which last for ever; but it does seem that for rendering the soil fine their regular form has this disadvantage, that they pass so equally over small clods as merely to press, not to grind them. A more squeezing motion seems to be wanted. Mr. Claes, of Belgium, exhibited a roller intended for narrow round ridges, but which seems to possess the germ of this very squeezing motion which we require. The roller consists, in its breadth, of four separate rollers of equal size; these do not work on a fixed axle, but contain a central circle of iron, within which the common axle lies for the four rollers to play freely upon.

The common axle rests, in fact, always on the lower surface of the internal circle of the four rolls, which thus move irregularly with the freedom desired.

The roller has, however, been superseded in its function of clod-crusher by the instrument which bears that name, though we still see farmers engaged in the hopeless attempt at breaking, by the alternate use of roller and harrow, clods which refuse to be broken. The barley crop of course suffers thereby in quality as well as in measure.

4. *Clod-crushers. Norwegian Harrow.*

Mr. Crosskill's clod-crusher is well known as one of the most popular of our new inventions. Its principal use is in breaking down turnip-land which has been fed off by sheep in wet weather and afterwards baked by the sun. Notwithstanding its jagged iron teeth, it has been found, too, the best presser for young wheat in March, when the soil has been swollen and the roots thrown out by alternating frosts and thaws. Thus applied it also arrests the wireworm, and, if it wound the tender blade, the wheat tillers the better. By using it according to its intention, especially in the preparation of barley-land, we may avoid sowing on cloddy ground, or save three weeks' delay of the sowing, and in either case may gain at least one quarter of barley per acre; thus paying for our implement in the first season. Mr. Gibson's clod-crusher, now first brought out, is on a different construction, being formed of two rows of very narrow wheels, alternating with each other. Mr. Crosskill's has the defect of clogging when the soil is moist. Mr. Gibson's of pressing the ground rather tightly: it is between these two weak points that a choice must be made in selecting a clod-crusher. There is a third implement—the Norwegian, or, as it should be called, the Swedish harrow—which neither clods nor kneads, but then it will not press, and is heavier for the horses. I should not hesitate to choose the clod-crusher if I could afford only one such implement; but from experience of both in barley sowing, should be extremely sorry to be without the Swedish tool also, which has been lately much improved by lengthening its teeth, while its draught has been lightened by one horse in four.

5. *Scarifiers, Grubbers, or Cultivators.*

Numerous as are the forms of this implement, and it appears in new forms every year, its full serviceableness has certainly not been yet understood. It has been used accidentally as it were, and not upon system, whereas, if it were used upon system, I have no doubt that, important as are the American reapers, the cultivator would insure to the English farmer upon stock land advantages quite as great, if not greater, for it would save him nearly one-half of the entire labour now bestowed on his ploughing; but to prove this it will be unavoidable to enter somewhat into the detail of actual farming. Indeed, our implements must of course be judged not merely by their power of effecting a certain object, but by the usefulness of that object when it has been effected. Thus Kilby's paring plough will peel off the turf from a bowling-green as even as a web of cocoa-nut matting, yet if that were all, it might serve the gardener but would not serve the farmer. It does, however, serve the farmer, because it gives one mode of accomplishing a most valuable new process, the autumnal cleaning of wheat stubbles.

In order to prove this great saving, the ordinary course of ploughing on a common stock farm, according to the usual four-course system, must be shortly stated.

After the wheat crop, the land, being full of running couch, is ploughed in the winter, and ploughed again, with other operations, thrice more in the spring, until it appears to be clean, when the turnips are sown. In the next spring it is ploughed by many good farmers *twice* for barley, in order that the sheep-droppings may be well mixed with the soil, and so the growth of the barley be rendered regular. The third crop, clover, sown with the barley, gives a year's rest to the teams until it is broken up with one ploughing, and the fourth crop, the wheat crop, is sown. The account will stand thus:—

	Ploughings.
Root crop - - -	4
Barley - - - - -	2
Clover - - - - -	0
Wheat - - - - -	1
	7

Now, it has been found that if immediately after harvest the wheat land be not ploughed, but pared at a depth of 2 inches only, the couch, the cause of so much labour, is intercepted before it has penetrated the ground, and all that future toil becomes needless. This work is done with the scarifier. The saving of labour is easily calculated, if we only compare the breadth of the scarifier, whichever it be, for there are many of them, with the breadth of the plough. Thus our ploughs make a furrow nearly nine inches wide, and are drawn by two horses. Coleman's scarifier, one of the best for hard ground, is 5 feet wide (seven times as wide), and is drawn by six horses. These three pair, therefore, will cover as much ground as seven pair at plough, and the labour, accordingly, would not be half of one ploughing. There must afterwards be one good ploughing given to lay up the land for the mellowing effect of the winter's frost. In the spring the land can be once more stirred with a wider scarifier (Biddle's, 6½ feet wide), which would go deeper, the land being looser, with four horses only. As this implement is equal in width to 8½ ploughs, four horses would thus be doing the work of sixteen. The operation will in labour be only a quarter-ploughing. There are saved, besides, in spring, infinite harrowings and rollings, which will defray the expense of drilling the turnips.

Again with regard to the barley-sowing after turnips, it used to be good farming, as I have said, to plough twice. But in order to save ammonia, it is still better to pare the land as quickly as the sheepfold is shifted. This may be done by Kilby's or Bentall's paring-plough, and may be set down as a half-ploughing. The frost mellows the surface, and four horses scarifying at seed-time will make it fit for the drill. This last operation may be set down as one-third of a ploughing. We may now examine what saving of labour has been produced by this new class of implements:—

	Old System. Ploughings.			New System. Ploughings.
			One scarifying - - -	½
Roots	4	-	One ploughing - - -	1
			One scarifying - - -	¼
Barley	2	-	One do. - - -	½
Clover	0	-	One do. - - -	¼
Wheat	1	-	- - - - - - - - - -	1
	7			3½

Thus it appears that cultivators will spare just one-half of the horse labour employed on the plough, doing the work, too, as well or better. Adopting the standard of economy as the test of their merit, we find that, if a ploughing be valued at 8*s*., they can save 7*s*. an acre yearly over the whole of an arable farm. And we may adopt this calculation in their favour more confidently, because by other means an equal saving of horse-work can be made at other seasons in other descriptions of work. Some exceptions to this general use of cultivators will occur of course to every farmer; but the substitution of them for the plough has long been known to many good farmers, though probably it has not as yet been carried out upon system by any one of them to its fullest extent.

These implements were not originally intended for stirring hard ground, but were gradually developed out of the harrow, which was mounted on wheels, with a view to the raising of loose couch out of ploughed ground, a use which autumnal cleaning will soon, it may be hoped, make obsolete.

Of the prize cultivators, Biddle's, by Messrs. RANSOME, is one of the oldest, and still one of the best. The width gives it great steadiness, and its leverage is good, though wearing an awkward appearance. Many attempts have been made to remove this defect, but none so successful as the simple straight levers by which the other prize scarifier, Coleman's, is lifted out of the ground. Since the trial I have used Coleman's implement, and find it superior to other wide scarifiers. For these implements have hitherto had two defects. They sometimes rise partially out of the ground, and sometimes swerve in their course; thus in each case missing a part of their work. Hence arises often the necessity of dragging them a second time crossways over the same piece of ground. Coleman's scarifier never rises or swerves, but does its work as true as a plough, doing it therefore once for all. This is a decided advance, and greatly facilitates the substitution of the scarifier for the plough. For the mere paring of a very tight surface, however, even Coleman's may be sometimes too broad, and Bentall's narrow one is excellent for that purpose. Its long snout, like a swordfish's horn, is an ingenious device by which it is enabled to adhere to the land. This cheap implement has also received a prize as a subsoil plough; and though it be a good rule that no implement should do more than one thing, an exception must be clearly made here.

Another cheap paring plough, Kilby's, should be mentioned though not in the Exhibition, because it has the peculiar merit of turning over as well as paring the land.

In limiting, as has been done above, the number of ploughings, the new system of winter cropping has been passing over, because those extra crops, green rye or tares, winter peas or beans, would more than pay for their extra ploughing. Taking the old system simply, and working it with new tools, we see that common stock land need be ploughed twice only instead of eight times in four years—once after clover, when the green leaves must be turned down and the dung perhaps be covered in, which the plough only can do, and once, in order to stir the land deeply for root crops, and lay it rough for the winter frosts. I will venture to add what may appear theoretical—that, if ever steam be successfully employed in cultivation, it will probably be less by ploughing or digging than with an implement like one of these cultivators, because they are able to work so much wider a space as they pass long in their course. This plan of autumn-cleaning is the more valuable because it is a *practice* of actual farmers. When we hear of wheat being grown on alternate portions of the same field every year, such an experiment is highly interesting in a scientific view, yet we feel certain that it cannot become general; but when we know that good farmers are yearly extending the practice of autumn-cleaning upon stock land, we are assured that whatever be its advantages they will be generally available upon land of that character From the preparation of land we may now proceed to

II. IMPLEMENTS USED IN THE CULTIVATION OF CROPS.

1. *Drills.*

The sower with his seed-lip has almost vanished from southern England, driven out by a complicated machine, the drill, depositing the seed in rows, and drawn by several horses. Here, at least, one would suppose that there must be an increase of expense in the new operation, and, above all, an increase of horse labour; but even here there is, or may be, sometimes at least, on the contrary, a diminution. For though we observe only the one seedsman striding over the fallow, he is followed by machinery—the drags and the harrows—which, though simple enough, yet, as they repeatedly traverse the land, run up to a formidable amount the horse-work expended in this primitive method of sowing.

In Mr. Haxton's Prize Essay upon Oats, which is just published,* we find the following passage:—

> *Sowing and Harrowing.*—The general practice in Scotland is to sow oats broadcast on the winter furrow, and to cover in the seed by two, three, or four harrows coupled together and drawn by as many horses. . . . . Six harrows, three and three together, and drawn by six horses and driven by two men, follow the sower, and give a double *stroke* in the direction of the ridges.

Three more strokes, five altogether, suffice, as Mr. Haxton informs us, on friable land, but on an old sward, the amount of horse-work expended is really wonderful.

> Old tough lea or wet-ploughed land requires a far greater amount of harrowing than this to bring it into a proper tilth. Two double strokes are given in the direction of the

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* Journal of Royal Agricultural Society of England, Part xxvii., p. 126.

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ridges to break the furrows and prevent the turf from being torn up by the cross harrowing; and it is seldom that the operation can be properly accomplished with less than six double strokes or twelve harrowings.*

Thus a harrow has to be drawn twelve times over the same ground by a horse. If we imagine it to be drawn once by twelve horses, we shall see at once the vast saving which would be effected by the Woburn drill, of about the same width with the harrow, drawn by two horses only, yet burying at once most of the seed, and followed, as it has been preceded, by a light harrow—a saving of eight horses in twelve, or two horses in three. This is, however, an extreme case; but we should not be far wrong in saying that by the Woburn drill, which will come presently under our notice, two horses in four, or one-half, might be saved to the farmer who has been in the practice of broadcasting.

There is also a saving in seed by the use of the drill; but it is further interesting to observe how the drill dovetails, as it were, with our last class of implements, the scarifier. When drilling was unknown, great stress was laid upon so ploughing the land that the furrow edge would stand up sharp at the exact angle of 45 degrees, in order that the harrows catching those edges and crumbling them down might properly cover the seed. No one would have dreamed of sowing corn upon scarified land. Now, on the contrary, the surface may be perfectly smooth; and wheat may be drilled after turnips in winter upon land which has been only breast-ploughed, pared, that is, half an inch deep; for the seed, if drilled, is perfectly covered, and wheat prefers a firm bed. The drill again is indispensable for the use of many new artificial manures, distributing them by special coulters beneath the ground, and covering them with earth, that their excessive strength may not injure the seed, which is deposited, above, last of all. The beautiful system of horse-hoeing depends too, of course, entirely on the use of the drill, which may be regarded as the key of the new system. We ought, then, to regard the whole as a system; not, using the drill, retain ancient courses of ploughing which were meant for the seedsman, nor, on the other hand, fall short in the consequences of the drill—use it, that is, as some farmers do, but with no artificial manure, and without a horse-hoe to follow.

As to particular drills, there is the general-purpose drill, a very complete implement, capable of drilling, with or without manure, wheat, beans, and turnips at the different intervals suited to those plants respectively, from 2 feet to 7 inches. It comprehends, in fact, two drills, the parts of which are substituted for each other at pleasure; yet admirable as is the implement, one may question whether, as corn seldom requires manure to be sown at the same time, it be not better to buy two drills separate, one for corn, the other for turnips. One improvement should be used with all drills as most conducive to the ease of the carter. Formerly, drills went upon one pair of wheels, but after they were made to carry a large weight of manure, it became hard work for the carter, who, in his zeal to keep the work straight, while leading the thill horse with a stick, steadied the shaft with the other hand, which was almost benumbed when he reached the end of the furrow. A fore-carriage was therefore added by Messrs. Garrett, which is under the command of the carter, who, by a lever keeps, without exertion, one wheel in the rut down which it previously passed, so that the rows must be perfectly parallel. This steerage is the carter's friend, and the horse's friend too, as it removes a heavy load from his back. Messrs. Hornsby have since adopted, and perhaps improved on the principle.†

The excellence of all Messrs. Hornsby's and Garrett's drills is well known. The Woburn drill of Messrs.

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* Journal of Royal Agricultural Society of England, Part xxvii., p. 126.

† *Report on Drills.*—Nearly twenty of these implements were selected and sent down to Pusey for trial. Messrs. Hornsby and Son had five drills: their ten-rowed *corn and general-purpose* drill was a highly-finished and well-made machine, with a recent improvement, patented by them, of India-rubber tubes for conducting the seed down to the channel made by the coulter, which I consider a valuable improvement upon the old plan of a series of cups, made of tin, working one within the other. This drill also has another improvement, of two coulter bars, by which an equal pressure is obtained upon every coulter, and the double-action lever enables the manure to be deposited to any depth, and covered up previous to the seed being deposited. The price of this drill is 44*l*.

A ten-rowed corn and seed drill, peculiarly adapted to drill corn on side hills by a highly-finished and ingenious contrivance, of extending or contracting, by means of a screw, two legs, similar to the governor of a steam-engine, attached to the side of the drill, and by which (the drill being hung by or supported on the centre) it can be regulated while in motion. It has also improved slides for regulating the quantity of seed delivered; it has the improved India-rubber tubes and coulter bars, like the former drill; also a very excellent fore steerage, with a rack and pinion attached, by which it can be guided with great exactness. It did its work extremely well; and we awarded it a Council Medal.

A three-rowed drop drill, which can be used either on ridges or flat ground. It is capable of depositing pulverized manure at any required distance from 10 to 18 inches, in given quantities from 10 to 50 bushels per acre. The seed can be deposited with the manure, or the manure covered up with soil and the seed delivered on the drops. The drill economizes manure, and worked very well. Price 24*l*. We awarded it a Council Medal.

A two-rowed turnip drill on the ridge, which can be made into a three-rowed turnip drill on the flat, for drilling turnips or mangold-wurzel seed and manure. This drill embraces a variety of improvements—the rollers being made in sections capable of being adapted to a larger or smaller ridge of the proper form to receive the seeds, and the second concave rollers follow, and leave the ridge in a perfect form. The drill is now so perfect, and did its work so well, that we awarded it a Council Medal.

Messrs. Garrett and Son exhibited their well-known general-purpose drill, with the improvement of a simple method of regulating it so as to work on the sides of hills. There is also a slide for the regulation of the feed of the manure, with an index to show the quantity delivered. Price 42*l*. This drill did its work remarkably well; and we considered it entitled to a Council Medal.

A four-rowed turnip drill on the flat, embracing the improvements of the general-purpose drill, was also put to a severe test with other drills; but, upon the whole, we considered it to do its work a shade better than those brought against it, and we awarded to it a Council Medal.

A hand-barrow drill—the construction and excellent workmanship exhibited in the implement merited the unqualified approbation of the jury—distributing grass-seeds broadcast in an excellent manner, by means of two compartments in the same box, that the quantities of each may be regulated as desired, the clover and rye grass being mixed in their transit to the ground. We considered it a very useful implement, and recommended it as worthy of a Council Medal.

Messrs. Ransomes and May, of Ipswich, exhibited a very well-constructed drop drill, which did its work excellently, and of a very different construction from any of the other drop drills; and, for the ingenuity of contrivance and superiority of workmanship, we awarded it a Prize Medal.

Mr. Busby, of Newton-le-Willows, near Bedale, exhibited a drill which he called a ribbing drill, which is well constructed, very simple, and strong, and does its work extremely well, making a broader seam to lay the corn or seed in, which is considered by many, and especially by foreigners, as a great advantage. Price 14*l*. To which we awarded a Council Medal.

Messrs. Hensman and Son, Woburn, Bedfordshire, exhibited a self-adjusting steerage corn drill. This drill varies from the generality of drills, as it is drawn from the centre by whipple-trees instead of shafts; and the drill-man behind can steer or direct the drill with the greatest nicety. The corn-box of the drill is entirely self-acting, and delivers the seed equally well going either up or down hill. It is also capable of horse-hoeing, by attaching hoes to the levers, instead of the coulter shares. This implement works very well, and the price from 18*l*. to 20*l*. We awarded it a Prize Medal.

M. Claes, of Belgium, exhibited a nine-rowed, very simple, well-made Belgian drill. It did its work extremely well. The coulters made a broader seam to receive the corn than the generality of English drills; and the harrow which is attached to the drill covers the seed with fine

Hensman and **Son** has also obtained a Prize Medal, and has this peculiarity:—In all other drills the coulters, which distribute the manure or seed, hang from the carriage In this drill the carriage rests upon the coulters, which are like the irons of skates; it may be said, indeed, to run on four pairs of skates. Hence this drill's power of penetrating hard ground, and of giving a firm bed to the wheat-seed in soft ground. Each drill coulter, however, preserves its independence as when suspended. This self-adjustment is required by the inequality of tilled ground, and is thus obtained: each pair of coulters is fixed to the end of a balance beam, these again to others, and they to a central one. Thus each coulter, in well-poised rank, gives its independent share of support.

Hence this drill is simpler in management than any other, for, resting on its own base like a plough, it is also guided from behind like a plough; and any man who can hold the stilts of a plough for a straight furrow can steer this drill with a pair of horses only and reins. Hence, too, its convenience; for if you wish to sow close up to the sheepfold, instead of ordering out a drill and four, as it were in state, you merely keep back one plough from the field.

Hitherto we have been dealing with corn drills intended generally for seed only. In endeavouring to fill up the picture of the point of development at which agricultural mechanism now stands, we come next to turnip drills, in which manure is also distributed as well as seed, generally bones or superphosphate. As is well known, there are two ways of growing turnips, the ridge and the flat. In the ridge, or Northumberland method, the ground is thrown into ridges by a two-sided plough, "a double Tom," and, dung being laid in the intervals, the ridges are split, and the new ridges enfold the dung.

It is on these ridges that Mr. **Hornsby**'s prize drill works, depositing manure-dust and seed, and reducing the ridge, by concave rollers, to a compact rounded form.

The ridge system, however, is most at home under our cool northern and moist western skies—in Northumberland and in Lancashire. In our drier districts, as in Lincolnshire and Berkshire, it is found better with the bulk of the crop, when rain does come, to make more expedition. Using a turnip drill, therefore, 6 feet wide, we sow four rows at once with some light manure, and are thus enabled to sweep rapidly over our ground, while the seed finds a moist bed fit for germination before the dust begins once more to fly.

Still, however rapid the four-row turnip-drill, south-country farmers are often obliged to wait in July for a soaking shower—waiting, indeed, often in vain, until it is too late to look for a bulky turnip crop. A south-country farmer, Mr. **Chandler**, of Market Lavington, Wilts, has produced a machine to deal even with this defect of our climate. His water-drill pours down each manure coulter the requisite amount of fluid, mixed with powdered manure, and thus brings up the plant from a mere bed of dust. Having used it largely during three years, I may testify to its excellence. Only last July, when my bailiff had ceased turnip-sowing on account of the drought, by directing the use of the water-drill, I obtained from this later sowing an earlier and a better show of young plants than from the former one with the dust-drill. Nor is there any increase of expense, if water be within a moderate distance, for we do not use powder-manures alone. They must be mixed with ashes that they may be diffused in the soil. Now, the expense and labour of supplying these ashes are equal to the cost of fetching mere water; and, apart from any want of rain, it is found that this method of moist diffusion, dissolving, instead of mingling only, the superphosphate, quickens its action even upon damp ground, and makes a little of it go further.

There is yet one more kind of drill. The common drills economize manure by concentrating it in lines along the rows of the turnip plants. Thus, instead of shovelling bones from carts, as was first done in Lincolnshire, at sixty bushels per acre, we came to sow only sixteen bushels of bones in lines, or more recently but three bushels perhaps of superphosphate, prepared either from bones or from the animal remains of geological ages, among which Liebeg told us, and told us truly, to search for our phosphorus. But though turnips are sown in lines, and come up thickly in lines, no sooner are the thriving young plants well marshalled in green array than nineteen in twenty are ruthlessly cut down by the hoe, so that the field appears for a time once more bare. The roots must, of course, be allowed ample room in the row, but some manure will have been wasted in nourishing the plants doomed to perish. Hence, Mr. Hornsby's drop-drill, avoiding this wholesale massacre, is made to drop the seed and the manure, by a second step of mechanic frugality, only at those points in the lines where the plants are intended to stand. Nor are these points in the lines fixed points, for their distance can be varied from 9 inches to 18 inches asunder, and the intervals between the rows can be equally varied from 15 to 30 inches. The dose, again, of mixed manure can be varied from ten to fifty bushels per acre. Such is the elastic, yet accurate pliability, with which in agriculture mechanism has seconded chemistry. Having now gone through the various kinds of drills—corn or turnip drills, ridge or flat drills, dry or wet, line or drop drills—we may pass to a kindred but entirely new class of implement.

2. *The Top-dresser, or Manure Distributor.*

Although, as has been said, wheat is seldom sown with the manure-drill, being usually provided with its chief requisite, nitrogen, through farm-yard dung or through sheepfolding, no plant is so liable as wheat to break down from its first promise; and on inferior soils, whether too light or too heavy, one might almost say that wheat always looks well before Christmas, and always looks ill before Lady-day. Our predecessors, to refresh its flagging strength, used to spread soot or pigeon's dung, both containing ammonia, over it, especially on the lower sides of the ridges near the water-furrow, where the plant was perhaps almost killed by the lodgment of rain. But their practice was, of course, limited by resources so narrow. We, having guano and nitrate, can deal out liberally the timely supply. But if sown by hand, these very light manures, especially guano, are carried away before their descent by a strong wind; and sometimes when half a gale has been blowing, it has seemed to me that I was manuring my neighbour's field quite as much as my own. A manure-distributor was therefore required; and the agricultural meeting at Exeter brought out eight competitors, the winner being Mr. **Holmes**'s, of Norwich.

I rejoice to find that we have not only a good invention here, but that it is being actively used. The machine, new as it is, and involving a new outlay for artificial manure, is employed very largely in the western division of Norfolk—the classic ground of improvement—for distributing a small quantity, such as three bushels per acre, of guano or nitrate of soda, or a larger quantity of superphosphate and rape-cake, on wheat in the spring of the year. This fact deserves the more to be known, because the convincing argument for any agricultural change is that it has become a *practice* somewhere or other—an argument that answers where reasoning fails. The other argument—that, namely, founded on quick return—is also not wanting, as it has lately been shown that nitrate so applied on poor land will sometimes yield double its own value,—nearly a quarter of wheat at a cost of 20*s.* per acre.

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earth as soon as it is dropped. There is no part of this drill likely to be out of order: it can be worked with one horse; and there appears no part of it that, in case of accident, could not be repaired by a common blacksmith. Price 10*l.* In consequence of its combined merits, simplicity and cheapness, we awarded it a Prize Medal.

Liquid-manure Distributor.—Mr. T. R. Reeves and Mr. J. Bratton, of Westbury, exhibited a liquid-manure distributor, which did its work in an extraordinary manner, distributing equally manure-wature or the thickest sewerage in the most perfect manner. From the construction of the machine, it is impossible to clog in the delivery of the thickest slush. It consists of a series of buckets or troughs that are attached to a metal chain or band, and which works round two rollers as the cart goes on, the wheel giving the motive power to the rollers. The price of this admirable water-cart, complete, is 16*l.* We awarded it a Prize Medal.—C. B. **Challoner**.

It is curious, indeed, that this very cheap and simple machine is on some soils superseding the more costly and intricate drill. In the words of Mr. Holmes, its inventor,—

> They were used very much last turnip-sowing season, and considerably more this season, for sowing manure (rape-cape, malt-coombs, and guano, about 8 or 10 bushels per acre, and in some instances as much as 20 bushels to the acre, when a quantity of burnt earth or ashes are mixed) into the furrows of the ridged turnip-land, at 24, 26, and 27 inches apart. The ridges are then turned over on to the manure by the double-breasted plough, and the manure is covered sufficiently out of the way of the seed, although distributed equally around, so that, instead of striking immediately into the whole body of manure—as is the case when drilled in with the manure—it catches it gradually in its different stages of growth.
>
> This plan proved highly satisfactory to all those who tried it last season, which has induced many others to pursue the same course this season, not only as regards the crops themselves, but also in the labour required to put the crop in. Our manure distributor will cover 3 or 4 furrows at 27 inches apart, if required, and is worked with one horse. It is followed by a light drill expressly for turnips and mangold-wurzel, which is also worked by one horse. Thus it will be readily seen that a great saving of horse-labour was effected by the use of the distributor in the place of the drill.

This saving of horse-work is indeed great; but it must not be disguised that there is inconsistency between the principle of general diffusion here recommended, and the concentration which is the aim of the drop-drill. Each method, in fact, has its merits for different purposes,—concentration for pushing the young plant, extension for feeding it in its later stages. The question, like many others, must be decided by longer experience; but the most perfect method would probably be the combination of both plans. To return to our present subject, the young growing wheat, it may not only be revived in spring by additional food, but is usually, on light land, settled down in its bed by

3. *Press-rolls.*

On some soils, especially the calcareous, the ground alternately frozen and thawed in winter throws the roots of the wheat plant almost out on the surface. For this mischief and that of the wireworm, flocks of sheep were once driven over the wheat; but we have long had the well-known wheel-roll, and, as has been said, Crosskill's clod-crusher is a still better presser when it can be used, but is not a perfect substitute, as it requires the land to be drier. The new clod-crusher, however (Gibson's), must serve, I suppose, for both purposes equally well.

4. *Horse-hoes.*

Machinery can do but one thing more for the growing crop. The hoe not only clears away a host of young weeds, but, by loosening the crusted surface, admits the air, and stimulates the growth of the true crop. Even vineyards are thus found to be relieved during long drought, and hence it is said that iron should be always between the rows of our root-crops. Ridged root-crops have been long hoed by a single horse, one row at a time. Garrett's horse-hoe cleans four rows at once of turnips, six of beans, nine of wheat. To hoe wheat thus is a delicate operation: to hoe even turnips so, when their lines are but just distinguishable, or again, when the leaves almost meet, requires not only a first-rate implement, but a steady hand and cool head to steer it. This tool will stand well the test of economy, for it will go over ten acres a-day easily, with two horses (sometimes one), a man, and a boy, at a cost of, say 10*s.* The work could certainly not be done otherwise for less than 2*s.* an acre, 20*s.* altogether, even if you could find hands to do it, in harvest-time. This estimate accords, I find, with the report of the Judges at the York Meeting, practical farmers, who thus speak of the implement:—"The work done by it is far superior to any hand-hoeing: it can also be done for less than half the cost: indeed, so highly do we value it, that we think no farmer can farm as he ought without it." The crops, after hoeing, soon cover the ground, and are thus beyond man's interference until time, the ripener, summon him to the operations of harvest.

III. HARVESTING IMPLEMENTS.

1. *Reaping-Machine.*

At the opening of this century it was thought that a successful reaping-machine had been invented; and a reward was voted by Parliament to its author. The machine was employed here and abroad, but, from its intricacy, fell into disuse. Another has been lately devised in one of our colonies, which cuts off the heads of the corn, but leaves the straw standing, a fatal defect in an old-settled country, where the growth of corn is forced by the application of dung. Our farmers may well, therefore, have been astonished by an American implement which not only reaped their wheat, but performed the work with the neatness and certainty of an old and perfect machine. Its novelty of action reminded one of seeing the first engine run on the Liverpool and Manchester Railway in 1830. Its perfection depended on its being new only in England, but in America the result of repeated disappointments and untired perseverance. The United States' Patent Commissioner says of Mr. M'Cormick's Reaper—

> In agriculture it is, in my view, as important, as a labour-saving device, as the spinning-jenny and power-loom in manufactures. It is one of those great and valuable inventions which commence a new era in the progress of improvement, and whose beneficial influence is felt in all coming time.

Besides difficulties common to all inventions, the machine could be tested but for two or three weeks in each year. When a defect was discovered, before the remedy was applied to the instrument the harvest was over, and the new form had to wait a whole year for its trial, when some fresh failure required a fresh year's postponement of final success. It seems right to put on record Mr. M'CORMICK's own account of his progress, or some extracts at least from a statement written by him at my request:—

> My father was a farmer in the county of Rockbridge, State of Virginia, United States. He made an experiment in cutting grain, in the year 1816, by a number of cylinders standing perpendicularly. Another experiment of the same kind was made by my father in the harvest of 1831, which satisfied my father to abandon it. Thereupon my attention was directed to the subject, and the same harvest I invented and put in operation, in cutting late oats on the farm of John Steele, adjoining my father's, those parts of my present reaper called the platform for receiving the corn, a straight blade taking effect on the corn, supported by stationary fingers over the edge, and a reel to gather the corn, which last, however, I found had been used before, though not in the same combination.
>
> Although these parts constituted the foundation of the present machine, I found in practice innumerable difficulties, being limited also to a few weeks in each year, during the harvest, for experimenting, so that my first patent for the reaper was granted June 24th, 1834. During this interval *I was often advised by my father and family to abandon it and pursue my regular business, as likely to be more profitable, he having given me a farm.* No machines were sold until 1840, and I may say that they were not of much practical value until the improvements of my second patent, 1845.
>
> These improvements consist in reversing the angle of the sickle-teeth alternately—the improved form of the fingers to hold up the corn, &c.,—an iron case to preserve the sickle from clogging—and a better mode of separating the standing corn to be cut. Up to this period nothing but loss of time and money resulted from my efforts. The sale has since steadily increased, and is now more than a thousand yearly.

One merit of the machine consists in the extreme simplicity of its cutting part—a straight saw, vibrating rapidly right and left. The teeth, however, incline alternately in each direction, so that at each vibration half of them are inclined in the direction of the motion, as is shown in the diagram of a portion of the saw.

As to the practical working of the Reaper, two horses drew it at the trial very easily round the outside of the crop until they finished in the centre, showing that they could cut easily fifteen acres in ten hours. One man drives sitting, and another stands on the machine to rake. It is hard work for him, and the men ought sometimes to change places. The straw left behind at the trial was cut very regularly—lower than by reaping, but higher than by fagging. The inventor stated that he had a machine which would cut it two inches lower. This is the point, I should say, to attend to, especially for autumn cleaning. Though it seems superfluous to bring this machine to the test of economy, we may estimate the present cost of cutting fifteen acres of wheat, at an average of 9*s*. an acre, to be 6*l*. 15*s*. Deduct, for horses and men 10*s*. 3*d*., and for binding 2*s*. 6*d*. per acre; the account will stand thus:—

	£.	s.	d.	£.	s.	d.
Average cost of reaping 15 acres, at 9*s*. per acre - - - - - - - - - - -				6	15	0
Horses and men for reaper - -	£0	10	0			
Binding 15 acres, at 2*s*. 6*d*. per acre	1	17	6			
				2	7	6
Saving per acre, 5*s*. 10*d*. - - - - - - -				£4	7	6

The saving of wages, however, would of course be an imperfect test of the Reaper's merits, since in bad seasons and late districts it may often enable the farmer to save the crop.

Since this statement was written, fresh trials have been made of Mr. M'Cormick's reaper, as also of one by Mr. Hussey; and as the award under the Commission has been called in question, it is right that some statement should be made on the subject. In the first trial at Tiptree Hall, Mr. M'Cormick's reaper worked well, and the other did not act at all. As the corn, however, was then green, it was thought right to make further trial, and special leave was obtained from the Council of Chairmen to give *two* Council Medals, one to each Reaper, if, on further trial, their respective performances should be found to deserve one. The object in our second trial was not to decide which was the best implement, but whether either or both were sufficiently good to receive the Council Medal. Mr. M'Cormick's in this trial worked—as it has since worked at Cirencester College and elsewhere—to the admiration of practical farmers, and therefore received a Council Medal. Mr. HUSSEY'S sometimes became clogged, as in the former trial at Tiptree, and therefore could not possibly obtain that distinction.

Further trials, however, have since been made by other parties, elsewhere, in which Mr. Hussey's machine worked well; and one of our colleagues, Mr. Thompson, informs me that it has been used for a week by a practical farmer on his own farm, who was perfectly satisfied. Its inventor states that at the trials for the Commission the failure arose from the mal-adjustment; and Mr. Thompson informs me that at one of the subsequent trials a similar mal-adjustment impeded its action, until Mr. Hussey arrived to set it right. I am bound, then, to express my own individual opinion that the merits of the machine are such as entitle it to a Council Medal, and my regret that it should be formally disqualified to receive one.

We have, then, two good American reaping-machines. Their respective merits time will discover: but there is one caution which applies to the introduction of both into England. They both cut by a sidelong vibration, the frequency of which must be determined by the number of straws to be cut in passing over a given space. Now, as the acreable yield of England nearly doubles that of America, our straw it is probable stands much thicker than in the crops these Reapers have been accustomed to deal with, so that both implements when applied to heavy crops must be adapted to the superior farming they will have to encounter. At present, we only know that Mr. M'Cormick's machine is best for barley and oats when not intended to be bound up in sheaf: Mr. Hussey's for corn laid by the weather, or standing upon steep ridges. Mr. Hussey's can cut rushes, as was shown in Windsor Park. Mr. M'Cormick's has received a prize this autumn in the United States for cutting prairie-grass, competing there with three others.

2. *Horse-rakes.*

These are very neat implements, about 8 feet wide, running on low wheels, drawn by one horse rapidly between the rows of cocked barley, oats, or hay, and tipped from time to time, while they move on, by a man who follows. One of them must do the work of 10 or 15 women. They are common in many counties, yet in others unknown, or, when made known, not adopted.

3. *Haymakers.*

Every one has seen these machines tossing the hay high above them: instead of this rapid action, if the movement of the frame be reversed, they gently stir the grass without lifting it from the ground. The saving of labour must be as great as with the horse-rake, and the work is far better done.

4. *One-horse Carts.*

It is proved beyond question that the Scotch and Northumbrian farmers, by using one-horse carts, save one-half of the horses which south-country farmers still string on their three-horse waggons and three-horse dung-carts, or dung-pots, as they are called. The said three-horse waggons and dung-pots would also cost nearly three times as much original outlay. Few, I suppose, if any, farmers *buy* these expensive luxuries now; though it is wonderful they should keep them; for last year, at Grantham, in a public trial, *five* horses with five carts were matched against five waggons with *ten* horses, and the five horses beat the ten by two loads. It appears that some of our one-horse carts, not being well made, carry the corn less steadily than the waggons; but this last defence of the primitive waggon is broken down by the curved form which Mr. Busby has given his harvest rails, as is well explained by Mr. Thompson, of Moat Hall, a high authority on these matters, in the following interesting report:—

Carts and Waggons.—The Jurors appointed to examine these classes of implements were considerably influenced in their selection by the opinion that really good *carts* ought to be capable of easy adaptation to all the kinds of work for which agricultural wheel-carriages are required, thus rendering waggons unnecessary. The great majority of carts are, however, ill adapted for harvest work, and this is, no doubt, one reason why such slow progress has been made in substituting light carts for waggons. It may, therefore, be useful to mention the leading points which ought to be kept in view in the construction of harvest carts, or harvest frames adapted for common carts.

When a load of any height, technically termed a top load, is borne upon one pair of wheels instead of two, it is exposed to much more violent trials of its powers of cohesion. Every slight alteration of position of the horse which elevates or depresses the shafts of a cart, gives a tendency to the load to slide off either before or behind, which is not the case in a waggon, where no part of the weight rests on the horse's back. If, therefore, as is commonly the case, the harvest frame consists of two or three horizontal and parallel bars, it is found requisite to take small loads, or to bind the load very firmly together with ropes, either of which expedients causes a waste of time, which can ill be spared during harvest; and, in spite of such precautions, accidents frequently occur. To remedy this fault, some makers have constructed harvest frames with one bar only at the front and back, strengthened by iron stays, as is the case in Morton's harvest cart, exhibited by Messrs. Stratton. This is a considerable improvement upon the two or three bars above mentioned, inasmuch as the sheaves are bent over the single bar by the weight of the load, and thus obtain a firmer hold; but the desired object is more surely and efficiently obtained by the harvest frame attached to Busby's cart, where the ends and sides all slope towards the body, so as to condense the load by the motion of the cart. The fact that raised ends have a tendency to condense the load was first pointed out by the judges of carts at the Norwich Show of the Royal Agricultural Society in 1849; and in Mr. Busby's cart these suggestions have not only been adopted, but improved upon, by raising the sides as well as the ends.

Another important point is, that carts should be low, not only for the sake of diminishing the labour of loading, but to lower the centre of gravity of the load, and thereby lessen the great inequality of pressure on the horse which is experienced in high carts when going up or down hill. It also diminishes the danger of an upset in rough ground or on a hill-side. So long, however, as the shafts of carts were attached in the ordinary way, it was found that when carts were much lowered, a slanting direction was given to the shafts, which caused a top load to slide backwards; and this tendency it was scarcely possible to counteract when going up a steep hill. The mode of attaching the shafts observed in Busby's cart, viz., of fixing them to the side, very much diminishes this difficulty, as, when once the plan is abandoned of making the shafts a prolongation of the sole, their position is no longer dependent on that of the body of the cart, but may be varied to suit the objects for which it is built, or the size of the horses employed by the owner. By this arrangement for preserving in a great measure the horizontal position of the shafts in carts with low bodies, together with the form of harvest frame pointed out above, these carts are enabled *to carry corn or hay with as great safety as any four-wheeled vehicles;* and this point being once established, it is clear that there is no longer any necessity for incurring the expense of having waggons or carts expressly for harvest purposes, as the ease and quickness with which single-horse carts can be worked more than make up for the additional load carried by waggons. On the whole, the principles of construction of Mr. Busby's cart are considered more correct than those of any other in the Exhibition, and he has made great advances towards the production of a good cart-of-all-work. His cart has therefore received the distinction of being named in the award of the Council Medal: but it should be borne in mind that the medal is awarded to the improved principle of construction, and that it is not intended to stamp this cart as a model in respect of shape, size, and other points of secondary importance, which may be varied to suit the taste or the wants of the purchaser.

2. Crosskill's wheels are deserving of notice, being made by machinery, and accurately fitted. His operations being conducted on a large scale, he is enabled to furnish them at a moderate price.

3. The cart made by the Messrs. Gray, of Uddingston, near Glasgow, has been awarded a medal, though it is considered too high, and that the naves are unnecessarily loaded with iron. The wheels, also, are too much out of the perpendicular, showing that the arms are bent, and their under surfaces not horizontal. As this determines whether the weight of a cart, and consequently of the load, shall rest on a level bed or an inclined plane, it is a point of importance. The deviation in this instance is small; but as it is a fault which a few years back was almost universal, and was in many cases carried to a very mischievous extent, no opportunity should be lost of calling attention to it wherever it is observed. Having thus pointed out what are considered to be the faults of Mr. Gray's cart (the same may be said of the Scotch carts as a class), it is but justice to him to point out that in many respects it is deserving of great praise. The Scotch iron-work is notoriously excellent, and in Mr. Gray's case it is just what it should be, substantial and well finished, and (with the slight exception above mentioned) with nothing redundant. *It is also due to the Scotch wheelwrights to bear in mind that during the dark ages of English agriculture, when it was scarcely possible to meet with even a tolerably well-made cart in the central or southern parts of Great Britain, and when there seemed to be a rivalry amongst implement makers which could pile up the largest amount of unnecessary wood and iron in the form of a waggon, the Scotch carts universally retained their compact form and workmanlike character; and from being used by improving farmers in various parts of England, tended very much to originate that reform in carts and waggons which is now making such rapid progress.*

Waggons.—It is difficult to conceive why use of the waggons is still retained in particular districts, unless for the purpose of wearing out what has been already paid for, and cannot be disposed of without a great sacrifice. The fact that those who use waggons are also obliged to have carts for leading manure, root crops, &c., ought to decide the question, inasmuch as it necessarily follows that a double amount of capital is required in the first instance, and greater expense sustained ever after in repairs, renewals, and providing house-room for this unnecessary number of wheel-carriages. On a large farm it is certainly convenient to have a waggon for the removal of poles, furniture, or other bulky articles; but these are exceptional cases, and the ordinary routine of farm-work can be at least as well carried on by single-horse carts as by waggons. This has been proved on several different occasions by experimental trials, undertaken by the respective advocates of 2 and 4 wheeled vehicles for the express purpose of deciding the point. The great necessity at present existing for the introduction of every practicable economy will doubtless eventually substitute light carts for waggons, and in the meanwhile something would be gained by introducing light, cheap, pole-waggons in the place of the cumbrous shaft-waggons which are too frequently met with.

Mr. Crosskill's waggon was considered a very good specimen of an improved waggon, being light, low, and cheap (price 26*l*., including both pole and shafts). The advantages of a pole over shafts are, that horses can draw a greater weight when yoked abreast than at length; that two horses share the load down hill which is frequently injuriously heavy for one; and that the team can turn in less room, and is altogether more manageable.—H. S. Thompson.

Mr. Busby, it will be observed, by placing his shafts on the side of the cart, has lowered his cart. He has lowered it as much as one in four, thereby diminishing the toil of filling carts with dung, stones, earth, &c., to the amount of one quarter. If we calculate how many thousand arms are employed in this way throughout England for many weeks in the year, we shall find that this improvement, simple as it is, will save no small aggregate amount of misapplied strength to the country at large.

Having gone through the three classes of implements with which the land is first prepared, the crops next cultivated, and the grain afterwards harvested—and having found them to stand well the test of economy by which all machines must be tried—we have now to examine the fourth, by which the corn is lastly made ready for market.

IV. Preparation for Market.

1. *Moveable Steam-engines.*

Every visitor of the agricultural department must have been struck with the little steam-engines, which, though of pigmy dimensions if compared with the great railway racers, showed the same compactness of form and the same disposition to work. They connected the ruder tools of husbandry with machinery fitted for more intricate ends, and showed palpably that agriculture had not kept aloof from the spreading dominion of steam. Fixed steam-engines have been long used in Northumberland and East Lothian, in which spirited counties every farm has its tall chimney. These moveable steam-engines have been called forth by the Royal Agricultural Society within the last ten years, and appear preferable in general to the fixed engines, for the following reasons:—

If a farm be a large one, and especially if, as is often the case, it be of an irregular shape, there is great waste of labour for horses and men in bringing home all the corn in the straw to one point, and in again carrying out the dung to a distance of perhaps two or three miles. It is therefore common, and should be general, to have a second outlying yard. This accommodation cannot be reconciled with a fixed engine.

If the farm be of a moderate size, it will hardly—and if small will certainly not—bear the expense of a fixed engine: there would be waste of capital in multiplying fixed engines to be worked but a few days in a year. It is now common, therefore, in some counties for a man to invest a small capital in a moveable engine, and earn his livelihood by letting it out to the farmer.

But there is a further advantage in these moveable engines, little, I believe, if at all known. Hitherto corn has been threshed under cover in barns; but with these engines and the improved threshing-machines we can thresh the rick in the open air at once as it stands. It will be said, How can you thresh out of doors on a wet day? The answer is simple. Neither can you move your rick into your barn on a wet day; and so rapid is the work of the new threshing-machines, that it takes no more time to thresh the corn than to move it. Open-air threshing is also far pleasanter and healthier for the labourers, their lungs not being choked with dust, as under cover they are; and there is, of course, a saving of labour to the tenant not inconsiderable: but when these moveable steam-engines have spread generally, there will arise an equally important saving to the landlord in buildings. Instead of three or more barns clustering round the homestead, one or other in constant want of repair, a single building will suffice for dressing corn and for chaff-cutting. The very barn-floors saved will be no insignificant item. Now that buildings are required for new purposes, we must, if we can, retrench those buildings whose objects are obsolete. Open-air threshing may appear visionary; but it is quite common with the new machinery; nor would any one perform the tedious manœuvre of setting horses and men to pull down a rick, place it on carts, and build it up again in the barn, who had once tried the simple plan of pitching the sheaves at once into the threshing-machine. These moveable steam-engines have been gradually improved by the yearly trials of the Agricultural Society. It will be seen by Mr. Carr's Report* that such yearly trials are still needed, as the worst of those exhibited consumes three times more coal than the best. Mr. Locke, M.P., whose engineering experience gives weight to his judgment, thinks that in other respects, too, they might be still further improved:—

To P. PUSEY, Esq., M.P.

London, 11, *Adam-street, Adelphi, July*, 1851.

DEAR SIR,

THE detailed report of Mr. Carr, of the results of the experiments made on the portable steam-engines, has already been presented to the Jury over which you preside; and as you desired from me a short statement of my views of Mr. Carr's report, I beg to send you the following:—

You will find in the tabular statement of the consumption of fuel, that the several makers stand in the following order of excellence:—

	Per horse-power.
Messrs. Hornsby and Sons - - -	6·79 lbs.
" Tuxford and Sons - - - -	7·46 "
" Clayton, Shuttleworth and Co.	8·63 "
" Barrett, Exall, and Andrews -	9·20 "
" Garrett and Sons - - - -	11·65 "

In a subsequent trial, however, made to test the strength of Llangenneck coal with Messrs. Shuttleworth's engine, it appears that both engines burnt precisely the same amount of fuel; and Mr. Carr has deduced from this circumstance, that, but for some accidental derangement in the slide, in the main tabulated experiments the consumption of Messrs. Garrett's engine, which was 11·65 lbs. per horse-power, would not have been more than Messrs. Shuttleworth's, or 8·63 lbs. per horse power.

This mode of reasoning is, I think, liable to objection; and I allude to it with a view of preventing an undue importance being attached to it. Besides, I do not entirely concur in the remarks made by Mr. Carr on the construction of these two engines.

Messrs. Garrett's fire-box is, in my opinion, decidedly inferior to Barrett, Exall, and Co.'s; and the workmanship generally is not superior. It is lighter, and so far it is better; but whether the smallness of the fire-box, to avoid weight, may not entail other disadvantages, is a question on which a doubt may fairly arise.

As regards the engine of "Ransomes and May," which, from some accidental defect, did not go through a trial, I would beg to say, that in point of workmanship it is equal, if not superior, to any of the engines tried. I think the connecting-rod might be lengthened with advantage, but in other respects it is, I think, a good, serviceable engine. As regards the other engines, I agree entirely with the remarks made by Mr. Carr. If I might be permitted to suggest a little advice to the makers of these engines, I would beg of them to attend more to the proportions of the various working parts, and less to external ornament. There is a want of good proportion in several of the engines; and this, to a mechanic or an economical farmer, is of more importance than a profusion of brass.

JOSEPH LOCKE.

Much progress, however, has been made, as our best engine now consumes less than 8 lbs. of coal per hour per horse-power; whereas an engine made by the winning manufacturer of four years ago consumed 28 lbs., that is, four times as much fuel for the same work.

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* The mode of ascertaining the amount of duty done and weight of coal consumed, in a given time by each engine, was the same as that adopted by the Royal Agricultural Society of England, at their Annual Show of Implements and Machinery; and the dynamometer used for the trial was the same as the one supplied to that Society by Messrs. Easton and Amos, their consulting engineers.

Messrs. Tuxford and Sons presented the novelty of placing their cylinder and working parts in a wrought-iron box at the end of the boiler, having a pair of doors to lock the whole up when not in work, which I certainly think a good idea, and of some practical importance. But to gain this, the tubes at the smoke-box end were rendered difficult to be got at. There were two engines brought to the trial-yard upon this construction, one a 6-horse direct-action upright cylinder, the other a 4-horse oscillating; but the former worked out the most duty with the least fuel.

Messrs. Hornsby and Son were distinguished by placing their cylinder inside the upper part of the fire-box, the whole of which, together with the rest of their boiler, was carefully felted and lagged with wood; and they had a well-constructed water-heating apparatus in their smoke-box, which also helped to produce the satisfactory result of great economy in fuel.

Messrs. Garrett and Son, in their engine, had made a great effort to combine lightness with strength, having substituted wrought for cast iron in the bearing for crank-shaft and other parts. Their boiler presented a great amount of heating surface, but the fire-box, to insure greater strength and a less amount of flat surface exposed to steam pressure, was made partially oval, and considerably smaller than most of its competitors. The fire-bars being above the level of many of the tubes of the boiler, and the flame having to descend over a bridge, the manufacturers expressed themselves quite aware that this construction of fire-box would prevent their standing quite so well as some with respect to fuel consumed, but considered that superior strength, lightness, and portability would more than compensate, this class of engine seldom working more than a few months in the year, and having to be conveyed from farm to farm. And I certainly considered this engine the most portable, for its power, of any exhibited. During the trial some derangement took place in the slide, so that the result was not so favourable; but upon the engine being put through a second trial with Messrs. Clayton, Shuttleworth, and Co.'s, to test the comparative strength of the Llangenneck and Newcastle coals, she worked out to a decimal the same number of pounds of coal burnt per horse-power per hour as her competitor, which, allowing for the proved difference in the strength of the coal in favour of the Welsh, would have given Messrs. Garrett 8·63 lbs. of that coal burnt per horse-power per hour instead of 11·65, as shown in the tabular statement; which more favourable result I think them quite entitled to, as the derangement in the slide was purely accidental.

Messrs. Clayton and Co.'s engine was exceedingly simple, and worked well; the governors had perfect control during the trial, which was passed through with great steadiness and credit to the makers.

As regards the other engines, I will proceed to notice them in the order as tested:—

Messrs. Hensman and Son's 4-horse, of moderate workmanship, was evidently the production of a novice. The boiler was too small for the power, and the consumption of fuel more than as much again as most of the first-class engines.

Mr. Butlin's 4½-horse: workmanship moderate; arrangement of working parts simple; and duty done for coal consumed fair when compared with others of its class.

Mr. Caborn's 9-horse: workmanship moderate; arrangement of engine ill designed; and entire weight far too great to be generally suitable for a portable engine. The boiler being a large one, with considerable heating surface, the duty done was comparatively good.

Messrs. Barrett, Exall, and Andrews' 4½-horse: workmanship moderate. The cylinder and crank-shaft bearing in this engine were placed upon the same base-plate, which was bolted to the boiler, an arrangement giving superior strength and steadiness in working. These makers adopted a link motion, controlling the slide-valve and worked in connexion with the governor, which we think a very needless complication, and worked very unsteadily. The boiler was large for the size of the engine, and the duty done for coal consumed was more nearly approaching its first-class competitors; so that, as a whole, I cannot speak less than favourably of the engine.

Mr. Burrell's 6-horse: workmanship fair, and arrangement of working parts simple and good, and consumption of fuel comparatively moderate; so that in this case also I must report favourably.

Messrs. Roe and Hanson, Strand, London, 4-horse: workmanship very inferior; general arrangement ill-designed

2. *Threshing-machine.*

This is the most complicated agricultural machine in general use; but, though it has also been long in use, and though repeated trials have been made of competing threshing-machines at our great agricultural show, it was not till the Norwich Meeting in 1849 that a very singular discovery was made of their great imperfection. It occurred to the consulting engineer, Mr. Amos, that the draught of the common threshing-machine worked by horses, should be tested when empty; and it was ascertained that some of the best 4-horse machines required no less than three horses, putting out their strength as when at plough, to keep the machinery in motion without threshing at all. In other words, of the four horses dragging round in their weary circle, three were overcoming the resistance of the machinery; one only was threshing the corn. Technically speaking, the duty performed was 25 per cent. only. So little, too, had the makers studied the principle of construction, that this enormous waste of power was capriciously divided between the barn-works and horse-works. To quote Mr. Thompson, of Moat Hall, whose reports always show that he has mastered his subject—"The machines of Messrs. **GARRETT** and **WOODS** furnish an excellent illustration of this point, the whole friction being in these cases 2·78 and 2·81—all but identical; the friction of the barn-works being, however, 2·07 and ·46, while that of the horse-works was ·71 and 2·35." Thus the makers were working so much in the dark, that, if the two best of the correlative parts had been put together, one horse in the four would have overcome the resistance, and the duty of 75 per cent. would have been achieved; but if unfortunately the two worst had been mated, the resistance of the 4-horse machine would have amounted to four horses and a half before any corn was put in for threshing, and there would have been no duty at all.

The same rigid trial was applied to the threshing-machines shown at Exeter in the following year. It then appeared that Messrs. Garrett had profited by the lesson, and reduced their dead resistance from 2¼ to 1⅛, or one-half. Yet there was still found a vast difference in the power required by the competing machines. For threshing 100 sheaves in a minute, the two extremes of power required were as 14½ and 36; and the work of the machine which required triple power was inferior to that of the machine which required least power. This short summary of what has been done already seemed necessary in order to show the interest attaching to the following report by Mr. Thompson of the trial in the third year for the present occasion:—

1. Threshing-machines may be divided into two classes—those adapted for steam or water power, and those intended to be worked by horses. In the trial of the latter it is clearly desirable that the horse-works should be tested, and on this occasion, in the absence of the ingenious apparatus invented by Mr. C. E. Amos, of the Grove, Southwark, for this purpose, repeated attempts were made to obtain a satisfactory trial by the use of the dynamometer or draught gauge. But after various methods had been fairly tried, it became evident that the results obtained were not sufficiently accurate to warrant their being made public, and the trial of the horse-works was abandoned, and the whole attention of those who conducted the trials devoted to the more important part of the machines, known as the barn-works. The accompanying tabular form shows the results obtained, which were arrived at in the following way:—

The steam-engine selected to drive the threshing-machines was itself tested to ascertain the net pressure of steam which represented one-horse power. An apparatus was then attached to it, which registered on a counter the revolutions of the driving-pulley. As each machine was brought up for trial, the maker was asked how many horse-power he required, what number of revolutions per minute he wished the drum to make, and the exact dimensions of the driving-pulley. From these data a calculation was made of the pressure of steam required in each case, and the supply of steam in the boiler of the driving-engine was so adjusted that the calculated pressure was maintained during the trial.

On reference to the tabular statement, it will be observed that col. 1 gives the "nominal horse-power," as stated by the makers; col. 2 gives the horse-power corresponding to the power of steam actually employed during the trial. The figures in these columns are for the most part identical, it being wished that the machines should be tried in accordance with their designation—*i. e.*, that a 4-horse machine should be worked by steam of 4-horse power, &c. Some of the machines, however, could not be worked without additional power, which is recorded against them in col. 2. In col. 3 are given the revolutions made by the driving-engine whilst threshing the allotted quantity of wheatsheaves, viz., 2¼ cwt. Col. 4 shows the net pressure of steam at which each machine was worked, and which had been previously calculated from the data above mentioned. Col. 5 shows

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and clumsy; and cast iron used freely in the place of wrought. The coal consumed for duty done was three times that of the best engines.

Messrs. Ransomes and May brought an engine to the trial-yard, but from some cause it could not be made to work. It was a trunk engine, which, in so small a power as 5-horse, would give rise to much extra friction.

At the close of the trials, two engines, viz., Messrs. Garrett's and Messrs. Clayton's, were put through a second trial, to test the difference in steam-generating power between the Llangenneck coal used in these trials and the best Newcastle, when the difference in favour of the former was found to be as 8·63 to 11·3 lbs. of coal burnt per horse-power per hour.

TABULAR STATEMENT OF RESULTS.

Names of Manufacturers.	Nominal Horse-power.	Time getting up Steam.	Coal used in getting up Steam.	Coal Burnt per Horse power per Hour.
		Minutes.	lbs.	lbs.
Tuxford and Sons, No. 1 – – – –	6	53	56·68	7·46
Ditto ditto, No. 2 – – – –	4	41½	35·60	10·80
Hensman and Son – – – – – –	4	33	29·00	18·75
Hornsby and Sons – – – – – –	6	49	35·23	6·79
Butlin – – – – – – – –	4½	50	42·00	14·71
Garrett and Son* – – – – – –	5	42	26·50	11·65
Caborn – – – – – – – –	9	44	52·00	12·48
Clayton, Shuttleworth, and Co., No. 1 –	6	32	35·40	8·63
Ditto ditto, No. 2 –	6	42	Withdrawn.	
Barrett, Exall, and Andrews – – –	4½	26	25·56	9·20
Burrell – – – – – – – –	6	28	35·00	13·10
Ransomes and May – – – – –	5	70	Withdrawn.	
Roe and Hanson – – – – – –	4	83	75·20	25·80
* Garrett and Son's slide was wrong in this trial, but in a second experiment, tried with Newcastle coal, this engine worked out what would equal – – – – – – – – – – – – – – –				8·63

CHARLES JOHN CARR, Belper.

the comparative time of performing the same amount of work. This, it should be mentioned, is not the observed time, but the time calculated from the registered revolutions of the engine. The pressure of steam and the number of revolutions per minute which were equivalent to the horse-power applied to each machine having been ascertained, the whole number of revolutions made during the trial, divided by the calculated number per minute, gave the number of minutes required for the performance of the work at the specified power and speed of drum. The figures in col. 6 represent the horse-power that would have been required in each case to do the work in one minute; and show therefore, at a glance, the performances of the several machines in respect of speed and power combined. The lowest figures represent the most satisfactory results. Col. 7 shows the quality of the work done in respect of the three points of "clean threshing," "broken grain," and "state of straw." In each case a number is assumed to represent perfect work, which is considered to bear a proper proportion to the importance of the point—so that the total number obtained by each machine, as shown in the last column, may fairly represent the comparative goodness of the work.

The second trial was conducted in precisely the same manner as the first, the only change being that barley was threshed instead of wheat. Those machines only were allowed to compete which had acquitted themselves satisfactorily at the first trial.

For the guidance of those who are not in the habit of examining tabular statements, it may be useful to point out that the two columns to which attention should be particularly directed are those numbered 6 and 7—the latter being the most important. On ascertaining by the "total" number in col. 7 that a machine has done its work well, col. 6 should next be consulted to ascertain whether under that head it received a high or low figure; if the former, it must be either slow in its performance or heavy in its draught; but, if the latter, it may be inferred that it had threshed *wheat* well, and the second trial would be referred to to ascertain its capabilities with respect to *barley*. An examination of this kind will show that the machines which stand first in order of merit are those of Messrs. Holmes, Hensman, and Garrett; and their performances having been in all respects satisfactory, Medals were awarded to each of them.

The shaker attached to Messrs. Holmes's machine was especially commended as being very efficient, and yet adding little to the draught of the machine.

H. S. Thompson.

First Trial—Wheat.

—	1	2	3	4	5	6	7			
	Nominal Horse-power.	Horse-power required whilst Threshing	Revolutions of Driving-pulley, as shown on counter.	Net Pressure of Steam in lbs.	Minutes in Threshing 2¼ cwt. of Wheat-sheaves at the specified power and speed of drum.	Horse-power required to Thresh 2¼ cwt. of Wheat-sheaves in one minute.	Quality of Work.			Total.
							Twenty represent perfect work.	Twelve represent perfect work	Eight represent perfect work.	
							Clean Threshing.	Broken Grain.	State of Straw.	
					min. sec.					
1. Hornsby – –	4	4	616	15·76	4 13	16·88	18	9	4	31
2. Blythe – –	4	4	407	15·50	2 41½	11·76	10	12	7	29
3. Garrett – –	6	6	260	32·00	2 21	13·96	18	12	8	38
4. Crosskill – –	4	4	305	19·00	2 27	9·84	16	12	8	36
5. Hensman – –	4	4	358	17·50	2 40	10·67	20	12	8	40
6. Caborn – –	6	6	417	26·00	3 5	18·48	20	8	4	32
7. Barrett & Co.	6	6	396	26·00	2 58	17·88	16	10	8	34
8. Ransomes – –	4	6	368	26·00	2 44	16·44	18	6	6	30
9. Holmes – –	6	6	248	28·50	2 0	12·06	20	12	7	39
10. Smith – – –	3	6	595	24·00	4 0	24·00	20	11	7	38

Second Trial—Barley.

1. Garrett – –	– –	– –	160	32·00	1 27	8·72	20	10	8	38
2. Crosskill – –	– –	– –	346	19·00	2 47	11·16	20	11	8	39
3. Holmes – –	– –	– –	168	28·50	1 20	8·19	20	12	8	40
4. Hensman – –	– –	– –	195	17·50	1 27	6·62	15	12	8	35

The difference, as shown by the Table, in the power required by different threshing-machines for threshing a given quantity of straw, which was 1 to 3 at Exeter, is not much less now, being still as high as 1 to 2½. The speed, however, with which the straw is passed through the machine must not, of course be made the sole test of excellence. Clean threshing is a most material point, in which some machines are very deficient, as is proved after rain by the grassy verdure of a straw-heap so threshed. Thus the easiest-working machine, Mr. Crosskill's, seems to have gained that ease at the expense of its efficiency, as appears in the column which registers the cleanness of the threshing. On the other hand, clean threshing may be obtained by beating the sheaves too roughly, as must be the case with Mr. Hornsby's, which bruises the straw, and what is worse, breaks the grain. Still, the power required by the three prize machines averages only about 12, while the maximum of power required is just double, namely 24, by Mr. Smith's, which, therefore, of course wastes half the power, whether of horses or steam, that may be applied to it.

A separate trial it will be seen, was made with barley. Long as the threshing-machine has been known, the maltsters in most counties refuse to buy barley unless threshed by the flail, because most machines bruise the grain, and destroy its power to germinate. The assertion that malting barley could be threshed by machine, would in many parts of England simply be disbelieved. Yet where the best machines are used, the maltsters no longer object to barley so threshed; so that it is most important to test all threshing-machines with barley. Enough, however, has been now demonstrated to convince farmers that they should no longer buy blindly the threshing-machine which comes nearest to hand, buying thereby double or perhaps treble labour for the same or worse work, and leaving their barley, which is, probably, half their corn-crop, to the tedious work of the flail, though the labourers themselves begin to regard that work as too irksome.

There remains only in this class of machinery to apply the test of economy, and compare the cost of threshing by flail, by horse, and by steam. In the two former cases the rick must first be removed into the barn by eight men, a boy, and two horses—I take the numbers as they have been employed on my own farm, because it is difficult to ascertain such figures, and the comparison will at least be a fair one:—

	s.	d.
8 men, at 1*s.* 4*d.*	10	8
1 boy	0	10
2 horses	6	0
Cost of barning	17	6

The price of threshing wheat by flail varies, with the yield and the district, from 2*s.* 6*d.* to 4*s.* a quarter. Three shillings then will not be an unfair average. If the rick hold forty quarters, we must add 5*d.* for barning, and the cost will be 3*s.* 5*d.* per quarter.

In threshing with the unimproved machines, I find on inquiry that neither my neighbours nor myself have hitherto got out more on an average than thirteen quarters a-day. The supposed rick would take, therefore, three days to thresh:—

5 men, at 1*s.* 4*d.*	£0	6	8
4 women, at 8*d.*	0	2	8
1 boy	0	0	6
4 horses, at 3*s.*	0	12	0
	1	2	0
			3
3 days' threshing	3	6	0
Barning	0	17	6
	£4	3	6

The whole system of horse-machines has cost us, therefore, 2*s.* a quarter. But improvement has been carried further: for steam-threshing we require additional hands, sixteen instead of ten, but we get over three times the work, passing the rick in one day, not three, through the machine. The figures on steam-threshing will be then as follows:—

1 engineer (head carter)	£0	2	6
10 men, at 1*s.* 4*d.*	0	13	4
5 women, at 8*d.*	0	3	4
Coals, 3½ cwts.	0	3	6
	£1	2	8

If we make up this sum to 30*s.* for the use of the engine, the cost of steam-threshing will be 9*d.*; the saving as compared with hand-threshing, 2*s.* 8*d.*, or with horse-threshing 1*s.* 3*d.*; an average of 2*s.* per quarter of wheat —a large saving certainly to be effected in one only of five main departments, but not larger, I believe, than may be shown to arise from the use of improved machinery in most, if not all, of the four other departments as well. It may be objected that credit is given for the value of the horses' labour; and though in valuations horse-work is often charged high, we are apt, I know, as farmers, to regard each particular use of horses as costing us nothing. This view may be even correct on small matters occurring at leisure seasons, but it would be false if applied to a demand like the present, large in itself, distressing also for the horses, and liable to occur at all times of the year. It can have no truth in it at all, when we endeavour, and by reformed implements in all other departments are enabled, to reduce the permanent staff of horses kept on the farm: for this plain reason, that, if we do not carry the reduction throughout, we either press the horses unduly at one time, or require horses to be kept which are useless at other seasons.

Since the trial for the Commission, a fresh trial has been made at Bridlington. There the prize was awarded to a machine by Messrs. Clayton, Shuttleworth and Co., which not only threshes out 50 quarters in a day's work, but dresses the corn also to a great extent at the same time, yet requires, as the makers state, only fourteen hands for both purposes; not more hands, therefore, than we have employed to get out with our horse-machines, and afterwards dress 13 quarters:—

	s.	d.
Engineer	2	6
Feeder	2	6
Six men, at 1*s.* 4*d.*	8	0
Six women or boys, at 8*d.*	4	0
Coals, 5 cwts.	5	0
	£1 2	0

If we add 7*s.* for wear and tear,* we find the wheat to be threshed *and winnowed* for the almost incredibly low sum of 7*d.* only per quarter. Messrs. Clayton, therefore, have now taken the lead in the improvement of threshing-machines.

3. *Winnowing-machines.*

Even winnowing is become a refined process; for instead of trusting the corn to the wind, it is now placed in a machine so discriminating that the best of these, Messrs. Hornsby's, required, on the part of the Judges at the York meeting, specific terms for describing its work more than are easy to understand; but the Judges' account is for that very reason worth quoting:—"Several machines," they say, "were tried, but could not get through the grain, shorts, straws, and chaff, as it came from the threshing-machines, without being choked or requiring much more time than Hornsby's, which did its work well, parting the whole into best corn, good tail, tail, whites, screenings, and chaff, at the rate of about fifteen quarters an hour, and dressing over the second time at the rate of above twenty quarters per hour, parting the whole into six parts, as before, in a workmanlike manner." Such masterly mastication and digestion, making the contents of our supposed wheat-rick, forty quarters, in five hours ready for market, must be appreciated by farmers; and Mr. Hornsby's winnower has not lost character at Kensington, as appears by the Judges' Report:—

> *Winnowing-machines.*—Messrs. Hornsby and Son are, above all others, the most successful in these machines, dressing more than double as much corn as any other in a *rough state.* Theirs is fitted with a spike roller, working through a grating, and forms a sort of hopper, separating the corn from the chaff in the rough pulsy state, *as it comes from the threshing-machine,* without being previously riddled; and can be adjusted to suit corn either in rough chaff or in any other state; the second time over, a slide-board is adjusted in the front of the grating, and is excellent for finishing the corn for market. We therefore awarded it a Medal. Price 13*l.* 10*s.*
>
> Mr. Gooch exhibited a machine which did its work well, but too slow.

C. B. Chaloner.

The corn being now fit for the miller, the task of a reporter on agricultural implements fifty years since would have ended; nor is it within this branch to enter on the new process of grinding, by which the finest flour is produced from ordinary red wheat; but though the preparation of food for man belongs to another department, there is an entirely new class of implements belonging to this Jury which must not be passed over.

V. Machines for preparing the Food of Stock.

Formerly our farm stock was fed with hay, or turned out to pick over straw, sometimes with whole turnips thrown to them. But practice, anticipating Baron Liebig's brilliant discoveries in animal physiology, found that the labour of the jaws wasted the beast's muscle and thus retarded his progress. Our stock, therefore, are saved even from that exertion, and distinct machines have been invented for mincing each description of food with which the animals are made ready for market. The most common of these is

1. *The Turnip-cutter.*

The test of labour saved cannot, of course, be applied where the labour is applied to a new object. These machines, however, have recommended themselves so widely, that to prove their advantages is almost idle. Still it deserves mention that, in the opinion of good farmers, lambs fed with the aid of a turnip-cutter would be worth more at the end of a winter by 8*s.* a-head than lambs fed on whole turnips, the cost of using the machine being but 1*s.* per head, and of the machine itself 5*l.* only. If this be true—and it has not been disputed—this simple instrument gives a saving of 70*s.* an acre upon the turnip crop. Hitherto the Banbury turnip-cutter has stood almost alone, thousands, I believe, being sold in the year; but in the Exhibition Building it has at last found a rival.

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* I am told that this would be a fair allowance for wear and tear on a farm of 500 acres, where the steam-engine is used for chaff-cutting, grinding, &c., as well as threshing.

Turnip-cutters.—Three of these implements were tried: that of Messrs. Burgess and Key is upon a different principle to those generally in use; their implement cuts a very large amount of roots for sheep and beasts at the same time, exceedingly well, and requires a very small amount of power. There is a great facility of changing any of the knives that may become blunt or broken; and there is a very simple and ingenious method of letting stones or gravel escape before coming in contact with the knives. Price 5*l.* Both for novelty and usefulness we awarded it a Prize Medal.

Mr. B. Samuelson (successor to the late James Gardener, of Banbury) has very much improved that well-known implement. The framework is made of cast-iron, light, portable, and durable, and well adapted for field work. He has also made a great improvement in the facility of getting at, repairing, or adjusting the knives. Price 5*l.* We awarded a Prize Medal.

Mr. Phillipps's turnip-cutter was tried, but could not compete either in construction or work with the other two.

C. B. Challoner.

2. *Chaff-cutters.*

These instruments, which cut straw into very short lengths for feeding stock, are so called because there not being enough natural chaff for the purpose, artificial chaff was made in this way. At first the straw was cut in a rude box, with a chopper raised by the hand, and cost 2*d.* per basket; then with a circular movement, costing 1½*d.*; and may now be cut by steam-power at not much more than ½*d.* per basket. The process makes, too, an arable farmer independent of natural meadow; for sheep, it is well known, especially breeding ewes, require much dry food; but this artificial chaff mixed with rape-cake, takes the place for them of hay, or hay may be cut with the straw. It is also worth while to cut hay, though consumed by itself. Even in the new circular chaff-cutters we find a difference as to the labour required by them for preparing a given amount of chaff. The difference, indeed, was so great in the trials at York, that it is worth while to quote some of the figures:—

	Price.			Weight of Chaff cut.	Power required.	
	£.	s.	d.	lbs.	lbs.	
Cornes -	14	0	0	112	14,126	Did its work well.
Garrett -	10	10	0	112	31,291	
Crosskill	18	0	0	112	44,800	This machine made very rough work.

This table is most instructive; for we find here three first-rate makers staking their reputation in a public trial on their respective instruments, one of which nevertheless requires three men to do badly what another enables one man to do well. Surely farmers must learn from such results a more careful choice of their implements. It is due to the two makers last named to mention that the lesson was not thrown away on them.

Chaff-cutters.—Mr. Cornes, of Burbridge, has, in the trials at Kensington, maintained his previous reputation for the greatest economy of power in proportion to the work performed; also the machines of Messrs. Garrett and Son, and Messrs. Smith and Co., of Stamford (17*l.*), are worthy of the highest commendation, the latter for an ingenious application of a spring lever to throw the rollers out of gear when starting the machine. To these three we have therefore awarded a Medal.

C. B. Challoner.

3. *Linseed and Corn Crushers.*

The same extraordinary disparity of power required was found also two years since, at the Norwich Meeting, in this class of implements:—

	Linseed Crushed.	Power required.
	lbs.	lbs.
Stanley - - -	112	24,238
W. Nicholson -	112	94,080

In fact this is the greatest difference we have found yet in any machine worked by hand, being about four to one: so that to obtain the same work four men must turn one machine, while a single labourer turns the other.

Linseed and Corn Crushers.—Mr. Stanley, of Peterborough, at present stands unrivalled with this machine. By his recent improvement of a lever in front to relieve the pressure when the corn is first let in upon the rollers, he has perfected this machine, which was much needed, as machines on this principle have been made by various other makers, but have always been subjected to the inconvenience of being choked with the corn at starting. On these trials Mr. Stanley's machine required less power to drive it than others; and was, in consequence, awarded a Prize Medal.

Messrs. Barrett and Exall's crusher merits commendation.

Messrs. Garrett and Son have introduced some additional motions, and have thereby added considerably to the friction of their machines.

C. B. Challoner.

4. *Oil-cake Bruisers.*

Not being able to procure the thick cake, the machines were tried with the small 3-lb. cakes.

Mr. Nicholson, of Newark-on-Trent, exhibited a machine, the price of which was 5*l.*, which did its work very well. Messrs. Hornsby brought two very excellent machines (I think the larger one is to be preferred), breaking for beasts, sheep, and manure equally well. To each of these exhibitors a Prize Medal has been awarded. Others, on the same principle, were tried, but did not do their work so well.

C. B. Challoner.

5. *Mills for grinding fine Meal.*

Mills for grinding fine Meal.—The best metal mills that have been produced for the operation are those of Messrs. Hurwood, of Ipswich, and Messrs. Crosskill, of Beverley; that of Messrs. Hurwood, which is composed of a series of cutting rings screwed upon a cast-iron plate, having the dress somewhat resembling the common millstone; the drift increased from the centre, to enable it to clear itself. The rings appear to be easily replaced by new ones when worn out, which is a great advantage over the old mills. This mill did six bushels of barley per hour, with a power of a little more than three horses, and is applicable to beans, barley, and oats. We awarded it a Prize Medal.

Messrs. Crosskill's is an American invention, consisting of a number of cast-iron plates turned up in circular grooves, either fine or coarse, dependent upon the work required, and fixed *eccentric*, which gives them a sort of clip. The mill requires great power, and should be driven at great speed. By changing the plates it will grind anything from linseed to flint-stones. In the trials at Kensington it ground linseed, barley, beans, and oats very well. Price 28*l.* We awarded it a Prize Medal.

Mr. Bentall, of Woodbridge, exhibited a small steel mill, requiring very little power, which split beans very well, at the rate of ten pecks per hour, and deserves commendation. Price 6*l.* 6*s.*

C. B. Challoner.

6. *Gorse Bruisers.*

These implements have reached a high degree of perfection, but whether their application has increased in proportion, or has been found profitable, there is no sufficient information at hand.

Mr. Burrell's, of Thetford, did the most and the best work; and although it consumed rather more power than some others in bruising the gorse, it did oats and linseed at a moderate amount of power. We therefore awarded it a Prize Medal. Price 27*l.*

Messrs. Barrett and Exall, of Reading, exhibited a machine worthy of commendation. Price 25*l.*

Messrs. White, of Holborn, exhibited a machine that reduced the gorse into the most pulpy state, but required a great increase of power. The price (60*l.*) is beyond the reach of a farmer, which, I am told, they propose to reduce; but that was the price officially announced at the time of the trials.

C. B. Challoner.

7. *Steaming Apparatus.*

Besides the various modes of subdividing, it has been often proposed to cook the food of animals; but the practice has not spread widely, and the advantage must be regarded as doubtful, excepting as regards the steaming of potatoes for pigs; but even diseased potatoes, if not too far gone, by being thus treated, may be rendered good victuals and be stored up for months. It seems hardly worth while to set up expensive fixtures for this purpose only, especially as we have an excellent apparatus, Mr. **Stanley's**, which, like Soyer's magic stove, may be used when and where it is wanted. When tried* at York, it heated 126 gallons of water, while another heated but 70, little more than half, with the same allowance of fuel; yet this inferior one had been the best two years before.

VI. Churns.

The pace of the churn was first accelerated by the Americans, who sent us over a churn within the last few years that produced butter after ten minutes' work. It is not quite clear, however, whether this speed be compatible with the finest quality, for the New York Agricultural Society was not satisfied with the butter so rapidly made. The time in the present trials was reduced to two minutes, and even to one minute, but in the latter case with cream which, having come from Jersey, had been already half churned by the steam-packet.

Thirteen churns were tried in the first trial, with ordinary cream of good quality; the annexed tabular form will give the results. As will be seen, many of the churns worked equally well, and some of them which did not do so well would perhaps have shown a different result in an atmosphere more congenial to the making of butter. However, in both trials, the small family churn of Lavoisy did its work so well that we awarded it a Prize Medal. Those of Wilkinson, and Burgess and Key, also proved themselves to be excellent churns; and there was awarded to each a Prize Medal. The Belgian churn of Duchêne, though not quite perfect in every part, we consider entitled, as among the foreign churns, to a Prize Medal.

First Trial of Churns.

Exhibitors.	Cream.	Time.		Butter.		Residue.	Quality.	Form of Churn.	Thermometer.	
	Quarts.	Min.	sec.	lbs.	oz.				Air.	Cream.
Wilkinson - - - -	4	11	0	3	8	- -	Best - - -	Wood.		
Tytherleigh - - -	10	18	0	9	2	- -	Soft - - -	Tin - - -	70	69
Destrey - - - -	4	16	0	3	12	- -	Do.			
Ditto - - - - -	9	11	0	8	12	- -	Do. - - -			
Patrick - - - - -	10	20	0	9	4	- -	Do.			
Burgess and Key - -	4	10	0	3	12	- -	Second best -	Barrel.		
Drummond, American	6	9	0	5	2	- -	Not made -	Wood - -	72	71
Lavoisy - - - -	2	2	0	1	13	- -	Third best -	Tin.		
Dalphin - - - -	6	8	0	5	0	- -	Soft.			
Allen - - - - -	6	7	30	4	2	- -	Do.	- -	77	74
De Pourquet - - -	3	9	0	2	6	- -	Do.			
Duchêne - - - -	19	9	0	7	9	- -	Not all made.			
Smith - - - - -	5	22	0	4	10	- -	Indifferent -	Centrifugal.		

Second Trial, with Jersey Cream.

Wilkinson - - - -	4	1	45	4	0½	- -	Best - - -	Wood, box -	72	75
Burgess and Key - -	4	1	45	4	2	- -	Very good -	Do. do. -		
Lavoisy, French - -	2	0	45	2	2	- -	Third best -	Tin - - -		
Clare, French - -	1	1	45	1	0½	- -	Good - -	Do. - - -		
Duchêne, Belgian -	30	2	30	27	0	- -	Second best -	Barrel, wood		

VII. Draining.

This last class of machines, those connected with draining, ought perhaps to have formed the first class, inasmuch as draining is the only road to good culture on land which lies wet; but as much land does not require draining, and as it does not belong to the regular task of the farmer, but is a work to be done once for all by the landlord, the machines employed in this mode of improvement have been reserved to the end.

1. *Tile Machines.*

Twelve years ago draining-tiles were made by hand, cumbrous arches with flat soles, costing respectively 50*s.* and 25*s.* per 1,000. Pipes have been substituted for these, made by machinery, which squeezes out clay from a box through circular holes, exactly as macaroni is made at Naples, and the cost of these pipes averages from 20*s.* down to 12*s.* per 1,000. The old price was almost prohibitory of permanent drainage, excepting where stones were at hand; the new invention has reduced this permanent improvement to a rate of 4*l.* or 3*l.* per acre, not exceeding in cost the manure given to a single turnip crop in some high-farmed districts. This result has been obtained by a most spirited competition among mechanics, as no less than thirty-four different tile machines competed in 1848 at the York Meeting. Since then the struggle has been practically between three only, on which, in the present year, we have the following report:—

Trial of Tile Machinery.—I recommend to the consideration of the Jury the Tile and Brick Machines of Mr. Clayton, Mr. Scragg, and Mr. Whitehead.

I first tested their capacity in screening the earth. The result of this trial was that in five minutes

Mr. Clayton screened - 327 lbs. 2 men and boy.
Mr Whitehead - - - 361 „ 2 men.
Mr. Scragg - - - - - 202 „ 2 „

I give the preference to Mr. Clayton's screen, as it clears itself, and the portion rejected consisted almost entirely of small stones, &c.; whereas the screens of Mr. Whitehead and Mr. Scragg retained a large portion of clay.

In the manufacture of large pipes, nine inches in diameter, by horizontal delivery and the use of a cylindrical horse, the machine of Mr. Whitehead was perfect.

Mr. Scragg has much simplified the internal arrangement of his machine by substituting a chain for the rack and pinion: the pipes from this machine were not to be surpassed for regularity and uniformity of shape. After a careful examination of the working of these machines, we recommend the *horizontal* delivery of Mr. Scragg and Mr. Whitehead in preference to the *vertical* delivery of Mr. Clayton, but especially call your attention to Roberts's patent hollow and bonding bricks, as made by Clayton's machine.

A. Hamond.

The pipes so made are placed under ground with narrow spades; but in the form of the narrowest spade, if I may venture to speak from my own experience, it is clear that, so far as regards clay subsoils, a step has been taken backward in substituting a concave tool for the old triangular lance-headed tool of Essex, with which far more work can be done, by less exertion, too, on the part of the labourer. There is hope, however, that on clay soils manual toil will be superseded by the use of

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* The trial of Mr. Stanley's apparatus was overlooked accidentally, because a trial was thought unnecessary, there being no moveable apparatus in competition; but the Jury having decided that no prize should be awarded without trial, the oversight could not be remedied. There was also a fixed apparatus which could not have been tried.

2. *The Draining Plough.*

But for the American Reapers, Mr. FOWLER's draining plough[*] would have formed the most remarkable feature in the agricultural department of the Exhibition. Wonderful as it is to see the standing wheat shorn levelly low by a pair of horses walking along its edge, it is hardly, if at all, less wonderful, nor did it excite less interest or surprise among the crowd of spectators when the trial was made at this place, to see two horses at work by the side of a field on a capstan which, by an invisible wire-rope, draws towards itself a low framework, leaving but the trace of a narrow slit on the surface. If you pass, however, to the other side of the field, which the framework has quitted, you perceive that it has been dragging after it a string of pipes, which still following the plough's snout, that burrows all the while four feet below ground, twists itself like a gigantic red-worm into the earth, so that in a few minutes, when the framework has reached the capstan, the string is withdrawn from the necklace, and you are assured that a drain has thus been invisibly formed under your feet. The Jury decided as follows:—

> The implement went through the trial very well, laying in the tiles with great apparent ease, worked by *two* horses, with a capstan which was firmly and easily fixed into the ground, and afforded a firm traction to the plough by means of a wire rope and pulley. Progress has been made, since the implement was exhibited at Exeter, in rendering the level of the drains in a degree independent of the level of the surface; but there is still room for further improvement in giving to the drain a *uniform* incline.

The award, therefore, of the Jury was Honourable Mention. Since that trial I have thought it right to make further inquiry into the work of the draining plough. In the first place, the trial drains were opened and laid bare from end to end. Straightness is of course one requisite, and the pipes were laid straight; closeness of contact another, and they were perfectly joined. In level, the point on which the Jury doubted the perfection of the work, there was some deficiency, which, on entirely flat ground such as this, was a decided fault. That fault, however, has since been remedied for clay land at least. As the plough was shown last year at Exeter, it could not possibly lay a level drain, because, its under and upper parts being fixed at any unvarying distance, any unevenness of undulatory surface must be faithfully copied by an undulating drain below. This year the two parts were so connected that the workman, by turning a screw, can raise or lower the underground snout which burrows out the drain. But at the trial the use of this screw depended on the workman's judgment, which cannot give the drain absolute accuracy. A balanced level, however, has now been added to the plough, by which the changes of surface are made plain to his eye. Other improvements have also been made in the implement. The horse-power required has been reduced by a fourth, and the windlass at which the horses work need now be shifted only once in the day. As to the economy of using the draining plough, it is too expensive to purchase, unless for a large landowner, but it may be hired by the year or the month. Its inventor is also ready to execute work at his own risk by contract, at a saving of from one-third to two-thirds on hand labour—the greater the depth, the greater being the saving. I have only seen the actual cost of two drainages that have been made by this plough. They were were both without tiles and shallow, being only 2½ feet deep. Taking the highest of them, and adding the cost of tiles, the price of tile-draining land at that depth, and at 33 feet apart, would be 14*s*. only for work, and with 1¾-inch pipes, at 15*s*. per 1,000, 18*s*. 9*d*. for tiles, all together 1*l*. 3*s*. 9*d*., including horses and hire of machine. The plough goes as well, however, at a depth of 4 feet, nor could the additional cost be material. The plough has worked on the following farms:—

		Depth.		
	Acres.	ft.	in.	
Mr. Fowler, Melksham . .	14	2	6	with pipes.
Mr. Newman, ditto . . .	10	2	0	ditto.
Mr. Blandford, near ditto .	30	3	6	ditto.
Mr. Purch, Down Ampney .	100			without pipes.
Mr. Hall, Brentwood . . .	200	2	6	with and without.
" Wormwood Scrubbs	40			from 2 ft. to 4 ft., with tiles.
Mr. Harris, Darlington . .	now working	3	6	

In clay subsoils, with a gentle fall, the success of this new implement seems to be beyond doubt, and in all circumstances the inventor is ready to undertake the risk of the execution.

In now closing this Report, I shall be permitted to say that, although it is impossible adequately to value any productive machinery without detailing its objects and estimating its power to diminish human toil, or to increase the results of that toil, I could not have ventured to enter so far into the practice of husbandry, but for the interest your Royal Highness has long taken in these pursuits, and, above all, from the high concern entertained by you in the welfare of that important class among Her Majesty's subjects to whom agriculture affords the means not of harmless or useful amusement merely, but of anxious subsistence, not unaccompanied now with serious misgiving. A sure conviction, founded on no short experience, that those new implements which in the great Exhibition afforded not the least conspicuous testimony to the advance of English skill in devising mechanical means for the abridgment of labour, can practically afford to the English farmer, if rightly understood, important, easy, and immediate assistance, has emboldened me to pursue the necessary chain of evidence with, I fear, tedious minuteness; but that minuteness will, I trust, be excused, if it shall have established any definite truths, which, as affecting the prosperity of so important a body of men, may be thought in some degree to claim even national importance; and the claim alone will, I well know, have secured your Royal Highness's indulgent attention.

It seems proved, then, that within the last twelve years, since annual country shows of implements were established by Lord Spencer, Mr. Handley, and others yet living, old implements have been improved, and new ones devised, whose performances stand the necessary inquiry as to the amount of saving they can effect. To ascertain that amount precisely is difficult; but looking through the successive stages of management, and seeing that the owner of a stock farm is enabled in the preparation of his land, by using lighter ploughs, to cast off one horse in three, and by adopting other simple tools to dispense altogether with a great part of his ploughing—that in the culture of crops by the various drills, horse-labour can be partly reduced, the seed otherwise wanted partly saved, and the use of manures greatly economised, while the horse-hoe replaces the hoe at one-half the expense—that at harvest the American Reaper can effect nearly thirty men's work, while the Scotch cart replaces the old English waggon with exactly half the number of horses—that in preparing corn for man's food the steam threshing-machine saves two-thirds of our former expense—and in preparing food for stock, the turnip-cutter, at an outlay of 1*s*., adds 8*s*. a-head in one winter to the value of sheep—lastly, that, in the indispensable but costly operation of draining, the materials have been reduced from 80*s*. to 15*s*.—to one-fifth, namely, of their former cost; it seems to be proved that the efforts of agricultural mechanists have been so far successful, *as in all these main branches of farming labour, taken together, to effect a saving on outgoings, or else an increase of incomings, of not less than one-half.*[*]

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[*] The machinery is made by Messrs. Fowler and Fry, Templegate, Bristol.

[*] As mere reasoning seldom carries conviction, I may be permitted to mention that whereas in estimates by excellent farmers 12 horses are still assumed to be necessary for a farm of 400 acres, though with improved farming, I find now that I can work 400 acres of a mixed farm with 8 horses, which are by no means confined to the work of the farm.—PH. P.

This saving of labour or expense, though large for land—a material certainly very intractable—is small as compared with the saving effected in the weaving of calico, or the knitting of stockings. But it is important to observe, on the other hand, that the cost of the means which produce the saving is comparatively insignificant. When the distaff and knitting-needle were abolished, huge factories had to be built, and filled with intricate clockwork of spinning-jennies and looms, costing thousands of pounds. In agriculture we buy a few simple durable tools; and it is evident that a farmer setting up now in business, who, instead of the old waggons with three horses each, should buy one-horse carts, and the smaller number of horses required by such carts and by other improved machinery, would find that, without any increase of outlay whatever beyond the old scale, he could acquire all requisite modern machinery, with one exception, indeed—the steam-engine, but the steam-engine is often hired. It is therefore further demonstrated that *the new agricultural machines have, with reference to the amount of saving produced by them, the merit of very great cheapness.*

There is a further effect of machinery upon agriculture which has hitherto been overlooked. The main difficulty of farming has always lain in its uncertainty. Though machinery has not altogether cured, it certainly has much mitigated, this evil. On undrained clays a wet winter may destroy half the yield of the wheat. On the same land drained, the wheat may escape altogether unhurt, and you may also plough heavy land in wet weather when drained, though you could not before. Upon any land wheat may suffer in winter, but in spring the presser settles it in its bed, and the manure distributor with a cheap sprinkling restores it to vigour. In sowing barley earliness may save the crop; but the ground is often too cloddy, though the season is wearing away, and May-drought approaching. This cloddiness may be prevented, as has been said, by the paring-plough, or, if it could not be prevented, may be remedied by the clod-crusher or Norwegian harrow; and besides these implements, the cultivator does the plough's work in one-fourth of the former time, thus enabling the farmer to profit by the auspicious hour of seed-time. And so too with the turnip: the land, being prepared for it in the previous autumn and winter, is moist to receive the seed; the dry drill, supplying it with superphosphate, saves it almost certainly from the fly; or yet more, the water-drill, anticipating the clouds, makes its seed-time independent of weather, while the horse-hoe afterwards preserves it from neglect in the busiest harvest-time. Again, while machinery remedies the absence, it also guards against the inconvenient arrival of rain, by making hay and now even reaping corn while the sun shines. It may be further said, then, that *machinery has given to farming what it most wanted, not absolute, indeed, but comparative certainty.*

I wish I could add that the use of machinery has advanced as rapidly as its improvement. Still it has advanced greatly, as is shown by the increase, not only of implements but of eminent implement makers, and the sale has never been so great as it has been this year. Yet even the best new machines are not yet adopted into general use. This incomplete progress may, however, easily be accounted for. The farmer, whose life is secluded, has little opportunity of seeing them, and it is remarkable that nearly all our first implement-makers live on the east side of England, in those four counties from which the other great improvements of agriculture have also proceeded. For threshing-machines again, though universal, until very lately no record of their work has been published, so that a farmer in one county, threshing thirteen quarters only a day, could not possibly ascertain that in another county three times that amount was the proper work of a day.

But it must be further admitted, that few even of our best farmers, though they may possess the new implements, carry their use thoroughly out. It seems evident that *the new implements require a new system.* As yet many farmers use the drill, and do not use the horse-hoe afterwards, the use of which is pointed out by the drill, while most farmers still use the plough previously, which the drill may have rendered superfluous. It is of course very difficult to give up old practices, but the result of the whole inquiry into agricultural machinery appears to be this,—that, inasmuch as the new machinery effects a great saving of labour, and is also exceedingly inexpensive, giving also moderate certainty to a business proverbial for its precariousness, farmers ought no longer to bind themselves down by ancient customs in husbandry, but should consider at once how these practices may be reformed altogether, in order thoroughly to carry out the advantages of modern mechanics. They should look as much to a shed furnished with suitable implements as to their stables, remembering that the best of these implements, though it cost as much as a horse, may take the place of a horse; and, furthermore, when once purchased, does not, like the horse, entail a weekly expense afterwards. That this extension as well as improvement will come to pass in the mechanics of husbandry there is no reason to doubt, nor that both have been accelerated by the opportunity for careful study of agricultural implements which has been afforded during five months through their exhibition, under your Royal Highness's auspices, among all the other products of human industry.

NOTE.—In this Report it occasionally happens that an Exhibitor is named more than once in connexion with different articles he has brought forward as entitled to a Medal; as, however, no person can obtain more than *one* Medal in the same Class, that mark of distinction must be understood to represent the excellence of each of the objects rewarded.

JURY AWARDS, CLASS IX.

COUNCIL MEDAL.

Nation.	No. and Page in Catalogue.		Name of Exhibitor.	Objects Rewarded.
	No.	Page.		
United Kingdom -	15	366	Busby, W. - - - - -	Two or four-horse plough, horse hoe on the ridge, ribbing corn drill, and cart.
United Kingdom -	135	380	Crosskill, W. - - - - -	Norwegian harrow, meal mill, cart, clod crusher, and gorse bruiser.
United Kingdom -	142	385	Garrett and Sons - - - -	Horse hoe, general purpose drill, four-row turnip drill on the flat, improved hand barrow-drill for grass seeds, steam engine, and thrashing machine.
United Kingdom -	233	395	Hornsby and Sons - - - -	Corn and seed drill, drop drill, two-row turnip drill on the ridge, oil-cake bruiser, steam engine.
United States - -	73	1437	M'Cormick C. H. - - - -	Reaping machine.

PRIZE MEDAL.

Nation	No. and Page in Catalogue.		Name of Exhibitor.	Objects Rewarded.
	No.	Page.		
United Kingdom	132	380	Ball, W.	Two-horse plough.
United Kingdom	128	377	Barrett, Exall, and Andrews	Steam-engine and linseed and corn crusher.
United Kingdom	217	394	Bentall, E. H.	Cultivator dynamometer.
United Kingdom	237	397	Burgess and Key	Improved American churn and turnip cutter.
United Kingdom	37	367	Burrell, C.	Gorse bruiser.
Belgium	163	1156	Claes, P.	Corn drill and roller.
United Kingdom	242	398	Clayton, Shuttleworth, and Co.	Steam engine.
United Kingdom	47	369	Clayton, H.	Tile machine.
United Kingdom	216	394	Coleman, R.	Cultivator expanding harrow.
United Kingdom	143	387	Comins, J.	Horse hoe.
United Kingdom	205	393	Cornes, J.	Chaff cutter.
United Kingdom	96	374	Crowley and Sons	Cart.
Belgium	510	1167	Delstanche, P.	Plough.
Belgium	166	1156	Duchene, J. J.	Churn.
United Kingdom	129	380	Gibson, M.	Clod crusher.
United Kingdom	150	387	Gray and Sons	Cart.
United Kingdom	149	387	Hensman and Son	Thrashing machine, four-horse plough, corn drill.
United Kingdom	241	397	Holmes and Sons	Thrashing machine.
United Kingdom	240	397	Howard, J. and F.	Two-horse XX plough, four-horse plough, horse rake.
United Kingdom	414	301	Hurwood, G. (Cl. VI.)	Meal mill.
Netherlands	74	1146	Jenken, W.	Plough.
France	1299	1239	Lavoisy, A. D.	Churn.
United Kingdom	124A	376	Newington, Dr. S. (as Inventor)	Top-dressing machine.
United Kingdom	50	370	Nicholson, W. N.	Oil-cake bruiser.
Belgium	169	1157	Odeurs, J. N.	Plough.
United States	413	1462	Prouty and Mears	Plough.
United Kingdom	124	376	Ransomes and May	Drop drill.
United Kingdom	108	374	Reeves, T. R. and J.	Water drill and liquid manure distributor.
United Kingdom	185	392	Samuelson, B.	Turnip cutter.
United Kingdom	228	394	Scragg, T.	Tile machine.
United Kingdom	234	396	Smith and Co.	Haymaker, chaff cutter, horse rake.
United Kingdom	1	365	Stanley, W. P.	Linseed and barley crusher.
France	1028	1228	Talbot Brothers	Plough.
United Kingdom	271	401	Tuxford and Sons	Steam engine.
United Kingdom	220	394	Wilkinson, T.	Churn.
United Kingdom	151	388	Williams, W.	Light and heavy harrows.
United Kingdom	239	396	Whitehead, J.	Tile machine.
France	705	1224	Vachon, Son, and Co.	A seed and corn separator.

HONOURABLE MENTION.

United Kingdom	28A	366	Fowler, J.	Draining plough.

PH. PUSEY, M.P., REPORTER.

CLASS X.

PHILOSOPHICAL INSTRUMENTS AND PROCESSES DEPENDING UPON THEIR USE.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Sir David Brewster, F.R.S., *Chairman*, St. Andrews, Fifeshire, N.B.; Principal of the University, St. Andrews.
Professor Colladon, Switzerland.
E. B. Denison, 42 Queen Ann Street.
J. Glaisher, F.R.S., *Reporter*, 13 Dartmouth Terrace, Lewisham; Observer in Greenwich Observatory.
Sir John Herschel, Bart., F.R.S., 32 Harley Street; Master of the Mint.
Professor Hetsch, Denmark.
E. R. Leslie, R.A., United States; Artist.
L. Mathieu, France; Member of Bureau of Longitude, of Institute, and of Central Jury.
W. H. Miller, F.R.S., Scroope Terrace, Cambridge; Professor of Mineralogy.
Richard Potter, A.M., University College, London; Professor of Natural Philosophy.
Professor Schubarth, Zollverein; Professor of Chemistry and Natural Philosophy.
Baron Armand Seguier, France; Member of Institute, &c.

Associates.

J. S. Bowerbank, 3 Highbury Grove.
Rev. W. S. Kingsley, Sidney College, Cambridge; Fellow of Sidney College.
L. A. J. Quetelet, Belgium; Secretary to the Royal Academy at Brussels (Juror in Class XXX.)
Lord Wrottesley, 34 St. James's Place.

The duties of the Jury upon Philosophical Instruments have been found to be very heavy, as indeed might be expected in a field so vast,—including instruments relating to Astronomy, Optics, Light, Heat, Electricity, Magnetism, Acoustics, Meteorology, &c.; in fact, all relating to Physical Science, collected by a large number of exhibitors.

Astronomical instruments claim our first attention, the exhibitors of these, though few in number, have effected a most beneficial advance by the use of as few parts in their construction as possible; this is mainly observable in the British portion. The workmanship of those exhibited by Germany deserves the highest praise; the instruments are, however, few in number, and do not fully represent German art.

America claims particular notice by the application of electro-magnetism to the registration of astronomical observations, thus enabling the hand to do the work of the mind. This method has the further advantage of enabling us to record the observations taken at widely separated Observatories, the length of the wire used being immaterial; thus is established a means the best possible for the determination of the difference of longitude. Observatories so connected afford the means of performing the most delicate experiments dependent upon the appreciation of minute portions of time. This method has been recently used in America, for the determination of the wave-time of electrical currents; from which experiments it would seem that its velocity of propagation is much smaller than that determined by Wheatstone.*

Of nautical instruments, there are several exhibitors; but with the exception of those of America by Ericsson and St. John, there is but little novelty of construction. In surveying and levelling instruments, beyond some improvements observable in those exhibited by Austria, there is no novelty. In optics there are many exhibitors, and we remark the improvement of optical glasses in England, France, and Switzerland, and that the construction of large discs of glass for telescopes, in England, promises to add considerable optical power, and thereby tend to the advancement of Astronomy, &c. Of microscopes the British are by far the best. In physical optics generally, France is pre-eminent, having exhibited a number of delicately-constructed instruments, none of the same kind being contributed by any other nation: she also excels in lenses and in prisms. There are many other classes of optical instruments to be specified hereafter.

There are many photographic cameras, to the improvement of which much attention is at present being paid in both England and France. This leads us to the most remarkable discovery of modern times,—the art of *Photography*,—and never before was so rich a collection of photographic pictures brought together, the products of England, France, Austria, and America.

Before going further, it would be well to inquire into the utility of the photographic process as regards its application to art and science,—and, indirectly, to literature,—by affording a faithful transcript of authentic papers and original documents, upon which subsequent literary and historical research must necessarily be greatly dependent. That photography is yet in its infancy, there can be little doubt; and it is more than probable that its present application, (which we believe to be well represented in the Exhibition,) is no more its ultimatum than were the first applications of the telescope, shortly after the chance placing of two pieces of glass by Jansen's children had led to its invention. Who, at that time, could have predicted the important part that the instrument, based upon that discovery, was destined to play in the world of science? or have foreseen the excellence which it has since attained by successive improvements—even now making,—and of which the Exhibition affords ample proof.

Viewing Photography in connection with Art, it may at first appear as if a vast and powerful rival had risen up against and was destined to depress her in exact proportion to the superiority of the operations of nature over those of man. In its success, we perhaps expect to behold a transcript of objects and compositions more elaborate and more truthful than any the greatest genius could ever hope to achieve. United to this, and in addition to the rich Vandyke browns and Claude Lorraine tints of many of the works now before us, by the agency of chemicals whose existence is yet unknown, we may see foreshadowed a perfection of colouring as yet never imagined. By improvements in the camera and the daily increasing practical knowledge of experimenters, we may expect to behold compositions, embodying a degree of reality otherwise beyond our power of attainment. The truthful delineation of the various and just relations of the architectural edifice; the groups of figures at its base; the middle distance blended into the horizon by gradations so fine and truthful as to defy the utmost efforts on our part to surpass or even equal; are indications only of that which will utimately be achieved by the photographist, rich in experience and knowledge of the processes of photographic art.

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* See Gould's Astronomical Journal, vol. I., Nos. 2, 7, and 14.

But this is a superficial and imperfect view of the case,—not as regards the ultimate perfection of photography itself, but as concerning its influence upon art. With art, doubtless, its future destiny will be closely linked; but so far from becoming a rival, it will prove a most useful auxiliary, and a means by which the artist of merit may rise higher in reputation and eminence. By using photography as a means of replacing the purely mechanical parts of his labour, the work of the artist may be much lightened; and as, by speedy transit from place to place, man's life is virtually lengthened, so by relieving his path from that part of his labour which involves an expenditure of time disproportionate to the end attained, one great obstacle to the achievement of success is removed. Never need the artist fear that the employment of its services in conjunction with his pencil, or his adaptation of it in any way to his art, will ever derogate from that art, or render him a servile copyist; we may rather predict that each improvement in photography will tend to place both the painter's and the sculptor's art on a firmer and surer basis. It is likely that time will show that this beautiful compound of art and science will essentially cast its weight into the balance of art, and in future render itself more and more inseparable from, and essential to, her interests.

That Photography will have a great tendency to depress mediocrity, we may safely predict; that, from the date of the general application of Photography to the illustration of scenes daily passing around us, will commence a new era in pictorial representation; that it will greatly enrich us with authentic records of works, that would otherwise pass away without a single detaining effort from the hand of the artist, owing to their being of too transient a nature to admit of the accuracy and detail necessary to give it value in future ages;—is attested by the various and excellent representations which we now possess of the Exhibition building itself, in all its stages, by the faithful and well-executed photographic pictures of MM. Martens, Claudet, &c. Great is its usefulness as applied to transitory scenes of the above kind, and incalculable will be the advantage posterity is sure to reap from the ever increasing collection of such truly graphic representations; and great service, too, will the plain and truthful records of Photography afford to the historian of future ages. As applied to the illustration of works of the present day, it may be of two-fold service. By its application may be superseded the works of individuals, in whose hands illustration is rendered a mere trade, and the directing of whose exertions into another channel would be a means of removing many obstructions which hinder the advance of art. At the same time, the many books we possess for the education of the young, which are crowded with illustrations unfortunately but too well calculated to produce most erroneous impressions, would at once give way before the truthful representations of photography, which, by diffusing a more correct taste, would render essential aid to art herself.

Let us now view Photography in its applications to science. A process by which transient actions are rendered permanent, and which enables nature to do her own work, or in other words, which causes facts permanently to record themselves,—is too well fitted for the purposes of science to be long overlooked; but the difficulties to be overcome in its application, have been, and still are great, and the results proportionably few in number; we consider, however, that the commencement of a systematic application of the photographic process to the purposes of astronomy is indicated by the daguerreotype of the moon by Mr. Whipple (451, p. 1464); and great indeed will be the benefit conferred upon astronomical science, when we obtain permanent representations of the celestial bodies and their relative positions, transmitted through the agency of light.* Another illustration is afforded by the self-registering apparatus of Mr. Brooke (pp. 422-426), in which nature is made to perform the operations of a corps of observers, by an application of what must be considered a few only of the first principles of photography. That its application in causing instruments which are continuous and delicate in their action, to register their own work, must be attended with advantages—is evident to every reflecting mind; and points to some of the further advantages science is likely to derive from the ultimate perfection of the photographic processes.

As applied to the preservation of documentary collections, and thus indirectly to the purposes of literature, its use is too important to be passed over in silence. How often has the historian, in his search after authentic papers, and original documents, found them only to regret that, to posterity he must be the chronicler of events, the vouchers for which will have perished by the unavoidable ravages of time, or, as in too many cases, by supine neglect. To make use of the means afforded by photography to procure fac-similes of these is a duty we owe not only to posterity, but to our forefathers. Again—as applied to valuable documents of the present day, either testamentary or legislative, how important to secure photographic transcripts of these, which, being of indisputable authority, shall be also perfectly unavailable for any purpose other than that intended.

Let us now turn our attention to the collection before us, in which for daguerreotype portraits, America stands prominently forward;—France, first in order of merit for calotypes, or sun-pictures;—England, possessing a distinct character of her own, and presenting illustrations of nearly all the processes which have as yet been adopted. America stands alone for stern development of character; her works, with few exceptions, reject all accessories, present a faithful transcript of the subject, and yield to none in excellence of execution. France, in her daguerreotypes, of which she has but few, offers bright sunny representations; their effect rather injured than improved by too great masses of sunlight; but in her calotypes she stands unrivalled, and all but rejecting the processes of Daguerre, has concentrated all her energies in the further development of those of Talbot and his school.

Eminent amidst the exhibitors of calotypes, is M. MARTENS (610, p. 1207), whose works we may say with certainty, have never been surpassed; their colour, arrangement, and perfect finish, call forth the highest admiration: his success is not confined to one class of delineation in particular, the individual works comprising his collection, being nearly all of equal merit.

On turning to the photography exhibited by the United Kingdom, we find CLAUDET (296, p. 440) leading the way, and adding to the many improvements introduced by him into the various processes of the art by presenting the image *direct* instead of *inverted:* this is the distinguishing feature of his collection, and is the result of patient and untiring research in that class of investigation peculiar to himself.

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* The success of this application of photography must be dependent, to a considerable extent, on the object-glass of the telescope. The Report on Telescopes will show whether the improvements in this department of optics are commensurate with the requirements of photographic representations of this class.

Ross and THOMSON, of Edinburgh (299, p. 839), are fairly entitled to attentive consideration from their successful use of the albumenized glass, which they prepare by a process different to that adopted by M. Niepce, its originator, applying the albumen so as to ensure its even distribution, upon which evenness the success of the picture is mainly dependent. The pictures in their collection combine, with exceeding delicacy of execution, a richness of colour equal to that of Martens, but surpass him in the diversity of tints; the collection, besides embracing a long range of sepia tints and Vandyke browns, includes a small picture the colour of which is *blue*, and as this is a hitherto unprecedented result, we are led to give it weight, and will, in another place, describe the process by which it is produced. Some details connected with the methods adopted by Messrs. Ross and Thomson, and kindly furnished by them, are subjoined.

The process for producing negative Talbotypes, on glass, is as follows:—The whites of two eggs, being a quantity sufficient for coating a plate of glass 12 inches square, are placed in a bowl, and cleared from all opaque particles; ten drops of a saturated solution of iodide of potassium are added for each egg, and two-thirds of a wine-glass of water for both,—the whole being then beaten up to a light froth and carefully covered up and left to regain its liquid state. The glass to be coated is well cleaned with a solution of pure water and soda, or potass, and rubbed quite dry with a silk rag. The mixture is then poured on as evenly as possible, and fastening a piece of wire to the opposite corners, the excess of albumen is poured off by turning the plate gently upside down; it is afterwards made to revolve before a clear fire, by a thread of worsted tied to the suspending wire; when the albumen begins to crack, the plate should be removed to a greater distance, and there suffered to remain until equally cracked all over. To render the plate so prepared fit for the camera, it is breathed upon, to give it a degree of softness and to cause it to absorb as much silver as possible; it is then dipped (the prepared side undermost) very gently in a bath of nitrate of silver, prepared in the proportion of 60 or 70 grains to an ounce of water, the plate being prevented from touching the bottom of the vessel by a piece of bent glass, or metal covered with wax. It is then washed in a large dish of clean water, by repeated dippings, care being taken to keep the water running in the same direction. The plate is then placed in the camera, and if the picture when taken, is to be immediately developed, a quantity of acetic acid is added.

The mode of developing the image is as follows:—a quantity of saturated gallic acid is poured on the plate, and spread evenly with soft cotton-wool, after which, when the picture has well appeared, a small quantity of gallic acid is mixed with the nitrate of silver solution, and spread over the glass, which gives the development strength, and renders it more rapid. At this stage of the operation, a solution of hyposulphate of soda (50 grains to an ounce of water) is poured over the picture, and carefully spread with clean cotton; the process is then completed by pouring some water from a jug very gently over the surface.

The negative proof so obtained is transferred to paper by floating the latter on a solution of common salt (5 grains to an ounce of water) for a space of two minutes; it is then pinned up to dry and floated on a solution of nitrate of silver (70 grains to an ounce of water) for three minutes; it is then dried in the dark, and afterwards placed with its prepared side to the prepared side of the glass negative, and screwed in the pressure frame with a plate of glass below to ensure its close contact. The pressure frame should be surrounded with black boards to cut off the rays of light from the sides. To fix the impression, it should be first washed in cold water, then in hyposulphate of soda (100 grains to an ounce of water) for 15 minutes. It is then washed once in cold water, five or six times in boiling water, and finally suffered to remain an entire night in cold water, so as to remove entirely the remaining hyposulphate of soda, which would, in course of time, eat out the picture if allowed to remain.

The photograph thus obtained is afterwards mounted upon card-board, and pressed on a warm plate of steel, to communicate a slight glaze, which may be considered an improvement to its appearance.

The process we have just detailed is good in many points, but defective chiefly in one—sensitiveness; every effort to increase which has hitherto been attended with a softening of the albumen. This is a difficulty, but one which Messrs. Ross and Thomson will doubtless overcome.

The *positives* on *glass* are transferred and fixed in the usual manner (the albumen being mixed with salt instead of iodide of potassium), with the addition of pure plaster of Paris, which being mixed with the solution is poured on the face of the picture, and adhering to the albumen in a manner hermetically seals it, and thus effectually preserves it from injury.

This admirable system is, we believe, entirely due to Messrs. Ross and Thomson, whose collection of Talbotypes amply attests the superiority of their method; and indeed, as is the case of Mr. BUCKLE (301, p. 840), of M. MARTENS, or of any highly-successful photographist, it is but fair to infer that the superiority observable in their productions is due to their improvement of the processes which they have adopted.

Whether the followers of Talbot will ever obtain a pre-eminence over those of Daguerre, or *vice versâ*, is a question for time to solve; at present the two systems appear in the British Department of the Exhibition to be equally well represented; the followers of each, with few exceptions, laying claim to some improvement or peculiarity of manipulation. For example, in addition to the cases already mentioned may be included those of MAYALL (pp. 439, 440), who calls attention to his crayon daguerreotype, an invention of his own, and BEARD (p. 440), whose *patent* enamelled process is one of the very few instances of a patent having been obtained for any improvement connected with this art. Great as is the satisfaction with which we regard the efforts made for perfecting the processes of Daguerre and Talbot, still greater is that with which we observe experimenters divulging the processes they have adopted; the hitherto all but total avoidance of patent enrolment must be considered a distinctive feature of this art, to which fact, doubtless, added to the ready divulging of improvements, is chiefly due the rapidity by which up to the present time its progress has been characterized. The publication of each new process opens a fresh field of philosophical inquiry, gives to man increased physical knowledge, and may work great changes in his moral destinies.

We cannot pass from the subject of photography without alluding to a loss recently experienced in the death of its founder, M. Daguerre, whilst the Jury were engaged in their duties, and we feel it due from us not to let his memory pass unnoticed. In him was lost one of the lights of the age.

We now proceed to Electric Telegraphs, of which a great variety are placed in the Exhibition; many of them are remarkable for novelty of construction, and for important improvements. In the section devoted to their description we shall speak of them at some length.

When Oerten, in 1820, linked together the sciences of electricity and magnetism, great hopes were entertained of the application of electro-magnetism to the movement of machines: and as in the Exhibition there are several arrangements for obtaining motive power in this way, we are far from despairing of its successful application to mechanical motion.*

When Faraday obtained the converse of electro-magnetism, by induced electricity from magnets in motion, he originated magneto-electricity, and it is possible that its successful application to the purposes of the electric telegraph will supersede the use of galvanic electricity; the experiments which were made before us with the magneto-electric telegraph were satisfactory.

The application of voltaic action, by coating the inferior metals with the superior, is shown in the Exhibition in some beautiful electrotypes and intaglios; also in a recent and highly important application by T. H. Henry, Esq., F.R.S., as shown in the coating beams of balances with platinum and palladium.

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* See Jacobi's papers in Taylor's Scientific Memoirs; and also Lens on Electro-magnetism in the same work.

Chemistry and chemical apparatus need not detain us long—the Exhibition presenting little (in Class X.) that is new, excepting the application of the former to the extinguishing of fire by Mr. Phillips (Class V., 92, p. 222), who has successfully brought this element under our immediate control by the agency of carbonic-acid gas, nitrogen, and aqueous vapour. His contrivance, by which these agents are evolved, differs materially in its action from that of water, which simply cools the burning substance to a temperature too low for the existence of inflammable gas, but does not at all interfere with the current of fresh air, every accession of which is attended with a fresh increase of combustion. The chemical agents constituting the gaseous vapour generated by this machine, on the contrary, are highly inimical to fire, chiefly from the fact of their entirely preventing all access of pure air to the burning mass. There is another patented application of this kind, but we are ignorant of its details and application.

The Planimeters exhibited claim some attention, there being several ingenious machines of this kind adapted to the determination of areas of plane surfaces by mechanical means.

There are several exhibitors of air-pumps, who have exercised much ingenuity.

There are various machines for standard measures of length exhibited, two of which are extremely beautiful.

Calculating Machines claim some attention as a mechanical power by which the hand is made to do the work of the mind; and operose and long calculations, requiring much strained attention, are performed by turning a handle. Two such machines are shown, which performed well and accurately.

We cannot help recording how clearly the injurious effects of patent enrolments on science were shown in the course of our labours; many of the ingenious contrivances exhibited proved to be merely variations, for the avoidance of the infringement of patents. In many cases the subjects patented were of a very trifling nature, but still their effect was to shut up the path in that direction from further improvement. The great advance of photography, previously alluded to, and the perfection of the microscope, are chiefly due to the avoidance of patents in connexion with their improvements.

It was found that the instruments exhibited were, for the most part, collected without any concurrence on the part of the exhibitors, for the representation of the state of science in their respective countries, and that therefore it was useless to examine the instruments of each country separately. In the following Report we have, therefore, classified the instruments according to their use, including the contributions of all nations.

It is but right to say that some instruments inserted in the Catalogue have not been found, and that in other cases neither the exhibitor nor any explanation of the instrument were to be met with.

We now proceed to describe the several instruments in each class.

Astronomical Instruments.

It is to be lamented that this department of the Exhibition contains results of the labours of but few individuals; and of large instruments, with the exception of the great equatorial by Ross, there is not one. This circumstance, how much soever a matter of regret, is not one of surprise;—the risk of injury and difficulty of carriage being in some cases almost insurmountable, and the same obstacles existing in full force, with regard to the exhibition of the large class of instruments termed portable. When we consider that, in addition to the above obstacles, the risk of transmission and danger attendant upon removal must necessarily be great, and the involved exposure highly hazardous, the scarcity of instruments in the British, and more particularly in the Foreign Department, will be sufficiently accounted for.

But in those instruments which are exhibited, it is highly satisfactory to find the greater part of them characterized by exquisite workmanship, and a steady advance in their construction.

In Mr. Ross's great equatorial, it will be seen that he has followed the example of the Astronomer Royal, by having every part of the instrument cast in as few pieces as possible, and has thus avoided all unnecessary screw connections. The casting of this instrument, by Messrs. Ransomes and May, is a fine piece of work. The same principle of casting has been adopted by Mr. Simms, who has avoided various screw connections in the construction of his instruments.

It is most gratifying to perceive that, small as is the number of astronomical instruments, the credit they reflect upon the artists is very great; thus, the instruments exhibited by Mr. Simms possess points of high interest, viz., the conversion of the axis of the transit into a telescope; the modes of illuminating the wires and field of telescopes; the application of the principle of vertical collimation to the altitude and azimuth instrument by piercing the vertical axis; the adapting the axis of an equatorial to the application of a level, &c.,—all of which must be looked upon as improvements, and cannot fail to be of great service for the purposes of observation.

In the German instruments of Merz and Ertel there is exquisite workmanship, well maintaining the celebrated names of the makers of the Poulkova instruments.

The divisions of the Ertel instrument are beautiful; but works of this kind, performed by hand dividing, are operose and distressing.

The practice of hand dividing in this country is now almost superseded by machinery. Mr. Simms' instruments, for the most part, have been so divided. The advantages of this method cannot be better shown than in the comparison of the time occupied by the division of one of the instruments in the Exhibition, the far-famed "Westbury circle," and the time now occupied in performing the same piece of work.

The graduation of the two circles of the Westbury instrument occupied Mr. Simms, as he has informed us, nearly twelve weeks of six days each week, and on an average, of eight hours every day. The work was performed by lamplight, in a room otherwise completely darkened; and although practice enabled him, on subsequent occasions, to accomplish similar pieces of work in considerably less time, yet he always found it to be an exceedingly anxious and oppressive labour. By the means of Mr. Simms' self-acting dividing engine,* the actual graduation is effected in five hours, to which length of time a period of about five hours is to be added, which is necessarily occupied in the arrangement of the instrument upon the engine preparatory to cutting the divisions. Thus, the same work is done within ten hours which formerly occupied from five to six weeks, not to mention the saving of wear and tear upon the constitution of the operator. The divisions are found to be fully as accurate as those cut by the original process.†

In the American Department, Mr. Bond exhibits the electro-magnetic apparatus used successfully by the Americans, both for the purposes of geodesy and astronomy; this American invention promises to be a real improvement in practical astronomy, and will, in all probability, form a new era in astronomical observations.

DOLLOND (145, pp. 426—428, and see Illustration). A variation transit instrument. The horizontal circle is 12 inches in diameter, on which is fixed a smaller circle of 7 inches diameter; each is divided to every 10′, and the larger circle has three verniers, reading to every 10″. The telescopes are 14 inches focal length, and 1·3 inch aperture, with altitude circle and the regular transit series of spider lines, supported upon four pillars fixed to the horizontal circle.

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* This beautiful machine is described in the 15th volume of the Royal Astronomical Society.

† The dividing the 8-foot mural circle at Cambridge, which Mr. Simms graduated on its pier, occupied him several weeks: see the results of the examination of the divisions in the "Cambridge Observations" for 1833; see also the results of the examination of the altazimuth instrument at the Royal Observatory, "Greenwich Observations," 1847; and also the results of the examination of the divisions of the great transit circle lately erected at Greenwich, "Greenwich Observations" for 1851. Both these instruments were divided by Mr. Simms' self-acting dividing engine.

When the instrument is used for determining the actual or diurnal variation, there is a cover containing a lens, which is applied in front of the object glass of the telescope for reading off the divisions on the needles, of which there are two, 7 inches in length, together with various eye-pieces, &c. The instrument is supported on a strong tripod with adjusting screws.

SIMMS (741, pp. 475*—477*). A transit instrument, intended for use either in the meridian or prime vertical. The telescope and axis are of the form usually employed for this class of instrument, viz., two stout cones are connected by a sphere into which the cylindrical tubes of the telescope are screwed; the pivots are of hard bell-metal, and are both perforated.

The object-glass has an aperture of 2¾ inches, and a focal length of 42 inches; the diaphragm is furnished with seven vertical and two horizontal spider-lines. There is another vertical spider-line carried by a micrometer screw, and which can be moved completely across the field, so that the distance of an object from any one of the fixed lines may be measured by its means. The lines are adjusted to the focus of the object-glass by a milled head near the eye-end, and another milled head is placed near the axis for the purpose of regulating the intensity of the illumination of the field of view.

The axis of the instrument is converted into a telescope, by having an object-glass fitted into one of the pivots, and a sliding tube carrying an adjustable cross of delicate spider-lines with a positive eye-piece in the other.

The adjustment of this axis telescope is effected by a small collimator placed in a line with the axis—(unless a distinct mark can be seen through it),—and then turning the axis round, and moving the proper screws until the intersection of the lines remain stationary upon the mark, or collimator cross, during an entire revolution. If the principal telescope be adjusted to the meridian, the mark seen through the axis will be 90° distant in azimuth, and by its means the instrument can immediately be placed in the prime vertical, for the determination of the latitude by observation of stars near the zenith. By this invention the form of the pivots may be examined, for if they be not circular, the error will be shown when the cross is being adjusted. The azimuthal adjustment is provided with a micrometer head, showing seconds of arc, so that when the deviation is of known amount, the instrument may at once be placed exactly in the meridian. To take a complete observation of a star in the prime vertical, it is necessary to reverse the instrument, quickly and delicately, for a slight concussion might disturb the adjustments, and consequently vitiate the observation. For this purpose a reversing frame has been contrived and fitted to the base of the cast-iron stand, or support upon which the instrument is placed. It consists of a strong screw having square threads, the circumference of which fits into a cylindrical hole bored through the centre of the stand, and is prevented from turning round by a key which fits into a groove cut longitudinally throughout the length of the screw. The screw is raised or depressed by a pair of bevelled wheels, one of which fits upon the screw, and the other is worked by a winch handle. Above the screw a stage is fixed, and upon this two conical pillars are erected, having a fork covered with vulcanized India rubber upon the top of each of them. Upon turning the winch, the screw is raised, and the forks are brought into contact with the transit axis, and by continuing the motion, the instrument is lifted out of its Y bearings. The frame with the instrument is then, by means of stops, which are attached to the stand, to be turned 180° in azimuth, and then by reversing the motion of the winch, lowered again into its bearings. Two setting circles of 4 inches diameter, and divided to one minute of arc, are attached to the eye-end of the telescope, both of which, previously to an observation, should be set to the zenith distance of the star, in order that no time be lost after reversing the axis, in again directing the telescope to the object.

The stage is forced upwards by means of four spiral springs, which rest upon the base of the stand; these are sufficiently strong to support the whole weight of the instrument when lifted, so that the friction upon the moving parts is very inconsiderable.

The eye-pieces with this instrument are six in number, namely, five direct, magnifying 40, 53, 86, 120, and 140 times, and for zenith observations a diagonal eye-piece, magnifying 90 times.

Mr. Simms also exhibits a diagonal transit instrument of the form used by Reichenbach in his altitude and azimuth instruments. The object-glass is 1·7 inch in diameter, and has a focal length of 18 inches, with magnifying powers of 25 and 45 times. The circle, which is intended for a finder, is 6 inches in diameter; is graduated to show by opposite verniers to one minute of arc; a spirit level is attached to the index of the circle, and there is also a sensitive spirit level for the rectification of the axis. The whole is mounted upon a light cast-iron stand, and is suitable for fixing at a chamber window. In this construction, as is well known, the rays which pass through the object-glass, do not proceed directly to a focus, but are reflected by a prism, or speculum, within the axis, and form an image within one of the pivots, which is perforated, and in which the diaphragm and eye-piece are placed.

Up to the time of Mr. Simms' adopting this mode, no method for the illumination of the field of such an instrument had been devised, except the old one of placing a reflector in front of the object-glass, and throwing light upon it by means of a lamp or candle, in a distant part of the room in which the instrument was fixed. There are several objections to this method:—first, the difficulty of throwing light at all upon the reflector under such circumstances; secondly, the trouble of having to re-adjust it when the direction of the telescope is changed; and thirdly, part of the object-glass itself is cut off by the reflector being placed in front of it. Mr. Simms has very ingeniously overcome these difficulties by lighting up the field of such an instrument, through the opposite pivot to that in which the diaphragm is placed, which obviates all these objections, and effects the object as easily, in this case, as in that of an ordinary transit instrument. The detailed means of doing this are as follows:—

The back pivot, being perforated, has a small convex lens set within it, and a large convex lens of suitable focal length is fixed within the axis, at the back of the reflector; and its diameter is such that one or more segments near the edges (very small segments are sufficient), project beyond the edge of the reflector, and a lamp is placed at the back, with its light directed through the pivot. The action of the lens within the pivot condenses the light, which, after crossing, diverges upon the large lens at the back of the reflector, the open segments of which again condense it upon the field of view, where it produces a full and abundant illumination, that remains unchanged by any variation in the direction of the telescope.

GERARD (109, p. 418) has exhibited a portable or field transit instrument.

The instrument consists of two mirrors, so fixed as to measure an angle of 90 degrees. In use two stations are selected, the one about 100 yards east or west of the other, and on the same level. A mark resembling a target with equidistant concentric circles, is set up at one of the stations, the instrument taken to the other, and so placed as to have the mark in the middle of the field. The telescope is then turned on its own axis till the sun or star is seen by reflection, which will be a few minutes before it passes the meridian. The times of its passing the different circles in succession should be noted. Another set of similar observations should be made at the second station, the mark being set up at the first. The time of the meridian passage will be the mean of all the times at both stations.

DOLLOND (145, pp. 426—428, and see Illustration) has exhibited an altitude instrument, with two circles of 2 feet diameter divided on silver to every five minutes, each circle reading off to seconds by means of two micrometer microscopes attached to the cones which support the instrument. Two small circles are fixed towards the eye-end of the telescope, each of which reads off the minutes by verniers, with levels for setting the instrument in altitude. The telescope is of 2¾ inches aperture and 32 inches focal length, and is fixed between the two large circles. There are five vertical and three horizontal spirit levels in focus of the object-glass, also various eye-pieces, &c.

The instrument is supported in Ys fixed on the top of two strong cones, which rest on a circular metal base, with differential screws for levelling. The usual method of illuminating the webs through the axis of the instrument is adopted. There are also two fine spider lines reading to seconds.

Mr. Dollond also exhibits a double altitude instrument for observing by reflection and direct vision* (*Cat. suprà*). The altitude circles are 1 foot in diameter, divided to 20′, and are read off by micrometer microscopes showing seconds. Each circle has a telescope of 15 inches focus and 1·3 inch aperture attached to it, and there are two small circles, read by verniers, for setting the instrument in altitude.

The azimuth circle is 1 foot in diameter, and reads off by verniers to every 10″, having a telescope fixed underneath as a check upon the instrument when taking horizontal angles. The axes of the circles are perforated in the usual manner for illuminating the spider lines. The instrument is furnished with fine spirit levels, eye-pieces, &c.

SIMMS (741, p. 476*). A transit circle, the telescope of which has a focal length of 4 feet, and an aperture of 3·25 inches, furnished with a micrometer in the eye-piece, and magnifying powers of 63, 102, 130, and 165 times. The circle is 2 feet in diameter; it was cast in one piece, of bell-metal. It was divided by Mr. Simms' self-acting engine into spaces of 5′ of arc, and subdivided into single seconds by micrometers, of which there are two, fixed to the stone piers which support the instrument.

In addition to the finer graduations, there is another strong circle of divisions, which are cut upon the bell-metal, and numbered to four times 90, showing either altitude or depression. These divisions are read by a pointer, and they serve to direct the telescope to the object, whether it be seen by direct vision or by reflection.

The Y supports are fixed upon the stone piers. One of the Ys has a vertical adjustment for levelling the axis, which is performed by means of a striding level, and the other has an adjustment in azimuth for adjustment to the meridian. There is also a lever counterpoise fixed to that end of the axis near to which the circle is fixed for the purpose of equalizing the pressure of the pivots upon their respective supports. The instrument is furnished with an embracing clamp, or one which lays hold of the axis, to distinguish it from that kind which bites at the circumference, and also with a tangent screw, which exerts no lifting power, and has, therefore, no tendency to disturb the meridian position of the telescope.

The arrangement for the illumination of the wires is peculiar, and is the invention of the Astronomer Royal; but it was greatly facilitated by adoption of the peculiar method of graduating the light in the field of view, which had been practically introduced by Mr. Simms.

The illuminator, which is, as usual, placed near the centre of the transit axis, and receives the light through one of the pivots, turns upon an axis in order to change its angle of inclination with respect to the eye-piece. By this change of inclination the quantity of illumination is regulated; and if the plane of the reflector be placed perpendicular to the axis of the telescope, no light whatever will be reflected from it. Upon the reflector one or more prisms are so placed as to receive the light from the lamp when the reflector is in darkness. These prisms reflect the light when the reflector is in the position above mentioned, but at no other time, to other prisms, which are fixed in the eye-end of the telescope, near to the diaphragm; and by these last prisms the light is thrown obliquely upon the spider lines, and produces the effect of illuminating the wires on a dark field. To the edge of the reflector a wire is attached, which terminates in a small knob, or handle near to the eye-piece, and therefore, near the observer's hand. The only operation required in passing from one state of illumination to another, with all the intermediate gradations, is either to draw out or to push in a knob or handle through a space of one or two inches.

By these arrangements power is given to the observer to regulate the quantity of light in the field of the telescope, from the faintest gleam, by which the wires are just made visible, to the full illumination, and also to change instantaneously, as circumstances require, a bright field and dark lines to a dark field and bright lines. This change has hitherto been effected by the employment of two lamps, one placed near the perforated pivot to give the ordinary illuminated field, and the other to apply occasionally at the eye-end of the telescope, very nearly in the plane of the diaphragm, so that the light passing through a slit obliquely across the field of view, illuminates the lines which intercept its passage, leaving the surrounding field in darkness. It is clear that the change from one kind of illumination to the other with these arrangements, requires some considerable time, and the hanging a lamp on the eye-end of a telescope of such an instrument as a transit circle is exceedingly objectionable. By the new invention one immoveable lamp either illuminates the field or the wires, and the same lamp, at the same time, also illuminates the graduated circle by means of prisms attached to the micrometer microscopes.

This instrument has also another improvement, which was suggested by Mr. W. Simms, jun., since the erection of the transit circle at the Royal Observatory, Greenwich. It is by the perforation of a hole, about one inch and a half in diameter, through the centre cube of the axis, at right angles to the axis of the telescope, in order that a north and south collimator may look into each other without lifting the instrument from the Y bearings, and by this means very much simplifying the act of adjusting the line of collimation.

ROSS (254, pp. 435, 436) exhibits a large equatorial.

The focal length of the telescope is 18 feet, and the aperture is 11½ inches. The diameter of the hour-circle is 2 feet 3 inches, and that of the declination circle is 2 feet 8 inches.

The instrument is supported on a round cast-iron pillar 10 feet 9 inches in height, 2 feet 3 inches in diameter at the bottom, gradually decreasing to 1 foot at the top. It is formed of two portions, fastened together at the height of 4 feet 6 inches from the bottom of the base, by eight screw-bolts and nuts, passing through flanges, 3 inches in width, from the shaft of the column. This joint affords the means of an approximate meridian adjustment. The base of the pillar is 9 feet in diameter.

The polar axis is of cast-iron, 6 inches in diameter, and 5 feet in length; it is connected to the declination axis by a flange of 18 inches in diameter. The length of the inner male declination axis is 3 feet 6 inches between its bearings; and the outer or hollow axis is 7 inches in diameter. Both are of cast-iron. The inner axis and its flange form one casting with the central hollow cylinder, to the flanges of which the corresponding gun-metal flanges of the telescope are bolted. The tube is of copper.

The fitting bearings of the declination axis are cylindrical, and the axis is secured by a steel collar 4 inches in length, fastened by cross pins to the male centre at the end to which the circle is fixed. In the inner axis there is a counter-sunk cavity to receive this collar, and a second counter-sunk cavity, of large diameter, to receive a steel plate, which is fastened against the end of the steel collar by eight steel screws. By this means the end shake of the axis is adjusted.

The declination circle is of gun-metal, and is regulated by an endless screw, having an eccentric lever attached to a dovetail slide for gearing, and a pair of bevelled wheels at either end for Hooks' joint adjusting rods. There are, also, two other radial arms, with clamp screws, for securely fixing the telescope to the circle.

The upper part of the polar axis fits into a coupling block, having a hemispheric bottom; this is supported by an angular projection from the top of the pillar having a corresponding nearly hemispherical cavity, and the whole is bound together by bolts and nuts, having spherical faces, which bear in corresponding cavities in their washers; the bolts pass freely through the holes.

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* See "Astronomical Society's Papers," Nov. 24th, 1823.

The lower end of the polar axis is a hemisphere of hardened steel, bearing in a hardened steel dye, surrounded by an oil-cup, which is attached to dovetail slides having motions in rectangular directions, which are supported by a very strong bracket, projecting from the main column, and are applicable to the final adjustment of the polar axis.

The hour circle is moved by a weight and train of wheels, regulated by a Siemen's governor, the ball being suspended by four springs.

This instrument reflects high credit on its maker; it is distinguished by solidity of structure, good mechanism, and distribution of strength.

Also, an astronomical telescope of 3¾ inches in diameter, 42 inches focal length, mounted equatorially. This telescope, on examination, was found to be a very superior instrument, and is the best in the Exhibition for its size.

Also, an astronomical telescope 2¾ inches in diameter, and 30 inches focal length, mounted on a pillar and claw stand.

Simms (741, p. 475*), an equatorial, generally of the Frauenhofer form, with the polar axis elevated for latitude 25°, furnished with a clock motion for counteracting the effect of the earth's rotation. The focal length of the telescope is 7 feet, and its aperture is 4·9 inches: it is furnished with illuminating apparatus, a set of negative eye-pieces, magnifying from 60 to 450 times; a parallel line position micrometer with position circle. reading to one minute, and a transit eye-piece, the use of which is to facilitate the general adjustment of the instrument, and also for making observations for time, in the absence of a transit instrument.

The hour circle is 18 inches in diameter, and is read to one second of time by opposite verniers. The edge of this circle is ratched to fit the teeth of a screw, which is in connection with the clock before mentioned.

The declination circle is 18 inches in diameter, and is read by opposite verniers to 5″ of arc. The slow motion is by an ordinary clamp and tangent screen.

The action of the clock is under the government of a rotatory pendulum, similar to the governor upon a steam-engine.

The only peculiarity in this instrument is in the declination axis, which is not covered up, but open, and exposed between its two supports. The open part is turned cylindrical, and can be set horizontal by a striding level, similar to that of a transit instrument. This construction has several advantages over that in common use; it simplifies the adjustment and the rectification to the meridian, and adapts the instrument for use in the taking of transits, where extreme accuracy is not needed, and greatly adds to the value of the instrument.

Mr. Simms also exhibits a small equatorial, adapted for the latitude of London, but without clock motion. This instrument is upon the same principle as the preceding; it is understood to be inexpensive, but as far as its size permits, it is an effective instrument. The focal length of the telescope is 46 inches, and its aperture 3¼ inches; it carries a parallel line micrometer, with powers of 50, 90, and 150, and the telescope is furnished with an illuminating apparatus. The hour and declination circles are 6 inches in diameter; the former is read by vernier to one second of time, and the latter to one minute of arc, with clamps and tangent motions.

The instrument surmounts an iron pillar, with a tripod stand, and there are screw adjustments, both for elevating the polar axis to the latitude, and for correction to the meridian.

The open declination axis and riding level occur in this instrument as in the former.

Dollond (145, pp. 475—477), a portable equatorial, made for the late Capt. Kater, F.R.S. The object-glass of the telescope, which is 30 inches focus, and 4 inches aperture, is worked from a formula of Sir John Herschel's and performs extremely well. The instrument is supported upon a strong folding tripod, is furnished with divided circles, a finder, levels, and a complete set of eye-pieces.

The instrument is well adapted for seeking for comets.

Simms (741, pp. 475, 476). An altitude and azimuth instrument, known as the Westbury Circle.* The diameter of the altitude circles is 30 inches, and that of the azimuth circle is 24 inches. The divisions are cut upon a band of silver fitted into each circle, and situated near the circumference. The method adopted in graduating these circles was that invented by the late Edward Troughton, Esq., F.R.S., and described by him in the "Philosophical Transactions,"† as a method of dividing by the eye, to distinguish it from the old method of dividing by the hand.

The circles are divided into 360 degrees, each degree into twelve parts or spaces, and these are again subdivided to single seconds by two micrometer microscopes placed diametrically opposite each other upon both circles.

The microscopes for reading the altitude circle are fixed to the opposite ends of an arm which revolves about an axis concentric with, but perfectly independent of, the axis of the circle, which arm can be fixed in any position at pleasure. This contrivance, which, in effect, is the same as the power of changing the position of the telescope upon the mural circle was, we believe, first applied to this instrument.

The microscopes for reading the azimuth circle are fixed immoveably.

The azimuth axis descends within the pier to a depth of nearly three feet, and turns upon a steel point within a conical hole: the upper end of this axis is supported within a rectangular Y by openings opposite the points of bearing, and the axis can be corrected in regard to verticality by adjusting screws, which act upon the frame in which the Y is fixed.

The azimuth circle is screwed to conical radii which spring from the azimuth axis near its upper end.

The altitude axis resembles that of a transit instrument, and the diaphragm is illuminated through one of the pivots in the usual manner. From the central zone of the axis two sets of radiating cones diverge, and to the ends of these cones the circles are screwed, one on either side of the telescope. These circles are connected by cross pieces around the circumference, where they also lay hold of the telescope, which is thus secured against any considerable flexure, and the cones are braced together by two inscribed squares of brass, one upon each face of the instrument.

The object-glass was made by the late Charles Tulley: the diameter of its aperture is 2·7 inches, and the focal length is 36 inches. At the eye-end there is a diaphragm of the ordinary kind, with five vertical and five horizontal spider lines. The eye-pieces consist of both direct and diagonal, furnished with magnifying powers varying from 60 to 150.

The transit axis is adjusted by means of a spirit-level; there is also a spirit-level applicable to the telescope for giving the horizontal point, and a plumb-line apparatus is fixed to the column by which the micrometer support is carried, and serves as a watch upon the stability of this important part of the instrument. The construction of this instrument is light and elegant, and, as experience has shown, it is capable of giving results of a high degree of accuracy; but the modern plan of forming astronomical instruments of as few pieces as possible, of which Mr. Simms has given specimens in the alt-azimuth and great transit circle at the Royal Observatory at Greenwich, is fast superseding the more elaborate, and if not less accurate, certainly less durable construction.

This beautiful instrument was made by the late Mr. Edward Troughton, at about the beginning of the present century, for Mr. Pond, the late Astronomer Royal, who, by the observations he made with it at Westbury, demonstrated the change of figure of the great mural quadrant then in use at Greenwich. After long exposure to the influence of the atmosphere, and consequent decay, it was in the year 1823 repaired and re-graduated by Mr. Simms, the Exhibitor.

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* For a full description of this instrument, see Pearson's "Astronomy," vol. ii., pp. 419–434.

† See the volume for the year 1809.

SIMMS (741, p. 476*). A portable altitude and azimuth instrument, with circles of 15 inches in diameter, having a telescope of 24 inches focal length, and of 1·9 inch aperture, with two direct eye-pieces, of powers of 35 and 60, also a diagonal eye-piece magnifying 40 times.

This instrument is of the most recent form. A strong brass tripod supports the superior parts, to the centre of which the azimuth axis is fixed, and the azimuth circle is screwed upon its face.

A strong plate circulates upon the azimuth axis, carrying two pillars of massive proportions, by which the altitude circle is supported. To these pillars the azimuth microscopes are fastened, and one of these pillars carries two conical branches at its upper end, for the purpose of holding the microscopes by which the altitude circle is read, and a sensitive spirit-level is so placed as to detect any instability in these branches, and to give its amount in arc. The telescope and axis are formed like those of a transit instrument, and two circles are on each side of the telescope, braced together with it by intervening pillars.

The circles were graduated upon Mr. Simms' self-acting engine, upon rings of silver, and the subdivision is made to single seconds of an arc by means of two opposite micrometer readings upon each circle. The microscopes of this instrument have achromatic object-glasses.

The transit axis is adjusted by the usual standing level, and each circle is fitted with a clamp and tangent screw motion.

The novelty in this instrument is the introduction of a central collimator, a ready means at all times of determining the nadir point: this important addition is the invention of Mr. Simms.[*]

The invention consists in placing a small achromatic telescope in the centre of the azimuth axis, which is perforated for its admission. It is furnished with a cross of delicate spider lines in the focus of its object-glass, and has suitable adjustments.

If the principal telescope of the instrument be directed to the collimator, an image of the cross lines of the latter will be seen upon the diaphragm of the former, and as the collimator remains at rest, being in firm connection with the tripod upon which the instrument stands, it follows that if the superior parts of the instrument be turned round in azimuth, the axis of the two telescopes may, by adjustment, be made to remain perfectly coincident during an entire revolution.

If, in this state of things, the azimuth axis be set truly vertical by means of the spirit-level, which is fixed upon the instrument, the centre of the collimator becomes a nadir point to which all observations may be referred.

This *point* has additional uses; for instance, in performing the collimation adjustment of the telescope, and in setting the altitude axis at right angles to the azimuth axis, and would consequently supply the place of the transit level, if by accident the latter were broken.

The importance of this invention, especially to the scientific traveller, is obvious; several such instruments have been made by the Exhibitor, which are in use in the Boundary Survey of the United States, and on other similar services.

For the several inventions in these beautiful instruments, the Jury voted, unanimously, the Council Medal to Mr. Simms, which award was also passed unanimously by the Group, but was not confirmed by the Council of Chairmen, and therefore Mr. Simms will not receive that kind of Medal to which the Jury considers him fully entitled.

CRICKETT (267, p. 437) exhibits a model of a stand for mounting an equatorial.

ERTEL and SON (2. Zollverein, Bavaria, No. 25, p. 1099,) exhibit a portable universal instrument, with horizontal circle of 15 inches in diameter, and two circles of altitude of 10 inches in diameter. The horizontal circle is divided to two minutes of arc, and is read by two micrometer microscopes to seconds; it is also furnished with four verniers, which read to two seconds. The divisions are fine, clear, and distinct. The circles of altitudes are well divided to four seconds of arc. The two reflectors for illuminating the division under the microscope are so made as to receive light from all sides.

All the clamps are applied to the centre to prevent any bending of the spokes, or affecting the figure of the circle.[*]

On fixing the lower clamp, the instrument was found to be absolutely fixed; and in this state was capable of being used as a transit circle. The level was made to rest on three bearing points; it is good; and when placed on the instrument no motion of the vertical circles affected the horizontal fixity of the instrument, or *vice versâ*.

The horizontal circle is, in fact, composed of two concentric parts in the same plane;—an inner one, which moves on its own pivot, and revolves, without touching the outer part of the circle, and each moves independently of the other. The centring of these circles is beautiful.

This is a telescope of security, and which has its own motion, and can be sèt upon any object; and the fixity of the instrument when thus tested was found to be quite satisfactory.

At the intersection of the telescope with its horizontal axis is placed a right-angled prism. By internal reflection at the hypothenusal surface of the prism rays of light coming from the object-glass are reflected towards one end of the axis where the eye-piece is placed, so that in all positions of the telescope the observer looks in a horizontal direction; on the other end of the angle is a graduated circle of 10 inches in diameter, with four verniers (in the same plane as the graduated limb of the circle) each reading to 4″. The vernier circle carries a level moveable round the axis of the vernier circle, and capable of being clamped to it in any position with the level fixed: a double zenith distance of any object may be observed on one part of the limb. The level may then be fixed in any other position, and the double zenith distance measured on any other part of the limb.

The supports of the horizontal axle of the telescope rise from a strong horizontal piece of metal, to which is attached a vertical steel axis, passing through a vertical cylinder—terminating, below, in a tripod with foot screws. The steel axis carries a horizontal circle, graduated by a line at every three minutes, and also two arms carrying micrometer microscopes. The vernier circle (15 inches in diameter) has a hollow axle which fits on the outside of the cylinder through which the axle of the vernier circle passes, and is capable of being made to revolve in its own plane. Attached to the end of the vernier circle is a check telescope with a vertical wire moveable by a micrometer screw.

The vernier circle is graduated by lines at every two minutes. This graduation is read to seconds by each of the two microscopes. The vernier circle being capable of revolving in its own plane, horizontal angles may be measured on different parts of the arcs, by both the verniers and the microscopes. The microscopes have two wires very close to each other parallel to the division in the centre of the field. In observing, the image of the division is made equidistant from the two parallel wires. The axle of the telescope has a striding level for determining its horizontality.

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[*] For a full description of this invention, see the 15th volume of the "Transactions of the Royal Astronomical Society."

[*] The axle clamp, as used by Troughton, is essentially different from that employed by Ertel. With Troughton it was a matter of convenience: with Ertel it is considered indispensable in order to obtain accurate observation. It is used for the horizontal circle of the Westbury circle, while the more important part, the vertical circle, has a clamp on its limb. In the Westbury circle the extremity of the arm of the clamp is fixed in the direction of its length as well as in the direction perpendicular to its length. This, in the case of the Westbury circle, strains the vertical axle. In the case of a transit instrument, it either bends the axle downwards, or lifts it out of the nearest Y, so that it touches one side of the Y only, or rocks from side to side. In the Munich instrument the axle clamp has a polished surface, which is made to press against the end of a screw by means of a spring or the tension of a spring by which a weight is suspended, and is acted upon by no force in the direction of the length of the arm. I find these clamps recorded as new in notes made during a stay at Munich.—W. H. M.

Troughton objected to repetition in large instruments. Zach and Bohnenberger had shown that repetition introduced errors larger than those it was intended to correct in well-graduated vertical circles. Struve found that even in the measurement of horizontal angles it was much better to measure the angles on different parts of the arc than to repeat. Accordingly, this instrument is constructed to measure horizontal angles and double zenith distances, but not to repeat. In the older instruments constructed by Reichenbach and Ertel, the circles were made to clamp at their circumference.

In a universal instrument having a horizontal circle of 24 inches diameter (used by Struve as the principal instrument for the triangulation for the Russian arc of the meridian passing through Dorpat), when clamped at the circumference, on turning the slow motion screw the spokes were found to head through an angle of nearly 8″ without moving the telescope. In order to avoid this source of error, the clamps are applied to the axes of the vertical and horizontal circles of the instrument.

The heads of the foot screws are graduated; this facilitates the operation of levelling the instrument, and also enables the observer to measure the angle corresponding to a division of either of the levels.

The axle clamps at the extremity most distant from the axle have flat surfaces of polished steel. This surface is pressed by a spring against the point of the slow motion screw. By this contrivance the axle is prevented from rotating, without the danger of straining or bending it, or lifting a horizontal axis out of its Ys, which might happen if the outer extremity of the clamps were fixed, as in the axle clamps that have been used in this country.

It is called a "universal instrument" because it is a transit instrument, and serves also to measure zenith distances and horizontal angles. It is the invention of the firm now represented by Ertel.

The double wires (vertical for the telescope; probably 20″ distant from each other) were the line introduced by Reichenbach or Ertel. When a single line is made to bisect a very faint object, the object is extinguished. This is not the case when the object is made to bisect the space between two wires 20′ asunder, though it would be if the wires were much closer.

The telescope is diagonal, and consequently only one-half the usual length, the eye, in observation, being always at the axis; and by this means observations can be made in the zenith.

There are on the inner portion of the horizontal circle 10,800 lines; and on the outer portion 7,200, or altogether, 18,000 lines, as fine and distinct as on the largest astronomical instrument. This piece of work alone occupied a fortnight, working many hours daily; and it is a masterpiece of hand dividing.

M. Ertel's objects have been, the combining of the greatest possible simplicity with the greatest possible firmness.

This form of instrument, invented by M. Ertel, has been used with great success in the measurement of the arc of the meridian, by Struve.*

The Jury voted to Ertel and Son, a Council Medal for this beautiful instrument, which award was sanctioned by the Group; but unfortunately did not pass the Council of Chairmen, who sanctioned the Prize Medal only.

Merz and Sons (Bavaria, No. 30, p. 1100,) have exhibited an equatorial, with the polar axis adjustable within certain limits, so as to adapt it both as a portable instrument, and applicable to different latitudes within those limits. The focal length of the telescope is 4 feet, and the object-glass has an aperture of 4 inches, a very unusually large aperture for this size of telescope, admitting a large pencil of light, and thus adapting the telescope for faint objects.

It is furnished with powers magnifying 20, 64, 96, and 216 times. It has an hour circle, and a declination circle, both of 7 inches diameter.

The workmanship of this instrument is good, and fully sustains the justly celebrated name of the maker.

The telescope was tried twice; first, by Sir John Herschel, Lord Wrottesley, and Mr. Glaisher, who reported of the object-glass as being first-rate; and secondly, after the lapse of a month, by Sir David Brewster, M. Matthieu, and Mr. Glaisher, whose report was, that the secondary spectrum was not completely corrected, and this appearance was attributed by Mr. Glaisher to a disturbance of the lenses, since the first examination. At the time of the second examination, the image of the sun was good, and the spots on his surface, with their penumbra, were well shown.

A Council Medal was awarded to Messrs. Merz for this instrument.

W. Bond and Son (United States, No. 463, p. 1464,) exhibit an apparatus for observing transits, by means of a galvanic current. It consists of an electric break-circuit clock, a galvanic battery of a single grove's cell; connecting wires; a cylinder, around which paper is wrapped, and a spring governor, by which a uniform motion is given to the cylinder.

The clock is like those in common use for astronomical purposes. The pallets and the escapement-wheel are insulated, both from the pendulum and from the other wheels. When the battery is in connection, the circuit is broken by the pallet leaving the tooth of the wheel, but is restored at the instant of the beat of the clock, which is in fact the sound produced by the completion of the contact restoring the circuit; the passage of the current being through the pallet and the escapement-wheel alone.

Two wires pass from the clock, one direct to the battery, and the other through the break-circuit key used by the observer, and through the recording magnet, back to the battery.

The electro-magnet, with a slight difference in the form of the armature, is the same as that of Morse's telegraph. The armature carries a glass pen, supplied with ink from a small reservoir. Under this pen the paper revolves, on which the records are made. The breaking of the circuit by the clock, every second, is marked by an off-set made by the pen; and the breaking of the circuit by the observer, is similarly recorded, between the second marks of the clock. Unless a motion perfectly uniform is given to the cylinder, the second marks at the end of the hour, instead of being arranged in regular straight lines upon the paper, will change their relative positions. Uniform motion is given to the cylinder by means of an apparatus called a spring governor. The train of wheels which communicate the motive power to the cylinder is connected with a small fly-wheel. This fly is for supplying momentum, and near it is placed a half-seconds pendulum, with a dead beat escapement. The connection between the escapement-wheel and the fly is through a short spring. The elasticity of this spring allows the motion of the escapement-wheel to be completely arrested at each vibration of the pendulum, while the momentum of the fly, acting for a small fraction of a second only on the spring, keeps up the motion of the cylinder.

The cylinder revolves in one minute; the second marks in a continuous spiral.

In observing, the observer, with the break circuit key at the instant of the transit of a star over the wire of a telescope, touches the key, and the record is instantaneously made on the paper.

In the ordinary method of observation of transits, the observer listens to, and counts the beats of a clock, whilst his eye is directed to the object passing the wires; thus he combines the two senses, of hearing and seeing, in such manner as to be enabled to compute, mentally, the fraction of the second when the object passes every wire, the time of which he then writes down in an observing-book, still listening and counting the beats of the clock, and so on till the object has passed all the wires. In this new method, he observes with his eye the passing of the heavenly bodies, and at the same instant touches the break circuit key; with this apparatus it is evident that a signal almost instantaneous in duration can be recorded, by the momentary interruption of the circuit.

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* For a description of this instrument, see "Description de l'Observation Astronomique Central de Poulkova," par F. G. W. Struve, and also the "Recueil des Actes," pour l'année 1834.

The practicability of this method of recording observations is placed beyond a doubt by experience in America, and from the results there obtained, this method would appear to be more accurate than that usually adopted by the combination of the eye and ear. The question yet remains to be determined, whether there be a closer connection between the nerves of the eye and the ear, or between the nerves of the eye and the finger, and this question can be settled only by experiments.

The Council Medal has been awarded to Messrs. Bond.

Nautical Instruments.

Exhibitors of nautical instruments are few in number, and, with the exception of those exhibited by Ericsson (United States, No. 146, pp. 1442-1446), and those by St. John (United States, No. 95, p. 1439), display but little novelty, and no decided improvements.

The sea-lead and the several other instruments exhibited by Mr. Ericsson, reflect high credit upon him: they are original in their design, well adapted for their work, and useful.

Nautical Astronomical Instruments.

Simms (No. 741, pp. 475*, 476*), exhibits a Troughton's reflecting-circle, 10 inches in diameter, with three equidistant verniers reading to 20″ of arc, having an achromatic telescope with eye-pieces magnifying 8 times and 15 times, supported upon a counterpoise stand, with motions for placing the instrument in a vertical, oblique, or horizontal plane.

This instrument was invented by the late Edward Troughton, and was designed as an improvement on the reflecting-circle, previously in very general use. With it, a cross observation gives six readings upon the circle, which is perhaps as high a degree of accuracy as is attainable by any instrument held in the hand, and such an observation is obtained with much less labour than one claiming equal confidence upon the ordinary repeating-circle.*

Mr. Simms also exhibits a Troughton's sextant (p. 477*), fixed upon a counterpoise stand; this instrument was contrived for the purpose of combining strength with lightness, and consists of two thin frames of brass, united by pillars. This form was suggested to the inventor by his having observed, that with one of the large open-framed sextants, a contact of the sun's limbs made with the telescope directed upwards was but apparent, a large space occasionally intervening when the telescope was directed downwards into an artificial horizon.

This form of sextant has not only maintained its ground, but would appear by those exhibited to be fast verging on general adoption. It is usually made of 8 inches radius, and is divided to 10″ of arc.

A Prize Medal was recommended by the Committee upon Sextants for these instruments of Mr. Simms.

Barrett (No. 349, p. 449) exhibits several sextants, one of which is furnished with a magnifier, prepared for reading without shadow by night; the instruments are for the most part of an ordinary character, nevertheless Honourable Mention was awarded to Mr. Barrett.

Crichton (No. 452, p. 462,) exhibits many sextants, some of a very ordinary kind; there are two, however, numbered 2251 and 2252, which are well made, but the divisions on the vernier and on the limb do not agree in any of them. In connection with drawing instruments, &c., a Prize Medal was voted to Mr. Crichton.

Mrs. Janet Taylor (No. 350, p. 449,) exhibits a sextant intended rather for show than use. Other exhibitors of sextants are Elliott and Sons (No. 322, pp. 444-446), Watkins and Hill (No. 659, p. 438), and Dixey (No. 271, p. 466*).

Molteni and Siegler (France, No. 649, p. 1209, exhibit sextants and reflecting circles, pretty good in all respects, the divisions excepted. The Jury awarded these instruments Honourable Mention.

Vedy (France, 719, p. 1213,) has exhibited a reflecting Borda's circle divided to 20′, and read by means of verniers to 20″. A reflecting circle made after the improvements of Captain Richards, by means of which very large angles may be measured.

A sextant read by verniers to 20″; another divided to 10′, and read by a vernier to 10″; a third and fourth, reading to 15″; a fifth, whose reading is to 30″; and a sixth, which reads to one minute. M. Vedy also exhibits an artificial horizon. These instruments are well made, and a Prize Medal was awarded to M. Vedy.

Buron (France, No. 443, p. 1199) has exhibited various sextants and octants in ebony and brass, furnished with coloured glasses to the number of five or seven, and with both direct and inverting telescopes. The sextants are divided to 10′, and subdivided by verniers to 10″. The size and the construction of these instruments are in every respect like those made in England. Their divisions are good, and their price is low.

Beaulieu (Belgium) exhibits a sextant of 7·5 inches. The graduations are on silver to 10″, sexagesimal, with every means for verification. The body of the instrument is in one piece, and is very solid; a second sextant of the same size, divided, &c., as the preceding; another sextant of 6·3 inches radius, furnished with the same accessories as the preceding, and reads to 15″ sexagesimal; a fourth sextant of 4·3 inches radius, divided to 20″ sexagesimal, a fifth sextant of 2·8 inches radius, divided on silver to sexagesimal minutes; a sixth sextant of ebony 9·4 inches radius, divided upon ivory to 30″ sexagesimal; also an octant in ebony of 10·6 inches radius, divided on ivory to sexagesimal minutes, and two artificial horizons. The sextants are solid and well made, and the work of all is good.

A Prize Medal was awarded to M. Beaulieu.

Oertling, A. (Prussia, (1) No. 87, p. 1053,) exhibits sextants whose divisions on the limb are faint, but good; the verniers are such that it is difficult to judge of the reading to 10″ in the larger, and to 16″ in the smaller sextants.

Imperial Ijorsk Works (Russia, No. 169, p. 1372,) exhibits two of the largest sextants in the Exhibition, being 10 inches radius. These are sound and well made, and reflect credit upon the artists.

Ashe (No. 194, p. 431) exhibits an instrument for determining the course which a ship must steer to sail on a great circle. That the instrument will do its work is more than probable; but whether it has any advantage over the published tables for the same purpose is more than doubtful.

Various Nautical Instruments.

Ericsson (United States, No. 146, pp. 1442-1446,) has exhibited a sea-lead. This instrument, which is designed for making soundings at sea, independently of the length of the lead line, and without the necessity of rounding the vessel to the wind, is a modification of an instrument formerly constructed in conjunction with Mr. Ogden, of Liverpool.

The instrument consists of two large tubes; a chamber is placed immediately behind, and connected by means of a small bent orifice to the upper extremity of one of them. The top of the second is connected by a similar orifice to a third small tube suspended in the centre of the chamber. A stop-cock is placed at the lower end of the glass tubes for the purpose of cutting off communication, if necessary.

The lead being bent to the line is lowered into the sea, as it sinks, the water enters the chamber, and gradually rising in it and in the tube suspended within, causes an increased pressure upon the air, which is driven through the orifices into the glass tubes. The tube which is connected with that in the chamber will be entirely filled with the air thus forced into it from the suspended tube, the water will consequently rise, and its reading may be observed upon the graduated scale with which the instrument is furnished for that purpose.

The contents of the chamber being much greater than that of the tube suspended within it, the air with which it is filled will not be compressed sufficiently to admit water into the glass tube connected with it until the lead shall have descended to a depth of 25 fathoms. This tube is therefore well adapted for the measurement of deep soundings, whilst the other registers small depths, which otherwise could not be indicated. This instrument in its use is attended with less loss of time than the casting of the ordinary deep-sea lead.

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* For a full description of this instrument, see "Pearson's Astronomy," and "Encyclopædia Metropolitana," vol. I., p. 638.

Mr. Ericsson has exhibited an instrument for measuring distances at sea. This instrument is intended chiefly for the use of naval officers, to enable them to determine, by means of a single observation taken at sight, the distance of a vessel, either advancing to or receding from the observer.

If the eye be placed at a certain height above the level of the sea (say on the main-top of a ship), the vertical angle, formed by a line passing from the eye to any fixed point in the horizon, and a line from the eye to the water line of the hull of a vessel in the distance, will become greater as the vessel approaches to, and will become less as the vessel recedes from, the spectator; to measure this angle and to determine the distance of the ship, is the chief purpose of this instrument, which is composed of the following parts:—

An ordinary reflector, an object-glass, and a sight for measuring angles. The reflector is attached to the end of a spindle which is turned by means of a lever. At the lower end of this lever, in a slot, a sliding nut moves freely up and down, in which a thumb-screw is made to work. A pinion on this screw works into cogs cut in the circumference of a graduated index-plate, which is supported upon a frame, and revolves by means of a socket in a centre piece. The scale of the index-plate is graduated into yards for every variation of distance of 10 yards, from the horizon to 400 yards distance from the ship, as viewed from an elevation of 100 feet. For these and the other beautiful instruments exhibited by Mr. Ericsson, a Prize Medal was awarded to him.

KELLER (France, No. 280, p. 1190) exhibits a double planisphere, designed to assist navigators in great-circle sailing. It consists of two concentric circles, the one fixed and transparent, the other moveable.

ST. JOHN (United States, No. 95, p. 1439) has exhibited a very ingenious self-detector compass. In appearance it is very similar to the ordinary box-compass, and differs chiefly in the following particulars:—upon the compass card, and attached to it by pins, are two small needles, called satellites; to the centre of each a brass indicator is fixed; on the face of the card are engraved two semicircular scales, or arcs of circles, so placed that their centres are in the centre of the compass card, and in a line joining the centres of the satellites: both these scales are graduated to degrees, the numbering of the graduation proceeding on either side from the central point of each scale. The satellites are balanced upon pins, move freely, and thus permit the brass indicators to move easily over the graduated arcs, according to the amount of disturbance. The satellites and the main needle being equally magnetized, remain stationary when there is no cause of disturbance in the magnetic meridian, and the brass indicators point to their respective centres; but, should there be any cause of disturbance, the indicators move simultaneously in opposite directions, thus indicating its amount, and if the course of the disturbance be local, the indicator attached to that needle, the nearest to the seat of disturbance, will pass through the greater angle, and thus the direction of the disturbing cause is shown.

Mr. St. John has also exhibited an aquatic velocimeter. This instrument is designed to show upon a dial-face the distance traversed by a vessel in a given time, and its velocity. Upon the dial are three circles, each provided with an index, and so graduated that the first performs one revolution in a mile, the second in 100 miles, and the third in 1,000 miles. The motion is communicated to the clock mechanism by means of several mechanical adjustments, within a tube, which is inserted in the bottom of the vessel, and protected from injury by a coating of India-rubber, and a wooden box, by which it is completely enclosed. The chief part of the mechanism consists of a revolving shaft, which receives its motion from a paddle-wheel attached to it. The water acting upon its fans causes it to turn round, the shaft in connexion with it performing one revolution in a distance of 4 feet. The arrangement also includes a metal frame, and pistons to obviate any danger which might arise from the position of the pipe within the vessel; there are also facilities for disconnecting the apparatus from the clock-work, for the purpose of setting the index to any time or point desired. This instrument is new, and seems to be well adapted for its work. The Jury consider much merit due to Mr. St. John for these inventions, and award the Prize Medal to him.

Surveying Instruments.

The instruments exhibited in the British portion of this section are few in number, and, with the exception of those by Simms, Dollond, Marratt, and Yeates, are, for the most part, of an ordinary kind, there being neither improvement nor attempt at such in their construction.

In the Foreign Department it is otherwise. In Belgium may be found Beaulieu, worthily following in the steps of his celebrated master, Gambey. In Germany, Breithaupt's admirable method of covering the divisions of the circle by a thin circular plate seems to be generally adopted, and commands attention. The further improvements which he has introduced in his surveying instruments will be detailed presently.

The Polytechnic Institute of Vienna has exhibited various instruments for levelling, which present many improvements, the result of more than an ordinary degree of attention. Mr. Burt, of America, has exhibited a compass well adapted for surveying.

Surveying and Levelling Instruments.

SIMMS (No. 741, p. 476) exhibits a transit theodolite. This kind of instrument was introduced a few years since by Mr. Simms; it is intended especially for the use of the scientific traveller and civil engineer. It is, in fact, an extremely portable altitude and azimuth instrument. The ordinary vertical arc of the theodolite is extended to a complete circle, and is read by two opposite verniers. The range of the telescope is unlimited, like that of a transit instrument, and by means of a diagonal eye-piece, observations can be made in the zenith. The axis is perforated for illumination of the field of view. The instrument is 8 inches in diameter; it is graduated in silver to 10″ of arc; its readings are by means of verniers. By estimation the angle can be read to less than 5″.

The telescope is 13 inches in focal length, and 1¼ inch aperture, and is furnished with magnifying powers of about 25 and 40 times. The magnetic needle, spirit level, lamps, and tangent screws, and other fittings, do not differ materially from those usually adapted to theodolites of the best construction.

DOLLOND (No. 145, pp. 426—428). A transit theodolite. The circles are 12 inches in diameter, each reading by verniers to every 10″ of arc. The telescope fixed to the altitude circle is 20 inches focal length, and 1·6 inches aperture, furnished with direct and inverting eye-pieces, and is supported on Ys, on two strong cones resting on the azimuth circle. The compass is 5 inches in diameter and divided to every degree. The spider lines are illuminated in the usual manner through the axis of the altitude circle.

YEATES (No. 332, p. 446) exhibits a very portable small theodolite, with good divisions, well made, and strongly put together. It is furnished with one large spirit level. Also a 4-inch theodolite, displaying good workmanship; a prismatic compass with a spirit level attached, and an optic square, intended for use in determining distances. All these instruments are well made, and deserving of Honourable Mention.

MARRATT (No. 409, p. 554) exhibits a 7-inch theodolite, which reads to 15″. It is furnished with a locking-plate and tripod. The lower portion consists of a massive tripod with foot-screws, to which is fixed the centre on which the instrument revolves. The lower limb is in one piece, and is furnished with tangent-screws and three verniers. The exterior centre and Ys for the support of transit axis are cast in one piece, and to which is attached a spirit level. The telescope is soldered to the axis, and the vertical circle is firmly screwed to it, so that the vertical circle, axis, and telescope, are firmly connected. The whole instrument is formed of the smallest number of pieces, with the view of preventing flexure and insuring stability. The Jury awarded Honourable Mention.

JOSEPH (Canada, No. 182, p. 968) exhibits a 6-inch theodolite of very indifferent workmanship.

ELLIOTT and SONS (No. 320, p. 444) exhibit an altitude and azimuth instrument of the ordinary construction. It is understood that this instrument is intended chiefly for surveying purposes; it is coarsely divided. They also exhibit two transit theodolites, the one of 5 inches and the other 6 inches diameter. These instruments were not adjusted. Messrs. Elliott and Sons also exhibit dumpy-levels of good workmanship. In those exhibited, the index-bar on which the level rests is placed vertically, instead of horizontally, as they were in those by Mr. Garratt, the inventor of this kind of level. There is also a change in the mode of adjusting the bubble; instead of the use of three screws at either end of the bubble, there is one strong joint at one end, and a screw at the other; the joint cannot move till the screw at the other end is loose, and it is so constructed that it is almost impossible to become loose by travelling; and they exhibit an instrument based upon the principle of similar triangles, adapted for the determination of distances.

BRIDGES (No. 339, p. 448) exhibits an instrument to determine the distances of objects, either by night or by day, and rules are given to determine the distance when the height is known, or when its breadth is known, or when neither is known, and also to determine the same by night.

BARTON (No. 708, p. 473*) has exhibited an instrument designed for sketching ground, for military purposes, with great rapidity. It is designed with a view to its being manageable in the hands of men engaged in military service, without regard to their scientific acquirements. Its simplicity of construction renders it very inexpensive. For description of this instrument, see Illustrated Catalogue. Honourable Mention is given to this exhibitor.

LIDDELL (No. 362, p. 450) has exhibited pocket-sight and field-sight spirit-levels to the number of 30, as used by mechanics, and adapted for drainage, road surveying, &c. The spirit-levels are exhibited on account of lowness of price; some of the sight-levels are furnished with reverse sights; there is one level with a revolving shade, intended as a safeguard to the level tube.

ADCOCK (No. 353, p. 449) has exhibited a machine for drawing and mapping roads.

GREEN (No. 446, p. 462) has exhibited a miner's compass.

COX (No. 347, p. 449) has exhibited a beam draining level, with adjusting parallel plates on tripod stand. It is a simple and inexpensive instrument, giving, by inspection, the rise and fall of land intended to be drained. It is also useful in laying tiles, levelling, and in building operations. Mr. Cox has also exhibited an A level, to be used without either parallel plates or tripod stand.

BLYTH (No. 367, p. 450) exhibits four levels, of different lengths, with stand and small telescope.

DOBBS (No. 346, p. 449) exhibits a spirit-level, applicable for levelling machinery.

HORNE, THORNTHWAITE, and WOOD (No. 220, pp. 434, 435) exhibit an angular spirit-level, showing the rise and fall in inches and parts. It is adapted for agricultural purposes.

DENTON (No. 317, p. 443) exhibits a workman's draining A level, with a bob, intended for the use of farm labourers; and a second level of the same construction furnished with a spirit-level.

WILTON (No. 402, p. 453) exhibits a miner's theodolite.

BURON (France, No. 443, p. 1199) exhibits a repeating theodolite with concentric circles, 8·7 inch diameter, divided to 10′, and read by four verniers to 10″. It is furnished with two telescopes of 17·7 inches in length, and apertures 1·2 inch. The vertical circle is 4·3 inches in diameter, and is divided to 30″. Mr. Buron also exhibits several levelling instruments.

BEAULIEU (Belgium) exhibits a repeating theodolite, of the form used by Gambey. Its circle is 13 inches in diameter, divided on silver to 10 centesimal minutes, read by means of four verniers to 10 seconds, and is adapted to take either horizontal or vertical angles.

The azimuthal circle is 8·7 inches in diameter. It is divided upon silver, and is read by a single vernier. It is furnished with two levels. The telescope is 1·8 inch aperture, and 19·3 inches focal length. There is a counterpoise attached, to be used when vertical angles are to be taken. This instrument was constructed for the Dépôt de la Guerre, in Belgium, for which service all the instruments are divided upon the centesimal system, but M. Beaulieu has likewise divided this instrument sexagesimally, the principal circle reading to 4 seconds of arc, and the azimuthal circle to 20 seconds. All the divisions of this instrument are very good, as indeed is the workmanship of the whole instrument, and the sextants exhibited (see Section, Nautical Instruments); a Prize Medal was voted to M. Beaulieu.

GROETAERS (Belgium, No. 156, p. 1156) exhibits an instrument for determining the distance of inaccessible objects. It is stated that the results obtained by the use of this instrument have been good.

DE HENNAULT (Belgium, No. 183, p. 1157) exhibits a miner's compass, intended for use in determining the coordinates of a mine.

LAMBERT (Belgium, No. 185, p. 1157) exhibits a small miner's compass, but not so well made as the preceding.

BECKER (Netherlands, No. 83, p. 1147) exhibits a levelling apparatus.

BREITHAUPT (Prussia, No. 670, p. 1087) exhibits a theodolite. In this instrument, as in most theodolites of German make, the circle which carries the verniers is let into, and surrounded by, the graduated circle, so that their upper surface, on which the graduations are traced, are in one plane. In order to protect the divisions from dirt, rain, and from mechanical injury, the vernier circle carries a thin circular plate of brass, which completely covers the graduated or outer circle, with the exception of two openings, covered with plate glass, through which the verniers can be seen.

This useful covering for the graduations, though now used by other artists, was, we believe, first introduced by Mr. Breithaupt.

Mr. Breithaupt also exhibits a level, which instead of having circular collars on the telescope, which it is difficult to make of equal diameter, and, if accurate when the instrument is new, are very apt to bear unequally, has towards each end of the telescope a knife-edge, and opposite to it, on the other side of the tube, a steel screw with a convex head; one knife-edge is on the upper side of the tube and one on the lower side. The level is attached to a plate of steel, having its under surface ground truly plane. By turning the convex-headed screws, the planes through the knife-edges, and touching the heads of the screws, can be made parallel to a line joining the centre of the object-glass and the intersection of the cross wires, and therefore to each other. The line of colimation of the telescope will be truly horizontal when the bubble of the level maintains the same position before and after inversion. This contrivance greatly increases the facility of adjusting a level, and of rendering the person using it independent of the skill of the maker.

It is a common error among surveyors to assume that the circular collars of a level are of equal diameter; and as long as this belief prevails, this invention must be of peculiar importance.

Mr. Breithaupt also exhibits a mining theodolite. This instrument is attached to its tripod by a slightly conical socket, and the graduated circle is made horizontal by two screws, opposed by two strong springs. The graduation of the horizontal circle is to 30″ and has two verniers. Its diameter is nearly 4½ inches. The vertical circle, which is about the same diameter, is also read to 30″ by two verniers.

The telescope, whose aperture is about 11 lines at the place where it meets the horizontal axis, has a right-angled prism, which reflects the rays coming from the object-glass. At one extremity of the long horizontal axis are placed cross wires, adjustable by rack and pinion, and an eye-piece, adjustable by screwing, similar to those of the levels. The telescope can be pointed to any object, from the zenith to a depression of 50° or more below the horizon, and can be clamped, at any altitude, to an arm which is moved by a micrometer screw; and thus distances can be measured from one station, by observing the altitudes or depressions of two fixed marks on a staff. A level, like that of the transit instrument, is applied to the axis of the telescope. (Prize Medal awarded.)

Lüttig (Prussia, No. 81, p. 1053) exhibits a levelling protractor, the divisions of which are good.

Kinzelbach (Bavaria, No. 26, p. 1115) has exhibited a surveying cross, being a cone of brass, with two pairs of fine slits, for sights, at right angles to each other, running obliquely up its sides, and revolving on a base, the circumference of which being graduated, is read off with a vernier, the whole being screwed on the top of the surveyor's rod.

Mr. Kinzelbach has also exhibited a diastimeter, or distance-measuring instrument; being a telescope, provided with a micrometer and divided scale, the micrometer being mounted with two parallel wires, moveable simultaneously along a scale, graduated to minutes, so as to remain at equal distances from the centre of the field of view, and thus to embrace the area of greatest distinctness in all cases. Also an improved Wollaston's goniometer.

Imperial Polytechnic Institute of Vienna (Austria, No. 130, p. 1014) has exhibited several beautiful instruments, constructed according to the plan suggested by Professor Stampfer.

1. A large level.* The aperture of the object-glass is 15 lines, and the power 20. The support of these levels consists of three feet, attached to the sides of a triangular prism by strong screws. The upper part of the prism is a truncated cone, fitting into a slightly conical socket, which forms the lowest part of the brass-work of the level. This socket is clamped very firmly on the stand by a single turn of a screw, so that the level can be readily attached to, or removed from, its tripod. The lower part of the level consists of two circular plates, connected by a ball and socket, as in the levels constructed in this country. But instead of four screws for making the upper plate horizontal, the Austrian level has two screws and two strong springs, the screw being at one end, and the springs at the other end of each of two diameters of the plates, at right angles to each other. By this contrivance the upper circle is more quickly and easily made horizontal than in many other known instruments of this kind, without the danger of either shaking or bending the plates, attendant upon the use of four screws.

The upper circle, which is about 4½ inches diameter, is graduated, and has two verniers, reading to 30″.

The greatest improvement introduced into this level is a micrometer screw, by which an angle in a vertical plane, if not more than 8°, can be determined to within 1″ or 2″ of the truth. This screw is of great use in making the telescope very accurately level, when the instrument is employed in the ordinary manner, and the situation of the levelling staves so chosen that they are intersected, at some point of their length, by a horizontal plane through the axis of the telescope. By the aid of the micrometric screw, however, the difference to the altitude of two stations can be determined, when it greatly exceeds the length of the levelling staff. For this purpose the staff carries two marks, at a known invariable distance from each other. The angular altitudes or depressions of these two marks, measured by the micrometer screw, serve to determine, with great precision, not only the inner elevations or depressions of either mark above or below the axis of the telescope, but also its horizontal distance from the centre of the instrument. These distances, combined with the difference of azimuth of the stations observed with the horizontal circle, afford data for constructing a map of the country passed over in levelling. The selection of stations in this mode of levelling is limited only by the condition that the elevations or depressions of the marks shall not exceed 8°. By one observation, differences of level of 100 feet between two stations may be measured; thus the stations may be taken at much greater distances from each other than in levelling by the old method. This advantage is particularly felt in levelling through a hilly country. By means of this instrument the altitudes of distant objects may be measured with great precision.

The telescope is adapted to the distance of the object observed by a sliding tube carrying the cross wires, moveable by a rack and pinion. This tube moves between three bearings, attached to the inside of the outer tube, at equal distances from each other; one of these is a spring wheel, which, by its constant pressure, prevents all shake of the tube carrying the micrometer. The telescope is adapted to the focal length of the eye of the observer, by having that lens of the eye-piece which is next the eye set in a cap, which screws on the end of the tube, and by turning it is brought to the proper distance, to give distinct vision of the cross wires.

2. Smaller levels, of similar construction, in one of which the telescope has a power of 15. In another the power equals 12. A fourth is similarly constructed, with the exception that it has no horizontal graduated circle: the power equals 6.

3. Two pocket telescopic levels.

4. A ruler for plane table surveying, with a telescope provided with a micrometer screw, similar to that of the large levels for measuring distances.

5. A ruler for plane table surveying, with telescopic sight. The Jury awarded Honourable Mention for these instruments.

Schrödter (Prussia, No. 484, p. 1078) exhibits a 6-inch theodolite, of very good workmanship. The Jury awarded Honourable Mention to Mr. Schrödter.

Imperial Ijorsk Works (Russia, No. 169, p. 1372) exhibit a levelling instrument, mounted on a well-braced and very firm tripod stand. The instrument is well made in every part, with good divisions, and reflects credit upon the artist.

Burt (United States, No. 187, p. 1449) has exhibited an "astronomical compass," an instrument intended for the survey of lands, bays, &c., for the determination of latitudes, apparent time, and the magnetic declination.

It consists of two plates of about 6½ inches in diameter: the upper revolves about the lower by means of a centre-piece, which, when fixed, leaves the under plate to revolve freely. The two plates can be clamped together by means of two clamps. The upper side of the lower plate is divided, the graduations being seen through two openings in the upper plate, and which are furnished with verniers. A small magnet is placed on the upper plate for determining the declination. To the upper plate is fixed a grooved arc, a latitude arc, a declination arc, an hour arc, two spirit-levels, &c. The latitude arc is fitted to one end of a curved bar, the other end of which is in connection with the hour arc, and can be adjusted to the latitude of the place. The declination arc is placed upon a limb which revolves equatorially upon a centre, and there is a second moveable limb turning on a pivot at one end, and furnished with a vernier at the other, which moves on the declination arc and affords a means of clamping it to the sun's declination. To each end of a moveable brass limb a small brass plate is attached at right angles; into the upper side of one, and to the lower side of the other, a small convex lens is inserted, fitted with a sliding shade, through which there is a small hole; opposite to each lens is fixed a small silver plate; on these plates fine lines are drawn, sufficiently separated to include the image of the sun. The arcs of latitude and declination have each a radius of 5 inches, and are graduated to 15′, and read by verniers to single minutes. The hour circle has a radius of 2½ inches, and is divided to half degrees. The instrument is furnished with every means of adjustment and verification. It is well adapted for surveys in new districts, and has rendered good service in magnetic districts, where it is understood that instruments constructed with magnetic compass have failed. The Jury voted a Prize Medal to Mr. Burt.

Standard Measures of Length.

Whitworth and Co. (Class VI., No. 201, p. 290) have exhibited a standard bar measurer. This machine consists of a metal frame, at each end of which is placed a micrometer; that to the right-hand is a combination of a screw about ten threads to the inch, of a tangent screw and wheel with 400 teeth, and also a circle with 250 divisions. Therefore the divisions on the circle indicate $\frac{1}{10}$th of $\frac{1}{400}$th of $\frac{1}{250}$th of an inch, or of one millionth part of an inch. The micrometer placed at the left-hand is furnished with a screw with ten threads to one inch, and a circle divided into 500 parts, and thus one part of the circle corresponds to $\frac{1}{5000}$th part of an inch. On the upper side of the frame, and extending through its whole length, is placed a half square groove made of steel, with its angle downwards, and its upper edges horizontal. In this the measure is placed. Between one end of the measure and the point of the right-hand micrometer, a perfectly flat contact piece of metal is placed, with its sides parallel; the other end of the measure abuts against the left-hand micrometer.

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* See the 20th volume of the Polytechnic Institute.

There are two methods of determining when contact takes place, and hence the length of the standard measure.

1. By that which is termed the test of gravitation.
2. By that which is termed the galvanic test.

(1.) The test by gravitation is as follows:—

The experimenter moves the end of the screw of the right-hand micrometer through one millionth of an inch, by means of the right-hand micrometer; then carefully raises the contact piece, and allows it to fall by its own gravity: he then moves a screw through a second millionth of an inch, raises the contact piece as before, and so on, till the approach of the end of the micrometer screw to the end of the measure prevents the contact piece from descending. This completes the measure.

(2.) The galvanic test is as follows:—

There is a small battery composed of a piece of zinc and copper soldered together and immersed in rain water, without the admixture of any acid; this is connected with the micrometer (which is insulated from the machine), and with a delicate galvanometer by means of covered wires. The measure itself is also insulated from the machine.

By pursuing the same process as before, contact is indicated on completing the circuit by the deflection of the needle of the galvanometer.

This beautiful and delicate apparatus seems to be capable of improvement: the ends of the measure exhibited are perfectly flat, and of its full size; the contact pieces are somewhat smaller, but the constant and repeated contact must wear the ends away, and soon alter its length. For a standard bar, it would certainly be better to insert at its ends a smaller contact surface, of a substance much harder than steel. A Council Medal was awarded to Messrs. Whitworth. (Awarded also in Class VI.)

BAUMANN (Prussia, No. 76, p. 1052,) exhibits Bessel's standard measure. It consists of a solid beam of mahogany 4 feet 6½ inches in length (Prussian measure), 7 inches 2 lines square. The two 3-feet bars to be compared are placed upon a carriage on five wheels, which run on rails in a direction at right angles to the length of the bars. At each end of the carriage are receptacles for the bars with screw adjustments for placing them in a proper position for comparison. At each end of the beam is placed a micrometer, consisting of a slider moved by a screw having about 400 turns to the inch. On the slider are two Ys, in which rests a cylinder of steel about 7 lines in diameter, and 4½ inches long. The inner end (viz., the end directed towards the middle of the beam) is ground convex, the other end is a cone. The point of the cone rests against a vertical plane of steel attached to the axis of a "fühlniveau" (level contact) at a point about 0·25 inches from the axis. The bars to be compared (bars of steel, not hardened, 0·75 inches square, having their ends on rather a small circular disc at either end, which is made of hardened steel, ground truly plane), are placed on the carriage, with their axis about 1½ inches asunder. The carriage is moved till the axis of one of the bars coincides with the ends of the steel cylinders, and the micrometer screws are turned till the convex end of the steel cylinders coming in contact with the end of the bar, the pointed end of each cylinder pressing against the steel plate attached to the axis of the level turns the level, till the bubble rests nearly in the middle. The divisions of the head of the micrometer screws, and the divisions of the level scales at which the end of the bubbles rest, are then read off. The slides are now withdrawn through a small space, the carriage moved till the axes of the second bar coincides with the axes of the steel cylinders, and the micrometer screws turned as before, till the convex ends of the cylinders come in contact with the ends of the second bar, the conical points turn the level till the bubbles rest nearly in the middle of the scale, the divisions of the heads of the micrometer screws and divisions at which the ends of the bubbles of level rest are read off. This constitutes one comparison.

After a certain number of comparisons have been made in this manner, each bar is turned, so that the surface which was undermost becomes uppermost, without turning either of them end for end, and the same number of comparisons made as in their original position. The object of this is to estimate any error that might arise in making the ends of the bars coincide with the axes of the two steel cylinders, supposing the plane end of the bars not to be exactly at right angles to the axes. During the comparisons the bars are covered by a wooden case, which allows the heads of the micrometer screws and tubes of the levels to be seen, and has two openings, covered with glass for observing the thermometers placed on the bars to be compared.

The delicacy of this "comparateur" is such that unless extraordinary precautions be taken, the errors produced by the fluctuations of atmospheric temperature are much greater than the errors of measurement.

In order to eliminate error, arising from the heat radiating from the observer, Bessel recommends calling the bars A and B; A should be brought between the micrometers, then B, B again, and then A. These four measures he calls one comparison. The observer then should station himself on the other side of the comparateur, and make a second comparison. Bessel made a number of comparisons of two bars in a cellar, where the change of temperature was very small.

The means of four comparisons, two before and two after, the bars were turned, differed from the mean of fourteen sets of 1 inch from comparisons by the following fractions of a line:—

− 0·00010
− 0·00010
− 0·00003
+ 0·00013
− 0·00001
+ 0·00010
+ 0·00002
− 0·00002
− 0·00011
− 0·00018
+ 0·00011
+ 0·00009
+ 0·00007
0·00000

To make the axes of the bars coincident with the common axis of the steel cylinders a ring carrying a fühlhebel (lever of contact) can be fastened on the end of either cylinder. Bring the fühlhebel in contact with that portion of the end of the bar which is cylindrical, and turn the cylinders round its axis. If the long arm of the fühlhebel remains pointing to the same division of the arc, along which it moves, the end of the bar is strictly centred, if not the long end of the lever will move on the graduated arc.* A Prize Medal was awarded to Mr. Baumann.

SIMMS (No. 741, pp. 475-477,) exhibits the three standard yards, prepared for Her Majesty's Commissioners, for the restoration of the standard of length, with two methods of supporting them; one by Professor Miller, consisting of a system of levers, by which an equal degree of pressure is sustained upon eight equidistant points of the bar; the second by the Rev. R. Sheepshanks, by floating the bar in mercury, which is therefore equally supported at every point throughout its length; the bar is covered with a coating of gold-beater's skin to defend it from attack by the mercury. It is probable that the former is the better method, as the latter, though good in theory, is probably not good in practice, from the fact that iron rusts easily in mercury, and copper and its alloys combine easily with it.

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* For a complete description of this instrument, see Bessel's "Darstellung der Untersuchungen und Maassregeln, &c.," Berlin, 1839.

Mr. Simms also exhibits two standard scales, which have been used for the formation of many scales now in use. They were made by the exhibitor, whose property they are. The tubular scale is No. 3 of Mr. Bailey's Report on Standard Measures.[*]

Dividing Machines.

Ackland (No. 368, p. 450) has exhibited a machine for dividing hydrometers and other variable scales, with accuracy. The instrument is furnished with a mounted head, screw, and suitable cutting apparatus.

The usual means of graduating hygrometers is by determining three points by means of three different fluids, whose specific gravities are known, and dividing the intervals between these points into equal parts. This method is evidently defective, as the divisions, instead of being equal, increase, in a given ratio from below upwards.

The plan adopted by Mr. Ackland may be divided into three processes:—

1st. The ascertaining the exact position of three or more points of the scale, according as the stem of the hydrometer is more or less cylindrical.

2ndly. The dividing with great accuracy a scale on box-wood, to show the specific gravities required to be indicated by the hydrometer, and to be used by the instrument for the purpose of measuring and correctly marking the distance of one division from another on the paper scale with true mathematical certainty.

3rdly. The making a reduced copy of the box-wood scale, so as to form a scale, the points of which shall correspond with the distance between the ascertained points of the hydrometer bulb. The scale so formed on paper is the scale for the hydrometer. For example, suppose it be required for a hydrometer to show specific gravities from 1·000 to 0·700; to show this a bulb is chosen with a stem as uniform as possible, and three points, viz., ·700, ·850, and 1·000, are ascertained as follows:—

Let a b c be the degrees required. Suppose m be the point on the stem whereon it is required to mark the highest specific gravity, viz., $1·000 = a$. To find this point, the instrument is loaded until it floats in distilled water at the temperature 62° Fahr., at the point m; let the weight of the instrument then be x.

To find $·850 = 6$.

Load the instrument until it weighs $\frac{a\,x}{b}$, where it floats in distilled water, mark the tube at n.

To find $·700 = c$

Load the instrument until it weighs $\frac{a\,x}{c}$, where it floats in distilled water, mark the tube o.

Finally, before sealing the instrument, make it weigh $a\,x$; then m n o will respectively represent the specific gravities required. By this plan, which was suggested to Mr. Ackland by Dr. Clark, of Aberdeen, the correct position on the stem of the three specific gravities is obtained; the next and most important operation is the subdivision of these spaces, so that each division shall be in its true position. This is done by copying a calculated scale by aid of the machine, the construction of which is such that a proportionate scale of any length less than the original can very readily be produced.

The scale is determined by forming a table of the reciprocal of the specific gravities, and taking the differences between them; in use the micrometer head is successively advanced, and each division is cut with accuracy and with great rapidity.

Most of the scales of the hydrometers exhibited have been graduated in the usual way, and are therefore inaccurate; those exhibited by Griffin (No. 457), were performed by this machine, which Mr. Ackland has the merit of inventing. He is the first in England who has carried into active practice a correct mode of subdividing glass vessels for gases and liquids by the aid of a machine.

The cutter is made to cut, and cuts a division. The detent, apparently, is then brought back to the common centre of the helix screw, either by lifting, unclamping, and re-clamping, or in some equivalent way, and runs its course again to bring the cutter ready for another cut, and so on. There is also a second novelty, viz., a neat little contrivance to make every fifth division longer than the rest by means of a wheel which advances one step at each division or movement of the cutter frame. A point, let drop to touch its circumference, determines, by the depth to which it descends, the length of the cut; but at every fifth step the wheel has a notch into which the point descends, allowing the cutter to make a longer stroke—longer by the depth of the notch.

A Prize Medal was awarded to Mr. Ackland.

Perreaux (France, No. 369) has exhibited a straight line divider. This is a beautifully-contrived divider on Ramsden's principle, with a long fine steel screw. The novelties are, first, the wheel at the screw head, which is divided into 400 parts, and has cut upon its circumference (which is made broad), a helix screw, in the thread of which runs a detent carried along by the run of the thread till it meets a stop clamped on the helix at a definite point. This arrests the screw, at this point of the motion. A Prize Medal was awarded to M. Perreaux.

Froment (France, No. 1609, p. 1254,) exhibits a divided metre, the divisions on which are beautifully distinct, and as far as could be ascertained, very exact. It is believed that the divisions were cut by M. Froment's dividing engine, which he has constructed for dividing astronomical and geodetical instruments. M. Froment has also constructed a screw more than a metre in length, for the purpose of dividing lines quickly, and it is understood that in so doing electricity is made use of in connection with the movements of the screw and machine.

A Council Medal was awarded to M. Froment.

The **Conservatoire des Arts et Métiers** (France, No. 1568, pp. 1251, 1252,) exhibits a brass metre by Gambey, decimally divided. Also a fine platina metre, which is described as the "second type of the Collection of Weights and Measures of the Conservatoire des Arts et Métiers,—executed by M. Brunnen, and compared by M. Silbermann," and is stated to be a copy of the ancient platina metre of the same collection, an immediate derivative of the prototype in the archives of France, and to be longer than that, of which it is an immediate copy, by 0·000019 millemetre.

It is properly speaking a "metre à bouts," and is converted into one "à traits" by attaching to each of its extremities a supplementary piece of platina, separated from the bar by a very thin lamina of gold, which appears as a fine line of gold at the junction. It is supported on a bed of bronze, to which it is attached firmly and by accurate adjustment at one end, whilst the other is left free to slide by expansion, thus converting the whole system into a Borda's pyrometer, the amount of relative expansion being read upon a scale, the value of whose points has been derived from experiment by immersion in melting ice and boiling water.

The Conservatoire des Arts et Métiers also exhibits a standard kilogramme and litre; a series of French coins of legal currency, and a collection of wood measuring rods, both in single lengths, and in more or less numerous joints; also measuring chains, and a series of measures of capacity of the following values (in litres), viz.:—

20, 10, 2, 1, $\frac{1}{2}$, $\frac{2}{10}$, $\frac{1}{10}$, $\frac{1}{20}$, $\frac{2}{100}$, $\frac{1}{100}$, $\frac{1}{200}$, in brass, with ground rims and sliding glasses to each.

Balances.

The Exhibition contains balances of all sizes, from Mr. Fox's balance, intended to carry extremely small weights, up to the balances of L. Oertling and the American balance, both of which are capable of carrying

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[†] See the "Transactions of the Royal Astronomical Society."

56 lbs. in each pan. Many of them have probably never been surpassed, in the construction of the beam, knife-edges, planes opposed to them, permanence of the adjustments and beauty of workmanship; yet in all, the position of the beam, when loaded with the weights to be compared, is shown by a long index nearly in contact with a graduated arc, although for several years other and greatly superior methods of determining the position of the beam have been in use, such as by a graduated arc attached to one end of the beam, and viewed through a compound microscope having a horizontal wire in the focus of the eye-glass, or by a mirror attached to the beam, in which the reflected image of a scale is viewed through a telescope.

In the balances exhibited the beam and pans are suspended on knife-edges, more or less in length, with the single exception of Mr. Fox's balance, in which the beam has pivots, the conical ends of which play in hollow agate cones of larger angle.

There is no example of the balances constructed under the direction of Gauss and Weber, and described in the "Göttingen Transactions," in which the beam is suspended by two watch-springs, and each pan by a single watch-spring; nor of either of Steinheil's balances, in which the beam and pans are suspended by wires or silk ribbons; nor of the balances first (Professor Miller believes) invented by Steinheil and used by Kupffer in comparing the Russian standard of weights, in which the beam carries two small steel spheres in the middle, resting upon a steel plane, and a sphere at either end, upon which rest the plane or slightly concave spherical surfaces of the plates from which the scale-pans are suspended.[*]

There are a variety of contrivances for checking the oscillation of the beam and pans when in action: none of them can compare in simplicity and efficiency with the apparatus invented by Wollaston, and used by the late T. C. Robinson, Barrow, Dover, and by most of the English makers of balances, and also by Nissen, of Copenhagen, the only foreign maker who appears to have made use of it.

In nearly, perhaps in every instance, when the divisions of the scale, to which the index of the balance points, were numbered; the division to which the index points when the beam is horizontal is marked zero, and the scale numbered 1, 2, 3, &c., to the right and left. This method is most inconvenient, and frequently leads to error. The number of the divisions ought to run all the same way, and need not begin with zero, it being far better to number that division to which the index points, when the beam is horizontal, 10, 20, or some multiple of 10, for the purpose of avoiding the trouble, perplexity, and liability to error, attendant upon the necessity of noting numbers, in addition to whether the numbers are positive or negative. This remark is of general application to all instruments to which scales are affixed.

L. Oertling (No. 334, p. 446) exhibits a large balance having a beam 3 feet in length, coated with platinum,[†] and capable of carrying 56 lbs. (equal to 25·4 kilogrammes) in each pan. The beam, a pierced rhomb, is constructed so as to give great strength in proportion to its weight. Any tendency to lateral yielding is counteracted by casting the beam with edge bars.

The whole length of the middle knife-edge rests upon a plane surface of steel: the three knife-edges are long. Plane surfaces of steel, from which the scale-pans are suspended, rest upon the extreme knife-edges. When not in action the beam and the steel planes from which the scale-pans hang, are supported, so as not to be in contact with each other. The frame for supporting the beam and pans is extremely well contrived; so also is the mechanism for lifting it.

He exhibits also a balance capable of carrying one kilogramme in each pan. The beam of this balance, which is 16 inches long, is coated with palladium;[†] the three knife-edges, as well as the plane upon which the middle knife-edge rests, and the planes from which the pans are suspended, are of agate, so that the whole instrument is unaffected by acid vapours. The beam is graduated, and small differences of weight are determined by a small weight that can be placed upon parts of the graduated beam. The beam and pans are supported, excepting when in action. The adjustments of the knife-edges, in the direction of the length of the beam, are as few as possible to be very permanent. The knife-edges are not capable of any adjustment after leaving the artist's hands in a direction perpendicular to the length of the beam. As far as the beam and knife-edges are concerned, a better balance has probably never been constructed. He exhibits also a smaller balance: the beam is 14 inches long, similar to the former in construction, and capable of carrying about 1,000 grains. A Council Medal was awarded to Mr. Oertling.

Dover (No. 344, p. 449) exhibits a balance, which in construction is similar to the balances constructed by the late T. C. Robinson, and, in execution, fully equal to the balances made by that most excellent artist. The beam is 10¼ inches long, and is capable of carrying about 2,000 grammes in each pan.[*] The three knife-edges are of steel, the planes opposed to them being made of agate. The final adjustments, both in the direction of the length of the beam and in a direction perpendicular to it, are effected by a cut at each end of the beam making an angle of about 45° with the axis of the beam, which may be widened by means of a screw. This is an excellent mode of adjustment, succeeding perfectly, and proved to be very permanent when confined to extremely narrow limits. If these limits be exceeded, as they sometimes are in unskilful hands, the end of the beam is cracked and destroyed.

Mr. Dover has substituted chains with long links for silk threads, for suspending the pans, and has added an ingenious contrivance for supporting glass tubes in weighing.

A Prize Medal was awarded to Mr. Dover.

Fox (No. 377, p. 451) exhibits a balance for extremely small weights, which has instead of a knife-edge at the middle, an axle ending in conical points, which points play in conical holes (the angle of the cone in the holes is, of course, greater than the angle of the cone of the pivots). The attraction of a magnet brings the beam exactly to zero before weighing. In order to overcome the friction, of which much is introduced by the construction of the balance, there is an instrument for rasping on the case.

Marriott (No. 341, p. 449) exhibits a chemical balance, the beam of which is made of a wide bit of wood (fir), with interstices cut out so as to leave a strongly framed network. The knife-edges do not appear to admit of any adjustment. The scale-pans are suspended from double hooks of wire hanging on the end of the knife-edges. This instrument is a curiosity: it is stated by the maker to be sensible to the 100th of a grain. It is a good example of a make-shift for a balance, when at a distance from good workmen.

De Grave, Short, and Fanner (No. 333, p. 446.) exhibit two assay-balances, apparently of very good workmanship, but not adjusted,[†] and a large number of commercial balances of various kinds, weights, and measures of capacity and length.

Bache (United States, No. 395a, p. 1462).—Large balance, capable of carrying 56 lbs. (equal to 25·4 kilogrammes) in each pan. The knife-edges are square bars of steel. Each bar is fitted into a socket attached to the beam, having a rectangular notch, so that any one of the four edges of the bar may be used as a knife-edge.[‡] The socket, in which one of the extreme knife-edges is fixed, moves in a slit in the direction of the length of the beam, and is adjusted in that direction by means of two screws.

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[*] See Kupffer's work on the "Comparison of Standards" for a description of this balance.

[†] These beams were coated by T. H. Henry, Esq., F.R.S., by a peculiar process, in which the electric current was employed in depositing these metals. It would seem, from this successful application, that the same process is applicable to graduated instruments.

[*] A similar balance, finished by Mr. Dover, was used repeatedly by Professor Miller to weigh 5,760 grains, and was not in the slightest degree injured.

[†] The centre of gravity is too high to admit of using them.

[‡] In the event of one of the edges being damaged this arrangement is of great service.

A smaller balance is exhibited, of almost exactly the same construction as the preceding; it is capable (probably) of carrying a kilogramme in each pan. A Prize Medal was awarded to Mr. Bache.

Deleuil (France, No. 160, p. 1178) exhibits a large balance, capable of carrying two kilogrammes in each pan. The middle knife-edge rests upon a plane surface of steel. The pans are suspended from plane surfaces of steel, which rest upon the extreme knife-edge. Screw adjustments appear to be avoided, in order to secure invariability in the positions of the knife-edges. The cast-iron base of the balance has holes under the extreme knife-edges, for suspending large globes of glass for weighing gases, in an enclosed space beneath the base of the balance. Both the construction and workmanship of this balance appear to be extremely good.

A chemical balance, by the same exhibitor, capable of carrying 300 grammes in each pan. The pans are of platinum, suspended by silver wires.

Another chemical balance, capable of carrying 200 grammes in each pan; the pans are of platinum.

In these two balances the middle knife-edge rests upon a plane surface of steel. The pans are suspended from slightly curved steel hooks.

Balances of this construction, though considerably inferior to that in which the pans are suspended from plane surfaces, are simple, not easily deranged, and accurate enough for all the ordinary purposes of chemistry, for which they are expressly constructed.

An assay-balance, of the ordinary construction and excellent workmanship, is also from the same exhibitor.

A Council Medal was awarded to M. Deleuil.

Collot, Brothers (France, No. 1155, p. 1233) exhibit a large balance, capable of carrying two kilogrammes in each pan. In its construction and excellence of execution, it very closely resembles the large balance of M. Deleuil.

An assay-balance of the ordinary construction is also exhibited by Messrs. Collot.

A Prize Medal was awarded to Messrs. Collot.

Béranger (France, No. 761, pp. 1216, 1217) exhibits a balance to be placed upon a counter, with platforms for holding the substance to be weighed, and the weights. With fifty kilogrammes in each pan, the addition of one gramme to the weights in either pan causes the index to move through about a quarter of an inch. When tried with twenty kilogrammes in each pan it was found to turn very sensibly on placing half a gramme in one of the pans.

M. Béranger also exhibits a steelyard in which the weight is moved along the arm by a screw of the length of the long arm, and parallel to it, having a head of about 4 inches diameter, divided into 100 parts. This steelyard is sensible to 100 grammes, with 1,000 kilogrammes suspended from the short arm.

Also, *bascule en l'air*, a double steelyard. The end of the short arm of a steelyard is connected by a link with the extremity of a lever, and at a distance from the fulcrum of the lever equal to a small fraction of its length is a knife-edge, from which the substance to be weighed is suspended. One of these, capable of weighing 1,000 kilogrammes, costs 260 francs.

M. Béranger exhibits a model of a machine for determining the pressure exerted by each wheel of a locomotive.

Also, a *peso-compteur*, a weighing-machine, which registers on a sheet of paper the weight of every article weighed. Besides these there are a great many commercial balances, all of which are most ingeniously contrived, extremely well made, very accurate, and considering the workmanship, and the number of adjustments to be attended to, very cheap. Although the Jury considered them well deserving such reward, no Medal was voted to M. Béranger, on account of these being commercial balances, and as such thought by the Jury to belong to instruments for direct use, rather than to philosophical instruments: they have, however, received a prize in Class V.

Sacré (Belgium, No. 504, p. 1167,) exhibits a large balance, capable of carrying two kilogrammes in each pan. The manner of fixing the extreme knife-edges to the beam is different from that usually adopted, in which the under horizontal surface of the knife-edge is in juxtaposition with the horizontal surface of the beam, widened at that particular part, and firmly fixed to it by one or more screws. In M. Sacré's balance, on the contrary, the ends of the beam terminate in vertical plane surfaces, to which are attached, by screws, vertical plates of steel, terminating above in knife-edges. The pans are suspended in such manner, that their swinging in any direction has no tendency to twist the beam of the balance.

This instrument is remarkable for the extreme beauty of its workmanship.

M. Sacré also exhibits an assay-balance, in which, contrary to the usual construction, the pans are suspended from plane surfaces of steel which rest upon long knife-edges, and are supported independently of the beam when the balance is not in action: it is therefore not only more accurate than ordinary assay-balances, but is enabled to carry 20 grammes in each pan without injury. The work is extremely good.

In assay-balances, as usually constructed, the pans are suspended from hooks, which themselves rest on hooks worked to a fine edge, attached to the ends of the beam, and are not calculated to carry a weight of more than two grammes.

A Prize Medal was awarded to M. Sacré.

A. Oertling (Prussia, (No. 87, p. 1053) exhibits a balance of very beautiful workmanship, capable of carrying a kilogramme in each pan.

The knife-edges are let into dove-tailed notches in the beam.* The adjustment of the distance of the extreme knife-edge from the middle knife-edge is effected by means of a vertical cut in the metal of the beam, which may be slightly widened or contracted by screws. The agates which rest upon the extreme knife-edges, and from which the pans are suspended, are *not* plane, but have an obtuse re-entering angle, into which the less obtuse angle of the knife-edge enters, and are not suspended independently of the beam when the balance is not in action.† Two thermometers are placed with the bulbs as high as the beam; but it probably would have been better if the bulbs had been placed a little above the scale-pans, for the temperature of the air immediately surrounding the object to be weighed often differs sensibly from that of the air in the upper part of the balance-case.

Oertling has also two smaller balances, of similar construction, capable of carrying 100 grammes in each pan. A Prize Medal was awarded to Mr. Oertling.

Reimann (Prussia, No. 86, p. 1053). Balance, capable of carrying one kilogramme in each pan. The knife-edges are opposed to agate planes. The adjustment of the position of the knife-edges is effected by means of an oblique cut at each end of the beam, the breadth of which may either be increased or diminished by screws.‡ This is the only balance in the Exhibition in which a circular level has been adopted. The Jury considered it worthy of Honourable Mention.

Hoffmann and Eberhardt (Prussia, No. 88, p. 1053) have exhibited balances for apothecaries: they seem well suited to the purpose they are intended to serve.

Luhme, J. F., and Co. (Prussia, No. 83, p. 1053) exhibit chemical balances. One of them is capable of carrying one kilogramme in each pan; another of carrying 100 grammes in each pan; a third 50 grammes in each pan; and a fourth 25 grammes in each pan.

A Prize Medal was awarded to Messrs. Luhme.

Batka (Austria, No. 135, p. 1014) exhibits a very small balance by Kusche, of Vienna, contained in a platinum blowpipe apparatus. It is very well made, and the Jury deemed it worthy of Honourable Mention.

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* It is doubtful whether this mode of attaching the knife-edge is quite as good as when the beam is made wider at the extremities and the middle, and the whole length of the knife-edge rests upon it.

† The form of the agates seems to be objectionable.

‡ In the present case, too much reliance seems to have been placed on this mode of adjustment; for one of the cuts has been widened by screwing till a crack in the beam has begun to form.

Dolberg (Mecklenburg-Schwerin). Balance, to carry one kilogramme in each pan. This balance is in many respects very well constructed: but the middle knife-edge is supported by two agate planes, and the bearings of the knife-edge on the planes are rather short, both of which circumstances are defects. The oscillation of the pans is checked by hair-brushes, which on turning a handle ascend till the ends of the brushes touch the under-sides of the pan: in this arrangement there is reason to apprehend that loose hairs might attach themselves to the under-sides of the pans, and so lead to an error in the weighing.* The pans are suspended from plates of steel, having plane surfaces, which rest upon the extreme knife-edges.

A Prize Medal was awarded to Mr. Dolberg.

Becker (Netherlands, No. 83, p. 1147). Balance, capable of carrying one kilogramme in each pan. The beam is a single bar, the middle knife-edge being supported on two agate planes.† The contrivance for lifting the pans and beam when not in action is ingenious, inasmuch as the motion is slow at the time the beam is deposited on the middle support, and the agate planes from which the pans hang on the knife-edges; but it is unsteady in a lateral direction. There is also reason to apprehend the extreme knife-edges would not touch the agate planes in the same parts in successive weighings. The method of attaching the pans to the brass rods by which they are suspended, in such a manner as effectually to guard against upsetting the pans wherever the weight may be deposited, is extremely simple and ingenious. The Jury considered it worthy of Honourable Mention.

Nissen (Denmark, No. 20, p. 1356). A large balance to carry 10 lbs. (4·54 kilogrammes): the middle knife-edge is cut away in the middle, so that the bearings of the edge on the middle plate are too short. The pans are suspended from plates having concave surfaces, which form of plate is objectionable. They are not supported independently of the beam, when the balance is not in action.

The excentric motion for putting the balance in action had been injured, so that it could not be tried.

A small balance exhibited by Nissen, capable of carrying more than 100 grammes. The middle knife-edge in this, also, is cut away, so that the ends only touch the plane surface on which it rests. The balance in other respects resembles Robinson's balances, except that the middle knife-edge rests upon two planes, and that the plane surfaces are of steel instead of agate. It is furnished with Wollaston's contrivance for checking the oscillation of the pans and beam.

The same exhibitor has also a small assay-balance.

The Jury considered Mr. Nissen as deserving Honourable Mention.

Littman (Sweden, No. 15, p. 1350). In this balance the index is at one end of the beam. In addition to this index there is another pointing upwards, the end of which is viewed through a compound microscope, having a divided scale or glass in the focus of the eye-piece. This contrivance for reading off the extreme portions of the balance during its oscillation is far inferior to a graduated scale, attached to the beam of the balance, observed with a compound microscope having a single wire in the focus of the eye-piece. It also adds greatly to the bulk of the balance-case. The Jury considered this balance deserving Honourable Mention.

Viberg (Sweden and Norway, No. 14, p. 1350) exhibits a chemist's balance, which the Jury considered worthy of Honourable Mention, it being well adapted for the purposes it has to perform.

Coin-Weighing Machines.

We will now turn our attention to another class of balance, recently introduced, viz., coin-weighing machines. Of these there are three in the Exhibition—one exhibited by W. Cotton, Esq., late Governor of the Bank of England; a second by Captain Smith; and a third made by Deleuil (France, No. 160, pp. 1178—1180); this last instrument was designed by Baron Seguier.

Before proceeding to the particulars of these beautiful instruments, it may be well for a short time to dwell upon the want which has called them into existence, as kindly explained by William Miller, Esq., of the Bank of England. All sovereigns brought into the Bank of England by the public are weighed singly, and this is found to be absolutely necessary; else the stock of sovereigns in the Bank would very soon fall below the legal current weight of 122¼ grains each. The Bank, therefore, is compelled to weigh all the gold coin it receives singly, to guard against loss.

In June, 1842, the Queen's Proclamation was issued, commanding all persons to cut and deface whatever gold coin was found to be below the current weight. Before that time the light sovereigns, though they were rejected by the Bank, were accepted almost everywhere for their full value, and the public were not disposed to criticise very nicely the Bank's weighing, as the rejection of their money occasionally, when it was really of the current weight, or the issuing it to them a trifle below the weight, was of small consequence; for, though it might occasion a little trouble, it entailed no loss. But it was quite a different affair when their sovereigns were cut as well as rejected, so that they were obliged to sell them as bullion, sometimes at a loss of three-pence or four-pence a-piece; or when, as was sometimes the case, they received sovereigns at one counter of the Bank which were cut and returned to them when tendered at another. The public then, as might be expected, were very angry; but there was no help for it. The Bank had provided the best scales that could be procured: they had the most experienced weighers: they re-weighed singly every gold coin in their stock, amounting to upwards of £8,000,000, and weeded it of all the light pieces that could be detected, at a loss of between £3,500 and £4,000; but the evil remained. Sovereigns were still issued at one counter which were rejected and cut at another.

This did not arise from any fault either of the Bank or of its officers, but from the inherent difficulties in the operation of weighing so accurately as was necessary, or with the same result, in a limited time, even with the best-constructed scales. Some of the causes of error Mr. Cotton ascertained to be—differences in the weights made (notwithstanding the Mint stamp attached to them), of considerable amount in relation to the degree of correctness required; currents of air acting unequally upon the scale-pans; a constant diminution of the weight of one pan, by the act of placing and displacing the coins to be weighed, by which the equipoise was every moment destroyed; the striking of the scale-pans upon the counter; difference in the judgment of the weighers; the short time which could be allowed for the operation; failing of the eye-sight, flagging of the attention, and sleepiness from the monotony of the employment; difference in the rate of vibration of the beams; defects of principle in the construction of the scales, to obviate which would have destroyed their simplicity and marred their general usefulness.

All these difficulties (and they were great) were overcome by Mr. Cotton's machine; and since the year 1844, out of the large number of 80,000,000 of pieces which have been weighed, not a single source of error has been made out against them. Some few sovereigns are still weighed as they are received from the public by the common scales; but such are never re-issued by the Bank until they have passed through the machines, which extract from them about two per cent. of lightness. The Bank sustains the loss upon these unavoidable errors, in preference to the loss of time, the trouble, and the vexation which the re-issue of them as they were received from the public would occasion to all parties.

We now proceed to the description of Mr. Cotton's machine.

It consists of a square brass box: on the top is placed a hopper to hold the sovereigns to be weighed. This hopper is a long trough, placed at an angle of about 45°

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* This contrivance is greatly inferior to Wollaston's for effecting the same purpose.

† This is not a good construction.

with the top of the box: it will hold about 500 sovereigns. In front of the box are two small apertures, to which are fitted two receivers, one for the sovereigns of full weight, the other for those which are light.

Inside the box, and near the upper plate, the beam or balance is placed; at one end of the beam, and above it, is poised upon a knife-edge, a small platform, which receives the sovereigns to be weighed. This platform, which, in fact, is one of the scales, is kept in its position by means of a small pendulum, on which, at about an inch below the platform, there is an oblong perforation, about half an inch in length, technically called a slot, in which a small ivory rod works freely up and down without touching the sides.

Between the slot and the platform a pair of forceps is placed. From a knife-edge at the other end of the beam a small round polished plate is suspended, to which a pendulum is fixed, and at its lower part the scale is placed to receive the weight. Above the small round plate, under the top of the box, is fixed an agate with a blunt point. When the machine is in motion the small ivory rod is depressed: this, on touching the bottom of the slot, or opening in the pendulum in which it works, brings down the beam on that side, and raises it, of course, on the other, the weight side, until the small round plate on that side touches the agate point. The beam is then in a horizontal position. As soon as this is effected the forceps catch hold of the pendulum between the platform and the slot, and hold it firmly. The balance is then in a condition to receive the sovereign, which is shifted from the bottom of the pile in the hopper, and brought by means of a slide along a channel, just large enough for a sovereign of the proper standard gold to pass, but not large enough to admit a counterfeit, and deposited upon the platform. The forceps then let go their hold, the ivory rod is gently raised, and if the sovereign happens to be light that end of the beam rises, and the other end leaves the agate point; but if the sovereign be full weight, the beam remains stationary, and the small plate on the weight end is in contact with the agate point.

When the sovereign is weighed, the operation of its removal is very ingenious, and is as follows:—Two bolts are placed at right angles to each other, and on each side of the platform or scale there is a part cut away to admit of the bolts striking so far into the area of the platform as to remove anything that would nearly fill it. These bolts are made to strike at different elevations, the lower one striking (as to time) a little before the other. If the sovereign be full weight the scale remains down, and the lower bolt knocks it off into the full-weight box. If the sovereign, on the other hand, be light, it rises up, the first bolt strikes under and misses it, and the higher bolt then strikes and knocks it off into the light box. This machine weighs about thirty-three sovereigns in one minute. The weights used are of glass, and are adjusted to within the ten-thousandth part of a grain.

It is understood that these machines, since they began to be used in 1844, have not cost £5 for repairs, and that they effect a saving in salaries alone of full £1,500 per annum, after deducting ten per cent. for the replacement of capital sunk in their establishment.

A Prize Medal was awarded to Mr. Cotton.

Smith (India) has exhibited a coin-weighing machine, which is an exceedingly ingenious application of that of the areometer or hydrostatic balance. The counterpoise to the point weight of the scale-pan and coin is made to rise and fall in a cylinder of water, the oscillation being deadened by a circular plate forming part of the counterpoise wholly immersed in the fluid, and of such an area as to afford considerable resistance to the rising or sinking motion. By a proper adjustment of the diameter of that portion of the counterpoise which is partly beneath and partly above water, and of the length of the lever arm which carries the scale-pan, a given deviation in the weight of the coin one way or other from its legal weight may be made to correspond with a given depression or elevation of the counterpoise, and therefore of the scale-pan, below or above a certain medium or zero position, the scale resting at a level, corresponding to the amount of excess or defect of the coin above or below the standard.

At levels corresponding to half grains of difference of weight, shelves are placed which receive the coins from the scale-pan, according as, on arriving at its point of equilibrium, it happens to be opposite to the interval between either shelf and the next above it; and once thrown upon that shelf, it glides down and finds its way into a receptacle corresponding by an appropriate passage. Thus the coins enter twelve panels, differing each by twelve grains of weight.

To throw the coin off the scale upon its proper shelf, the scale-pan is peculiarly constructed of wire, horizontally laid, so as to allow a scraper, also of wire, vertically arranged, to pass between and beside the frame-work of the pan, which, being pushed along at the end of each weighing, the coin is forced by it off the pan upon the shelf. The pan-frame, thus lightened, rises to the proper position for receiving another coin, which is placed on it by a feeding-pipe in the manner usual in coining processes.

Any number of small weighing-machines may be mounted side by side, so as to occupy a very moderate compass, and may be worked simultaneously by a common feeding and a common discharging movement; and all may be made to discharge their contents on the same shelves conducting to common receptacles.* A Prize Medal was awarded to Captain Smith.

Deleuil (France, No. 160, pp. 1178—1180) exhibits a beautiful coin-weighing machine, invented by Baron Seguier, Membre de l'Académie des Sciences, differing, however, from those above described in its mechanical arrangements, and in some particulars of construction which are necessary to its performance of the additional operation required by the French Bank.

In the Bank of France each piece of money is weighed in a small balance, especially constructed for the purpose, by men charged with this particular duty. The beautiful coin-weighing machine in question is designed to supersede this work by mechanical means. In its working it exhibits quickness and regularity in performing the operation of distributing the pieces into three classes, those which are heavy, those which are of exact weight, and those which are light.

The instrument is distinguished in its operations from Mr. Cotton's, by thus distributing the pieces into three classes instead of two, as in Mr. Cotton's, the three being necessary in the Bank of France, though not required in England.

The right to this elegant invention not being secured by a patent, its internal construction could not be examined; but so far as could be judged from working it, as exhibited, the principle seems to be the making available the declination of the index of the balance, or light steel rod, to the right or left of the vertical, according to the excess of weight in either pan, to give motion to one or other of two light brass plates *in the act* of raising the balance. The force so applied being, not the mere difference of weights between the scales, but an external power applied through this medium; the motion thus given to the brass plate being conveyed downwards by an appropriate train of mechanism might easily be applied to an interposed obstacle or otherwise. The coin, on its delivery from the scale, is diverted from that passage which it would have followed had the index remained vertical, into one of two other channels according to the inclination of the index.

The machine is fed by a hopper, the coin being thrown promiscuously in. To prevent its jamming, and refusing to pass, it is constantly stirred from below upwards by a wheel set round with steel pins so as to disturb the self-arrangement of the coins in the hopper, and let them fall over one by one into the feeding-trough. It is understood that about fifty coins could be weighed per minute by a double machine, such as that exhibited. The working appeared to be not quite continuous, but in all other respects perfectly satisfactory, the interruption to the regular delivery of the coins being little more than momentary.

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* A full description of this ingenious mechanism, which was contrived and executed for the Madras mint under Captain Smith's direction, will be found in the "Professional Papers of the Madras Engineers," vol. ii.

It will be understood that, for the reason above assigned, this account of its operation is merely conjectural. Sir John Herschel remarks that it would be easy to devise a machine for a similar purpose, founded on the principles, first, of preventing the descent of either scale, unless the excess of weight in it surpassed the legal "remedy," and allowance for wear and original error, which might be done, by giving each end of the beam a support from below equal to the remedy, but rising only on its descent; and, secondly, by presenting in the closest proximity to the under-side of the beam, but not in actual contact, the extremity of a conducting rod of copper, completing a galvanic circuit through the beam and its central steel knife-edge resting on a steel plane, and thus animating one or other of two electro-magnets, which by its attraction on a soft iron bar should shift either the point of delivering or the point of reception of the descending coins, on their egress from the scale. The circuit being completed, the right-hand conductor would thus deviate the coins into the receptacle for heavy, and the conductor on the left into that for light coins, while a state of rest of the beam, corresponding to any excess *within the remedy*, either way, would cause no deviation, but allow the coins to fall straight into the middle receptacle. This description might enable any mechanist to construct such a machine, probably at small cost, and without infringing any patent right.

It is highly satisfactory to find an instrument of such high importance as the balance so well represented in the Exhibition; and when it is considered, in order to have a balance as perfect as possible, how very many circumstances are to be attended to, it must be deemed highly honourable to the exhibitors of good balances to have produced instruments standing the test of the rigorous examination to which they have been subjected. We observe, however, in the Exhibition no self-weighing balances for small weights (up to 1,000 grains), on the principle of Marriott's spring-balance for large ones, or on that of the simple extension of a long spiral spring, which is a very convenient form of instrument when great accuracy is of less consequence than expedition.

Air-Pumps.

Most of the important facts which we know relative to the properties of air may be said to have been elicited by the employment of the air-pump. It is satisfactory to find that the Exhibition contains instruments of a new and improved construction; but it is matter of regret that so small a number of manufacturers have contributed.

The air-pumps most commonly used are made either with brass stop-cocks, or with valves of oiled silk or leather. The former, when properly constructed, and new, generally act well, by exhausting the air thoroughly; but after having been in use for some time, they become less accurate than those furnished with valves, after an equal amount of wear. But the valves themselves are also imperfect, owing to the pressure of the external air on that within the piston preventing the latter from rising when the air is almost exhausted. Attempts to overcome this difficulty have been made in the pumps exhibited, some of which are very superior in their action, and have probably never been surpassed.

The exhibitor of the best air-pump is Newman (No. 674, p. 468*). This has a ground glass plate, to avoid injury from sulphuric acid. It has two pumps with metal valves: on one of these are two barrels, open at the top to the atmosphere, as in the common table air pump; this arrangement exhausts the receiver quickly, but on account of the nature of the valves, not beyond 0·4 inch or 0·5 inch of mercurial pressure. The other pump has a single barrel, with an oil cistern at the upper part, the air being lifted through a valve at the bottom of this cistern. If anything re-enters the barrel it can only be oil, which is brought out with the air at the next up-stroke of the piston. The piston has a metal valve; but the opening of this valve is not necessary to the continuation of the exhaustion, as the piston at its lowest point passes below the aperture leading to the receiver. This construction of air-pump exhausts more thoroughly than any yet known.

In the experiments which were tried, the reading of the barometer at the time being 30·08 inches, the gauge of the air-pump stood at 30·06 inches. A Council Medal was awarded to Mr. Newman for this air-pump.

Watkins and Hill (No. 659, p. 466*) exhibit a new double-barrelled air-pump, on a plan suggested by Mr. Grove. It has oiled-silk valves, and is so constructed as to leave the least possible residue of air in the barrel, after each stroke of the piston. The piston is solid, without a valve, and the shape of its lower part is an obtuse cone: part of this cone rises at the top of each stroke above the aperture leading to the receiver, and the air which has entered the barrel is, by the down stroke, forced through a valve at the apex of the hollow cone terminating the lower end of the barrel, to which the lower end of the piston fits very accurately. The piston-rods pass through air-tight leather collars in the tops of the barrels. This pump exhausted the air till the elastic force was only 0·05 inch of mercury. A Prize Medal was voted to Messrs. Watkins and Hill.

Knight and Sons (No. 453, p. 462) exhibit an air-pump on Siemen's patent. It consists of two cylinders, of different diameters, the smaller one placed below the larger, and separated from it by a plate forming the bottom of the upper and the top of the lower cylinder. A piston-rod, common to both cylinders, passes through a stuffing-box in the plate, attached to which are two valved pistons, working in their respective cylinders. The advantage of this construction is, that the pressure of the external air on the oiled-silk valve of the larger cylinder is taken off by the vacuum formed in the smaller one, and in consequence no greater resistance is offered by the valve than that arising from its adhesion and tension. The exhaustion of this pump is very rapid, and in the trial amounted to 0·24 inch of mercury.

Varley and Sons (No. 257, p. 436) exhibit an air-pump upon a new construction. It is worked by a continuous rotatory motion of the handle, slide-valves being used to open and close the communication. On the piston arriving at one end to expel air from the barrel, it is followed by rarefied air from the receiver; the slide-valve closes upon the receiver, and connects the two sides of the piston; the residual air expands into the larger space, becomes equally rarefied, and the subsequent motion of the valves separates these spaces, and connects the receiver with the closed end; the piston then returns to exhaust air into this end of the barrel and to expel it from the other, and thus continuous exhaustion is kept up; for, how rare soever the air becomes, it keeps flowing after the piston continually. The barrel is twice filled for every entire revolution of the handle. This pump has a single barrel with double action: it exhausts quickly, and the exhaustion was found to be 0·05 inch for a moment, but could not be maintained.

Varley and Sons also exhibit a second air-pump, smaller than the former: it has a double-acting barrel. The piston is worked by means of a crank and continuous circular motion of the handle.

Heywood (No. 404a, p. 453). A rotary table air-pump, with self-opening valve worked by a crank motion. It acts with singular smoothness and ease.

Gogerty (No. 407, p. 454) exhibits an air pump of the common table form. It gave an exhaustion of 0·3 inch of mercury, which is considerable for this kind of air-pump.

Ladd (No. 291a, p. 440) exhibits an air-pump, which is single-barrelled and of a cheap construction, without any other claim to notice.

Yeates (No. 332, p. 446) exhibits a double-acting air-pump of a cheap construction, which appears to be good for its price. Its valves are of oiled silk. The communication is in the middle of the barrel, a valve being placed there and at each end. Honourable Mention was awarded to Mr. Yeates.

Bryan (No. 408, p. 454) has exhibited a double-action air-pump, constructed without valves, and having a rotatory motion. The pump consists of a barrel, to which two smaller ones are attached on either side. In the large or prime barrel is a solid piston, which may be made to rise and fall at pleasure, and is attached to a piston-rod; in the centre of the secondary barrels are also small pistons, whose movements are simultaneous. Each rise and fall of the large piston is designed to draw off from the receiver 53 cubic inches of air, simply by its own elasticity. The double action, combined with the rotatory motion, has been introduced with a view to economise both time and labour, and the absence of the valves, to avoid the limitation of exhaustion attendant upon their use. This pump was not tried, in consequence of no one being in attendance on the Jury to explain its action, &c.

Breton (France, No. 1113, pp. 12, 31) exhibits a double-barrelled air-pump. It has, instead of valves, a glass plate sliding over apertures communicating with the receiver and the pumps. The motion of this glass plate is produced by the mechanism which works the pump; it is very ingenious in its construction. The approximate exhaustion is first made by the ordinary alternate action of the barrels. The system of communication is then changed by shifting round the glass plate, which serves as a valve during one-fourth of a revolution, when the rarefied air is condensed in one barrel and sucked into the other, whence it is ultimately ejected through a valve of oiled silk very close to the piston. On account of the distance between the pumps and the glass plate, however small the pipe of communication, the exhaustion must be imperfect. The syphon gauge attached to the instrument indicated an elastic force of only one millimètre of a column of mercury; but a bubble of air was seen at the top of the mercury, proving its indication to be erroneous.

Deleuil (France, No. 160, pp. 1178, 1179, 1180). This exhibitor has a double-glass barrelled air-pump, on M. Babinet's principle, the valves being opened by means of wires passing through the pistons. The opening of the valves is by this means rendered independent of the elastic force of the air remaining in the receiver. The degree of exhaustion which can be produced must depend on the air after the action of the piston. This appeared by the syphon gauge to be about one millimètre of mercury; but the top of the gauge could not be seen so as to ascertain whether any visible portion of air was there. In this pump, also, the vacuum is first approximately made by the alternate action of the barrels, after which one barrel exhausts the other by suction.

Nissen (Denmark, No. 20, p. 1356) exhibits a double-acting single-barrelled air-pump, of an ingenious construction. This instrument only exhausted to 0·3 inch, as shown by the gauge, which was free from any visible speck of air. The Jury considered this pump as worthy of Honourable Mention.

Optical Instruments.

The telescope is an instrument of such high importance, that it ought to command at all times, from opticians, the incessant direction of their attention to its improvement and the bringing it to the highest possible state of perfection. In the Exhibition, if we except those affixed to astronomical instruments, there are but few telescopes. Of these the larger are for the most part good. **Wray** exhibits one with discs of a solid substance, instead of flint glass, which deserves commendation, as a deviation from the beaten path, that may conduct to new and important results. There are few samples in the Exhibition of optical glass; but all are good, and give great promise of an increase in the use of large telescopes. **Simms** exhibits several object glasses made of English glass; and **Chance** contributes a noble piece of apparently pure flint glass, of no less than 29 inches in diameter. **Daguet** sends some wonderfully pure glass, both crown and flint. Of lenses and prisms, there is not one British contributor; France standing alone in the exhibition of some very beautiful work, which reflects high credit upon **Bayerle** and **Bertaud**. Of physical optics, there is but one extensive exhibitor, viz., **Duboscq Soleil**, France (No. 1197, p. 1235), who has a beautiful collection of most delicately constructed instruments, adapted for physical investigation. Of microscopes there are a good many exhibited; among which the English microscopes are found to stand pre-eminent. Of lighthouses there are two, the one being made of glass almost colourless, and the other with that of a greenish colour. The glass of neither is pure, there being many striæ, &c., which must cause much light to be scattered and consequently lost. Of spectacles and cameras we shall speak in the proper place.

Telescopes.

Varley and Son (No. 257, p. 436) exhibit an apparatus to be used in Gregorian telescopes, consisting of three small speculums, grouped together on one stem, and fitted into a telescope, under adjustment from the eye end, by means of which any one of the three may be used at pleasure, so that the power may be changed without losing sight of the object. Within the tube are placed two slides, one near the eye end, adjustable by a screw; the other near the object end, which may be moved to and fro. The latter carries three small speculums, of different foci, mounted on a steel axis, held in a stiff frame. At the bottom of the axis is placed a toothed wheel and rack-work. This rack is kept from moving by a long bar proceeding from the first slide, so that it cannot move with the slide on which it lies; by this arrangement, on moving the slide, the wheel upon it will roll against the rack, and so present the next speculum.

The angle at which the speculums are opposed to each other on the block determines the number of teeth, or portions of the circle required to present each speculum. The diameter of the wheel determines the distance that such portions of the wheel must traverse to put each speculum in true focus. The slide nearest to the eye end is moved by a long bar, attached to it by means of a screw, whilst its near end lies on the other slide, and over the loop-hole. The bar has a screw handle on the outside of the telescope, by which to pull or push the further slide, and also to clamp it fast to the near slide when in the right place. This clamping connects the two slides, and causes both to obey the adjusting screw. In order to determine the exact places at which to clamp, the bar is furnished with three notches, whose distance corresponds with the difference of foci; a tooth snaps into each notch as it arrives; the hand of the observer feels this snap, and the object reappearing at the same instant, the screw is made fast. Having brought each speculum to its right distance, its perfect position is effected without trouble. The speculum wheel has three pins; against one of these a notch in the bar is urged by a spring, which holds its corresponding speculum perfectly in place, and in addition, moves the wheel and rack a little further than the hand and bar had formerly done. This simple action separates the two hooks, and thereby detaches the apparatus from each speculum whilst it is in use, leaving it at liberty to be governed only by its pin, and the notch in the bar already mentioned; the speculum by these means is held perfectly in its place. A cylindrical cap, as a protection from the weather, is made to slide over the speculums, and affords a dark margin round the pencils of light. This contrivance has been applied to telescopes of eight inches focal length, and six inches aperture.[*] The Gregorian form of telescope is the shortest, and consequently best supported on the stand; and possesses many advantages, as compared with others of equal power; from its large proportionate aperture, it gives a smaller disc to the stars, and does not require a deep eye-piece, but it is desirable to obtain power by deeper and smaller speculums.

Varley and Son also exhibit a portable Gregorian telescope, of two inches aperture, and six inches focus. It is mounted on a brass stand, and admits of being readily packed away in a small box. When held against a post or tree, the foot and telescope form a firm triangular bearing.

As in ordinary Gregorians, the length of telescope increases the power of the small metal reflector, so that a small portion only of an object can be seen at one time through the central aperture, it follows that with a sufficient field of view, we cannot have as low a power as would be desirable, without increasing the central aperture and the small reflector so much as to injure the telescope for the reception of high astronomical powers. To obviate this, if possible, Varley and Son have, in the first instance, made the great speculum of the shortest eligible focus, by which means the power of the small speculum is lessened and brought nearer, the angle of view being increased in the same degree. The small speculums are mounted in tubes of any length less than double their focus. This arrangement gives a more effective dark margin around the pencils of light, and such as would require a larger disc if placed behind the speculum. Small speculums of longer focus may thus be used with no greater obstruction of light, and an equally good field retained with a lower power. The mounting the small speculums in tubes effectually secures them from injury whilst in place, and when removed, a small cap completely excludes them from the air. The arm which supports them remains in the tube, it having a concentric ring, into which the small tubes are screwed for use, and from which they are more easily detached than when affixed to separate slides in the common way.

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[*] This contrivance received last year (1850) the large Silver Medal from the Society of Arts.

Ross (No. 254, pp. 435, 436) exhibits a telescope of 3 feet focal length and 2¼ inches aperture, of English flint glass, which, examined on test objects at 150 yards (consisting of two black marble balls, highly polished, placed in full sunshine; a watch-dial, and small balls of white ivory on a black ground), was found to perform well, giving well-concentrated images of the artificial stars produced on the marble balls, with but a small trace of uncorrected colour.

A Council Medal was awarded to Mr. Ross for this telescope in connexion with microscopes.

Callaghan (No. 268, p. 437) exhibits a telescope intended for use in deer-stalking.

Salmon (No. 266, p. 437) exhibits several day and night telescopes, intended for ships' use, which are good for their price.

Richardson (No. 264, p. 437) exhibits a small reflecting telescope, of 3 feet 8 inches in length. The large reflector, made of one piece of solid crown glass, was either painted, or had paper pasted against its back, thereby giving it that tendency to change figure by heat, against which Sir John Herschel has so strongly cautioned all constructors of glass mirrors.

Boyle (No. 392, p. 451) exhibits a reflecting telescope, intended for use without a tube.

Wray (No. 309, pp. 442, 443) exhibits a 7-feet refracting telescope, with 4¼ inches aperture. The peculiarity of this telescope is the substitution of a solid substance instead of flint glass. (See Illustrated Catalogue.)

On trial it was found to be badly achromatised. The colour above the image did not seem to be that usually called the secondary spectrum, but a remain of colour not fully compensated. The glass was neither fully corrected for sphericity nor for colour. It was observed that the object lens had rather a strong yellow tint, and was somewhat blotchy, as if the material used was not quite uniform in colour; all interior reflections were destroyed, so that it could not be suspected to be other than a single glass. As a telescope it is not very good: but, though an imperfect trial, it is yet a fair attempt to move out of the beaten track, and as a step towards the possible revival of fluid or semi-fluid object glasses, deserves commendation.

Watkins and Hill (No. 659, p. 466*) exhibit a telescope 3½ feet focal length, and diameter of object glass 2¾ inches, furnished with a finder, vertical and horizontal rack-work motion, and eye-pieces with powers to 220.

Marratt (No. 469, p. 454) sends an achromatic telescope of 5 feet focal length; it is furnished with powers of 65, 85, 120, 200, and 280. On trial it was found to be good, and to deserve Honourable Mention.

Harris and Son (No. 149, pp. 428, 429) have a micrometrical and double image telescope and "coming-up glass," for measuring distances either on land or sea.

This instrument is designed for the purpose of ascertaining the distance and dimensions of any inaccessible object by means of simple calculation; also to determine, without calculation, the distance of any known object, by means of a set of tables adapted to the scale. It is intended to act as a micrometer for the purposes of astronomy, and as a "coming-up glass," to ascertain whether a ship be approaching to the observer or receding from him, and withal to combine simplicity of construction.

Buron (France, No. 443, p. 1199) exhibits a telescope, the object glass of which is of rock crystal, 4 feet 2 inches in diameter, and 6 feet 3 inches focal length. Attached to the telescope is a finder, which embraces a field of view from 5° to 6°, and has cross wires, which, owing to the great illumination of the field, may be seen during the darkest night, and consequently the star brought into the centre of the field. On examining this instrument it was found to be good in every respect. It is fixed upon a very steady cast-iron stand, furnished with three small castors, brought into operation by means of rack-work when necessary to remove the instrument.

The object glass of this telescope is of rock crystal, which requires great care in its prepartion on account of its property of double refraction. In its working the following particulars are necessary to be attended to:—

1. The crystal must be cut perpendicular to its axis.
2. In working the axis, the spherical surface must always coincide with the axis of crystallization.
3. The curvature of their surfaces must not be made too large in the angles, as double refraction would then be visible to the eye.

M. Biot has shown that an angle of 5″ must always exist, but that this is not visible to the eye.*

The formula of Huygens has been used in working the rock-crystal object-glass; it is as follows:—Supposing that the refractions, both ordinary and extraordinary, take place in the plane of the principal section,

$$m' = \sqrt{\frac{m^2 \,.\, m''^2 \,(1 + a^2)}{m^2 \,.\, a^2 + m''^2}},$$

in which m' = The index of refraction.
m = The ordinary index, or minimum.
m'' = The extraordinary index or maximum.
a = The tangent of the angle of ordination of the luminous rays with the axis of the lens.

Thus m' is always an index of refraction, intermediate to m and m''.

M. Buron has also exhibited another telescope of about the same dimensions, which was found to be good. It is supported upon a stand, invented by the late M. Cauchois, the appearance of which is elegant, but as it compels the observer to stand during the time of observation, and as it is necessary to be moved entirely when large azimuthal angles have to be passed over, it is less convenient than the cast-iron stand before described. It is made of wood, which, though rendering it liable to be affected by variations of moisture, gives it the advantage of being lighter than one constructed of iron.

M. Buron has also exhibited telescopes of various sizes, provided with terrestrial and celestial eye-pieces, and mounted upon brass stands; also nautical and pocket telescopes. In the construction of his eye-pieces, M. Buron pays strict attention to the rules of M. Biot.

Many of the portable telescopes were tried, and their performance was found to be very good; they are remarkably cheap.

A Council Medal was awarded to M. Buron.

Lebrun (France, No. 298, p. 1191) exhibits several achromatic telescopes of a very good kind, and which are remarkably cheap.

Kinzelbach (Wurtemburg, No. 26, p. 1115) has exhibited an achromatic telescope of about 2½ inches aperture, and 23½ inches focus, constructed on the dialytic principle, in which the correction of the dispersion of the crown lens is performed by a flint lens of only half the aperture, placed mid-way between the crown lens and the joint focus; a principle of compensation originating theoretically, we believe, with the late Mr. Rogers, of Leith, and carried into practice with much success by Plössal. This instrument was found to give very perfect images, with no uncorrected colour, this, together with its being the only telescope of the kind exhibited, and the construction deserving of encouragement, has induced the Jury to consider it worthy of a Prize Medal. It is mounted on a stand, which, though defective in solidity, may be used as an equatorial mounting in any latitude.

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* See Biot, "Traité d'Astronomie Physique," vol. ii., 1844, and vol. iii., published in 1846; also "Mémoires sur les Oculaires Multipliées et Achromatiques, presentés à l'Academie des Sciences, 1843."

BUSCH (Prussia, No. 89, p. 1053) exhibits an achromatic telescope of 5 feet focal length and 48 lines aperture. On examination, this telescope was found to be pretty good. The same exhibitor has fourteen other telescopes of a small size. Honourable Mention is awarded to Mr. Busch.

Microscopes.

The Exhibition is rich in its collection of microscopes of all kinds, comprising instruments varying from the simplest forms to the most elaborate. Many of the latter have never been surpassed for power, goodness of object-glass, definition, large angular aperture, beauty of workmanship, great convenience of the subsidiary parts, combined with great permanence of adjustment.

The microscope has been rendered second in importance only to the telescope by its application to physical researches. To the science of geology it has been made to display its great powers in the discovery of many strata of considerable thickness, almost entirely composed of infusorial remains, too small for the naked eye to distinguish or appreciate their exquisite beauty of form and structure. To members of the medical profession its services are indispensable; and in various ways it may become of essential use to every class of society. By knowing the microscopic appearance of different articles, a microscopist may, with ease, detect adulteration in any form, as in adulterated bread or flour for instance, the presence of any grain other than that of wheat will be readily discovered, the starch in each variety of grain being possessed of a distinctive character, and in textile fabrics the intermixture of cotton with linen can be immediately detected. But these are two isolated illustrations out of many far too numerous to be mentioned.

When Tully constructed the first achromatic object-glass in this country, in the year 1824, Dr. Goring said, "that microscopes were now placed on a level with telescopes, and, like them, must remain stationary in their construction."* This prediction fortunately has not been verified, as the most careful examination of the instruments in the Exhibition has fully exemplified. To trace the causes of the steady and progressive improvements which have resulted in the production of microscopes of such perfection as those exhibited is most desirable. Mr. Bowerbank, who has always taken an active part in these improvements, has kindly furnished the necessary information.

About the year 1824 the first effective movement was made towards applying achromatic object-glasses to the compound microscope. In the same year the report of Selligue's microscopes was made to the Royal Academy of Science; and Amici resumed the subject after an interval of nine years. The late Mr. William Tully produced, on March 1st, 1824, at the instigation of the late Dr. Goring, his triple glass, ½-inch focal length, it being the first achromatic combination for the microscope made in this country. But in the following year, on Mr. Lister showing him the disadvantageous figure of this construction, he altered it to his well-known nine-tenths. This glass had an aperture of 18 degrees, and worked well with eye-pieces to about 120 linear. Subsequently a second smaller triplet was placed before the nine-tenths glass, and a power was obtained, with beautiful definition, of 300 linear, with a pencil of light of 38 degrees. The glasses thus combined were about equal to a lens of three-eighths of an inch focus.†

With a happy combination of mathematical knowledge and practical experience, Mr. Lister continued to pursue the subject, and in the year 1830 he published in the "Philosophical Transactions" his paper on 'Aplanatic foci of the double achromatic object-glass, with other properties belonging to it, and a means derived from them of correcting by combination both spherical and chromatic aberration and coma.' Upon this communication has been based the whole of the progressive improvements to their present state of perfection. Although the author of this paper has not since published the further fruits of his labours, he has continued his exertions, and the results have been freely communicated to those celebrated makers among our own countrymen, who have aided and assisted him by their abilities in obtaining the beautiful achromatic combinations, which are now so abundant among our ablest anatomists and naturalists.

Mr. William Tully, who led the way in the manufacture of achromatic combinations, died about the close of the year 1835. At this time Messrs. Ross and Powell had taken up the manufacture, but without much advance on the first simple application of the principle until the beginning of 1837, when, at the suggestion of Mr. Lister, Mr. Ross constructed a differently-arranged combination, but on the same basis. It consisted of two double and one triple compound lens. This combination was successfully worked out, and was designed to produce a great increase of defining power; and it was at this time that the thought occurred to Mr. Ross to leave the front lens moveable, so that by varying its distance from the others, the glass might be adjusted either for covered or uncovered objects.

In the summer of the same year a new construction, composed of two achromatic lenses for a lower power, was suggested by Mr. Lister, and executed by Mr. Ross. In 1843, Mr. Ross constructed a combination of two triplets and one doublet, by means of which an increased angle of aperture and improved definition were obtained. One or the other of the above combinations are now employed by our three chief makers, Messrs. Powell and Lealand, Ross, and Messrs. Smith and Beck, to whom Mr. Lister also communicated the results of his experience in the construction of achromatic combination, each occasionally surpassing the others in the quality of the glasses; and their successive exertions have resulted in that superiority of the numerous and beautiful combinations which they have produced over all others in the Exhibition.

To Sir David Brewster we are indebted for many valuable suggestions for the improvement of the instrument, especially for the best method of illuminating by transmitted light, by the application beneath the stage of achromatic combinations, in place either of simple reflection of light from plane or concave mirrors, or of its concentration by means of the Wollaston condenser. By this method of illumination, minute and delicate objects during examination are presented to the eye under the most favourable circumstances, and a beauty and correctness of definition obtained which no other mode of illumination is capable of producing.

To the same source we are likewise indebted for the valuable application to the microscope of the apparatus for the polarization of light, which has so powerfully assisted us in the investigation of delicate and transparent animal and vegetable tissues.

In conclusion, it may be observed that the low-priced instruments exhibited by Messrs. Ross, and Smith and Beck, are deserving of high commendation. The brass-work is good in principle, steady and free from tremor in operation; and the powers, varying from 1-inch to a quarter-inch focus, inclusive, are by far the most generally useful in the whole range of microscopic combinations, especially for educational purposes.

It must be remarked that it is advisable that the angle of aperture of the combinations should not be extended to its utmost possible limit, when destined for the general purposes of natural history or anatomical investigation.

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* Exordium to "Microscopic Illustration," 1829.

† See "Quarterly Journal of Sciences" for 1825, No. 37, p. 132; also for 1827, No. 44, p. 265. Specimens of these combinations are still in the possession of Messrs. Lister, Bowerbank, and Loddiges.

Combinations of high power, and extremely extended angles of aperture, are excellent in developing one class of test objects, viz., minute lines or dots on plane surfaces, and admirably demonstrate the high perfection to which such glasses are capable of being carried by scientific opticians; but such combinations, with a less angle of aperture and more penetrating power, are far more generally useful and valuable to the minute anatomist and the naturalist.

In regard to the brass-work, we may observe that the qualities especially requisite in the stand of a microscope are simplicity of construction, portability, combined with sufficient weight to ensure safety and steadiness, with smoothness and accuracy of action in all the working parts, and such a construction as to distribute any tremor that may be communicated to the instrument equally over its body, stage, and other working parts. These desirable points are admirably attained in the form suggested by Mr. George Jackson, and adopted by Messrs. Smith and Beck, Ross, and other makers. For purposes of delineation, Nachet's (France, No. 1370) form of prism is more advisable than that of Wollaston's, as the former having one reflection less than the latter, presents the image to the eye in an erect instead of an inverted position.

We now proceed to discuss the particulars of each instrument.

ROSS (No. 254, pp. 435, 436) exhibits a microscope, the mechanical parts of which are exceedingly good: the movements are very smooth and true; the stand is on a plan which is solid and steady, and at the same time not cumbrous. The object-glasses are constructed with different kinds of glass in the different compound lenses, forming a combination so as to double up the secondary spectrum, and this is done so well that scarcely any separation of colours can be detected. The angular apertures of the object-glasses examined are as follows:—

1-inch	focal length,	27°	aperture.
½-inch	,,	60°	,,
¼-inch	,,	113°	,,
⅛-inch	,,	107°	,,
$\frac{1}{12}$-inch	,,	135°	,,

Both the half-inch and the one-eighth of an inch foci are purposely made of smaller proportionate aperture than the quarter-inch, or the one-twelfth of an inch, as in all lenses of large aperture, the image becomes indistinct from the slightest change of focus:—and so, unless an object be an absolute plane, it is impossible to see the whole field tolerably distinct at once with an object-glass of large aperture. In the set examined, the inch, the half-inch, and the one-eighth of an inch, are intended for the general examination of objects; and the one-fourth and one-twelfth of an inch for the examination of minute structures. The object-glasses are first-rate. A Council Medal was awarded to Mr. Ross.

SMITH and BECK (No. 253, p. 435) exhibit a microscope, the stand of which in appearance is not highly finished, but their forbearance to expend time and money on elaborately finishing the non-working part has been adopted on the strong recommendation of some of the oldest naturalists in London, in order that students may acquire instruments with first-rate glasses at the least possible expense, and that such instruments may be brought within the compass of those whose means are limited. The stand is excellent in principle: the body, stage, and appliances beneath are all carried on one stout cast bar, on the recommendation of Mr. E. Jackson, by means of which the centring of the achromatic illumination is rendered easy and certain, and on any tremor being communicated to the instrument, it is equally distributed over the whole of the working parts.

The lever motion to the stage of this instrument is the most easy and generally useful that has yet been applied. If used with the right hand, while the quick and slow adjustments to the focus are worked with the left, there is no animalcule that cannot be readily followed, however fitful and rapid its movements; and any globule of blood pursuing its course through the most tortuous of the capillaries, can be steadily and easily traced, and every alteration of its form observed during its passage through these minute vessels. The field of view may also be swept horizontally or perpendicularly, and the most delicate micrometrical measurements made with great ease and precision. This stage is the invention of Mr. Alfred White; the rabbited groove on which the body moves was suggested by Mr. George Jackson, at whose recommendation the fulcrum of the stage movement was fixed to a spring, instead of to a rigid bar. The simplicity and efficiency of the whole of this stand are highly commendable. The object-glasses examined were of first-rate quality, and were as follows:—

⅔-inch	focus of	45°	aperture.
$\frac{4}{10}$-inch	,,	70° to 75°	aperture.
$\frac{4}{10}$-inch	,,	60°	aperture.
⅓-inch	,,	100° to 105°	aperture.

They are beautifully corrected for spherical aberration, but the secondary speculum has not been much diminished. The half-inch focus of 70° aperture is a wonderfully fine combination, easily showing objects, considered difficult for a one-eighth inch focal length a little more than a year since, and bearing the application of the higher eye-pieces in an unprecedented manner.

Smith and Beck also exhibit all that is necessary for the mounting of microscopic objects, as cells, slips, thin glass, fluids, covers, &c., and a few preparations as specimens. There is, also, a new form of cabinet, for the reception of objects, the names of which may be exposed, by means of porcelain labels with which they are furnished, and from which the pencil-writing can be easily effaced.

There are two tables with revolving tops, by which the microscope can be turned readily round for the convenience of examination by different observers, and thus rendered a social instrument. The microscopes are furnished with portable silver reflector and annular condenser, which exhibit transparent objects upon a dark ground. (This invention was made by Mr. Wenham, and Smith and Beck claim its first execution.) A Council Medal was awarded to Messrs. Smith and Beck.

VARLEY and SON (No. 257, p. 436) exhibit a microscope, the stage of which is moved by parallel rods, with ball and socket joints, which arrangement gives an equable motion in all directions, and is specially adapted for the examination of living objects. A second microscope is exhibited, adapted for receiving vials in which aquatic plants or animalculæ may be kept in a living state for any length of time. The plant is secured to one side of the vial by a piece of cork, and thus is within the reach of the microscope. The vial is kept full of water, and is only corked when used, at which time it is held in a jacket to cut off all extraneous light; a dark chamber projects from it, opposite to the magnifier, so that a single beam of light may be made to fall upon the part under examination.* A third microscope, of a simple construction, is also exhibited, chiefly intended for beginners.

Varley's lever stage is very much more complex than White's; and as the lever is placed behind the stage it is less convenient to use.

KING (No. 287, p. 439) exhibits a microscope stand, with micrometers and goniometers. It has a pyramidal tripod, with stage traversed in rectangular planes by micrometer screws. The parts of this instrument are so arranged that its weight is equally distributed over the base, and when inclined at its working angle, the principal weight is below the point of suspension, and the stand is steady and good. The traversing-stage is furnished with divided scales and verniers. The workmanship throughout this instrument is of the first order. It is furnished with many ingenious applications of subsidiary instruments, and of apparatus specially adapted to the examination of objects by polarized light, and goniometric apparatus for measuring the angles of microscopic crystals. The mode of illumination, by a prism worked into convex spherical surfaces, is also worthy of notice. The Jury considered Mr. King as well deserving Honourable Mention.

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* This instrument is fully described in the "Transactions of the Society of Arts."

PRITCHARD (No. 248, p. 435) exhibits an old-fashioned achromatic microscope, with indifferent object-glasses. The working of the mechanical parts is very good. This form of instrument is that which led the way in the great advance that has been made in the microscope by the introduction of achromatic object-glasses. The Jury voted Honourable Mention to Mr. Pritchard.

LADD (No. 291A, p. 440) exhibits a microscope furnished with chain and spindle movements, in place of rack and pinion. This movement has been applied to the microscope many years since, by Mr. Julius Page. The motion is smooth, and totally free from loss of time, and is likely to stand well the effects of constant use. The Jury award Honourable Mention to Mr. Ladd.

PILLISCHER (No. 269, p. 437) exhibits a large microscope stand, which is good for its price, but unnecessarily large and inconvenient for use. He also exhibits two small microscopes.

JACKSON, E. and W. (No. 258, p. 436) exhibit plain and excavated slips of glass, sections of tubes of various forms, for the construction of cells for mounting wet preparations, and thin glass for covering them, of various thicknesses. These materials are exceedingly useful for scientific microscopists.

HUDSON (No. 256, p. 436) exhibits microscopic objects intended for the use of the medical student, physiologist, and naturalist.

HETT (No. 249, p. 435) exhibits a variety of admirably-injected microscopic objects, illustrating the utility of the microscope to the physiologist. A Prize Medal was awarded to Mr. Hett.

POULTON (No. 252, p. 435) exhibits some well-executed microscopic objects, with drawings to illustrate their structure.

STARK (No. 284, p. 438) exhibits microscopic objects, mounted in *gutta percha* cells, instead of *glass;* and also slides for exhibiting opaque objects.

SHARP (No. 308, p. 442) exhibits a set of high power lenses, ten in number, for a microscope from one-tenth to one-hundredth of an inch focal length.

SHADBOLT (No. 677A, p. 469*) exhibits a sphero-annular condenser, for concentrating light on transparent objects while under microscopic examination, the object alone being illuminated whilst the field of view is dark. A Prize Medal was awarded to Mr. Shadbolt.

The principle of this condenser was suggested by Mr. J. F. Wenham, of Brixton, in his parabolic condenser. Mr. Shadbolt's condenser carries out Mr. Wenham's principle, with the advantage of superior reflecting arrangements, greater facilities of construction, and less liability of derangement.

Other microscopes are exhibited by **FIELD and SON** (No. 250, p. 435), **ELLIOTT and SONS** (No. 320, p. 443), **WATKINS and HILL** (No. 659, p. 466*), **ABRAHAM** (No. 263, p. 436), **GRIFFIN** (No. 457, p. 463); but they are not such as demand especial notice.

Let us now turn our attention to the microscopes exhibited by France; and first in order is **NATCHET** (France, No. 1370, p. 1242). The object-glasses, though inferior to both those of Ross, and Smith and Beck, are by far the best of the foreign ones. They vary from a focus of one inch to that of one-eighteenth of an inch. The following were examined; that with—

$\frac{1}{14}$th of an inch focal length, has an aperture of 134°.
$\frac{1}{8}$th " " 106°.
$\frac{1}{5}$th " " 88°.

In all of them the spherical aberration is not corrected; and although the method of adjusting by the separation of the lenses, invented by Ross, is adopted, yet the system is such that they are not correct at any distance. The workmanship of the stand is very good; and there are two ingenious forms of microscopes exhibited. One has the object-glass below the stage, with the tube inclined at a convenient angle and a reflecting prism for the examination of chemicals, or for dissecting transparent objects under fluids. The other is a dissecting microscope, with the body inclined in a convenient direction, and the image erected by reflecting prisms, so as to enable an observer to look in a convenient position whilst dissecting an object in fluid, which must be kept horizontal. A Prize Medal was awarded to M. Natchet.

Some microscopes, excellent for their price, are exhibited by **BERNARD** (France, No. 762; p. 1217). These instruments are the cheapest in the Exhibition, though none are of the first order. Honourable Mention is awarded to M. Bernard.

CHEVALIER (France, No. 1729, p. 1259) exhibits a microscope, with indifferent object-glasses. The workmanship of the mechanical part, however, is very good, the mode of mounting is excellent, and the instrument is convenient for all kinds of microscopic observations. The Jury voted Honourable Mention to M. Chevalier.

Some excellent microscopes, for their price, were also exhibited by **BURON** (France, No. 443, p. 1199).

MERZ (Bavaria, No. 30, p. 1100) exhibits a microscope, the mechanical parts of which are beautifully executed. The object-glasses are of small aperture, and the spherical aberration is not corrected. The one-twelfth of an inch focus has an aperture of only 65°, and the one-eighth of an inch that of 55° only.

HAZART (America, No. 16, p. 1433) exhibits a large instrument, furnished with very deep Huygenian eye-pieces, giving the usual extensive field obtained by such; it has, besides, two convex lenses in the body for enlarging the field of view. Neither chromatic nor spherical aberration is properly corrected, and the workmanship is not good.

PICK (Russia, No. 170, p. 1372) also exhibits a microscope, but it is an indifferent instrument.

We will now speak of some of the uses of the beautiful instruments we have just described; the most important illustration of their utility in the Exhibition is shown by **LEONARD** (No. 306, p. 442), in his correct representation of many different substances, &c., when highly magnified. He has selected several articles of food in daily use, also the substances with which they are sometimes adulterated, &c., as in the subjoined list.

Frame 1.

1. Transverse section of raw coffee berry, magnified 16 diameters.
2. Thin section of raw coffee berry, showing globules of essential oil, magnified 250 diameters.
3. Investing membrane, magnified 250 diameters.
4. Transverse section of chicory root, magnified 250 diameters.
5. Longitudinal section of chicory root, central fibres, magnified 250 diameters.
6. Longitudinal section of wheat grain, showing the embryo.
7. Wheat starch, magnified 250 diameters.
8. Investing membrane, 250 diameters.
9. Maize, longitudinal section, showing the embryo, magnified 12 diameters.
10. Maize starch, magnified 250 diameters.
11. Investing membrane, magnified 250 diameters.

Frame 2.

1. Horse-bean, transverse section, magnified 25 diameters.
2. Horse-bean, starch globules, magnified 500 diameters.
3. Horse-bean, investing membrane, magnified 500 diameters.
4. Potato starch, magnified 500 diameters.
5. West India arrow-root, magnified 500 diameters.
6. Sago meal, magnified 500 diameters.
7. Rice (raw), magnified 500 diameters.
8. Rice (boiled), magnified 500 diameters.

Frame 3.

1. Healthy nurse's milk, magnified 1,200 diameters.
2. Pure cow's milk, magnified 1,200 diameters.
3. Cream of cow's milk, magnified 1,200 diameters.
4. Curd of cow's milk, magnified 1,200 diameters.

Frame 4.

1. Adulterated milk, magnified 1,200 diameters.
2. Calf's brains, magnified 1,200 diameters.
3. Milk with linseed tea, magnified 1,200 diameters.

Frame 5.

1. Human bone, a thin transverse section of the clavicle, magnified 95 diameters.
   Small portion of ditto, magnified 440 diameters.
2. Ostrich bone, transverse section, magnified 95 diameters.
   Small portion, magnified 440 diameters.
3. Turtle bone, transverse section, magnified 95 diameters.
   Small portion, magnified 440 diameters.
4. Hoof of horse, transverse section, magnified 95 diameters.
   Small portion, magnified 440 diameters.

Frame 6.

1. Lepidosteus scale, transverse section, magnified 95 diameters.
   Small portion ditto, magnified 440 diameters.
2. Sword-fish, transverse section of the sword, magnified 95 diameters.
   Small portion ditto, magnified 440 diameters.
3. Spine of Ray, from which shagreen is made, magnified 95 diameters.
   Small portion, magnified 440 diameters.
4. Human lung (healthy) injected, magnified 150 diameters.
5. Human lung (with tubercles) injected, magnified 150 diameters.

These anatomical and microscopical drawings deserve very Honourable Mention: the whole of their outlines and proportions have been executed by means of the camera lucida, so that they represent truly what the eye actually sees, and the details are finished with scrupulous accuracy; they are, therefore, among the most trustworthy representations of minute and elaborate tissues that perhaps have ever been executed.

TOPPING (No. 667, p. 467*) exhibits five cases of microscopic objects. The contents of the first case are,—test objects adapted to the present state of microscopic science, ranging from two inches power up to one-twelfth of an inch of large aperture; also some of the most beautiful of the fossil infusoria.

Case 2—Contains fossil and recent vegetable structures.

Case 3—Dissections of insects. In this case are large dissections of the respiratory systems of the silkworm, caterpillar, and larvæ of beetles: all these are mounted in Canadian balsam.

Case 4—Sections of fossil teeth, bones, and shells, &c. In this case there is a diamond showing woody structure, and sections of oriental and Scotch pearls.

Case 5—Contains injected animal tissues.

Mr. Topping has mounted the greater part of these objects in Canada balsam: he remarks that this is the only medium which will permanently preserve specimens of natural history as objects for the microscope, and that he uses chrome yellow, instead of vermillion, for injections, with which material he can inject the minutest capillaries.

Mr. Topping's methods of mounting and preserving objects, are many of them of his own invention; he deserves to be distinguished above other exhibitors, as he was one of the first in the field, and perseveringly overcame many difficulties which others following after had not to encounter. His anatomical injections are admirable, as are also those of **HETT** (No. 249, p. 435), but in this branch neither of them is an original inventor, but are followers of John Queckett, Esq., of the Royal College of Surgeons. A Prize Medal was awarded to Mr. Topping.

BOURGOGNE (France, No. 434, p. 1199) has exhibited a case of microscopic objects prepared in the usual manner. They are mounted in Canada balsam, and consist of sections of wood, and entomological and other preparations, with a selection of salts to illustrate the polarization of light. The objects are well displayed, and carefully mounted. A Prize Medal was voted to M. Bourgogne.

NOBERT (Prussia, No. 77, p. 1053), of Barth, has exhibited his wonderful tracings on glass. The plan adopted by him is to trace on glass ten separate bands at equal distance from each other, each band being composed of parallel lines of some fraction of a Prussian inch apart, in some they are $\frac{1}{1000}$th, and in others only $\frac{1}{4444}$th of a Prussian inch separated.

The distance of these parallel lines form parts of a geometric series; thus—

0·001600 line.
0·000857 ,,
0·000735 ,,
0·000630 ,,
0·000540 ,,
0·000463 ,,
0·000397 ,,
0·000340 ,,
0·000292 ,,
0·000225 ,,

To see these lines at all it is necessary to use a microscope with a magnifying power of 100 diameters; the bands containing the fewest number of lines will then be visible. To distinguish the finer lines it will be necessary to use magnifying power of 2,000, and then the lines which are only $\frac{1}{17650}$th of an inch apart will be seen as perfectly traced as the coarser lines. Of all the tests yet found for object-glasses of high power these would seem to be the most valuable. These tracings have tended to confirm the undulating theory of light, the different colours of the spectrum being exhibited in the ruled spaces according to the separation of the lines; and in those cases where the distances between the lines are smaller than the lengths of the violet light waves, no colour is perceived; and it is stated that if inequalities amounting to ·000002 line occur in some of the systems, stripes of another colour would appear in them.* A Prize Medal was awarded to Mr. Nobert.

LENDY (Sardinia, 60, p. 1304) has exhibited several dies or minute copies on silver and steel, of various devices. These specimens of minute and excellent workmanship are produced by a machine invented, but not exhibited, by Mr. Lendy. By its means any model, however elaborate, varying in size from 7·87 inches to 0·039 inch in diameter, may be reduced to one-fifteenth of its original size, a degree of minuteness which renders the copies so reduced almost imperceptible to the naked eye. On subjecting them, however, to examination by the microscope, they are found to be composed of lines of all but unparalleled delicacy and distinctness.

Mr. Lendy, who has been for many years engraver to the Royal Mint at Turin, has originated this ingenious invention, for the use of banks, mints, goldsmiths' companies, &c., with a view to the avoidance of counterfeits. We may particularize the following dies or puncheons which are exhibited:—

A royal crown engraved on silver, and very elaborate, the lines within side being so fine, that a common hair covered five of them. The same design in relievo is also exhibited.

A ducal crown engraved on silver, and surrounded by a gothic frieze, executed with sharpness and precision never before equalled in so minute an object. The same design in relievo is also exhibited.

A coat of arms containing a gothic "R," surrounded by a gothic frieze, and engraved on steel, 0·013 inch in diameter; in its execution it is as graceful as distinct. A similar design in relievo is also exhibited.

Another ducal crown on steel, equally good with the preceding, is exhibited, as also one in relievo.

Upon steel a copy of Mr. W. WYON's medal (the design of which is a portrait of Her Majesty, surrounded with the words Victoria, D.G. Britanniarum Regina F.D.), it is 0·06 inch in diameter, the original being

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* See Poggendorff's "Annalen" for 1846, and "Proceedings of the Royal Society," April 10, 1851.

1·8 inch in diameter. This is a most elaborate work, and bears examination well by high powers.

This invention, apart from its great ingenuity and the perseverance by which it has been originated, promises to be of great utility in reducing standard works with accuracy only exceeded by a degree of minuteness calculated to render any attempt at counterfeit next to impossible.

Object Glasses for Telescopes.

SIMMS (No. 741, pp. 475*, 476*, 477*) exhibits several achromatic object-glasses; viz., one of 9 inches aperture, two of 8 inches aperture, one of 6·9 inches aperture, and one of 4 inches aperture. The largest which is exhibited is entirely of English manufacture, and the discs, both of flint and crown, were made by Messrs. Chance, of Birmingham. In all the remaining glasses, the crown is of English—and the flint of foreign—manufacture. The object-glasses are altogether the work of the exhibitor, and on examination were found to be good.

It is observable that the crown glass in all these specimens has a greenish hue, and Mr. Simms states, with reference to this particular, that he has found from experience (as might be expected from the extinction of one extreme, and consequent shortening of the total spectrum), that there is less irrationality between this kind of crown glass and the denser kind of flint, than between the same specimens of flint and any other crown or plate glass that he has been able to procure. We understand Mr. Simms' practice in determining the corrections required for achromatism consists in using that part of the spectrum which is included between the lines B and G; he finds, however, differences of small amount, sufficient to produce a sensible effect upon the results, between discs of glass sent to him at the same time, and which he supposes are prepared, if not at the same time, at least of the same materials.

The following are the specific gravities, &c. of specimens of flint and crown glass manufactured by Messrs. Chance and Co., of Birmingham:—

Kind of Glass.	Specific Gravity.	Index of Refraction B.	Index of Refraction G.	Dispersive Power B. to G.
Flint – –	3·583	1·6109	1·6336	0·036
Crown – –	2·539	1·5128	1·5274	0·028

To Mr. Simms the Jury consider very great merit is due, not only for the exquisite workmanship displayed in every instrument exhibited by him, but also for the *several new inventions and arrangements* which, by the greater facility they afford to observation, cannot fail in the advancement of astronomy. The Jury unanimously voted a Council Medal to Mr. Simms, which award was passed unanimously by the Group; but, unfortunately, was not confirmed by the Council of Chairmen; consequently the medal which Mr. Simms will receive is NOT that which, in the opinion of the Jury, is due to him.

GODDARD (No. 274, p. 438) exhibits an object-glass.

BURON (France, No. 443, p. 1199) has exhibited an achromatic glass 7·5 inches diameter and 10·8 feet focal length; the crown and flint glass for which were made by the late M. Guinard, of Paris, and the curves according to the theory of Sir John Herschel, and is designed to show stars of the eleventh magnitude. It was not tried by the Jury on account of its tube being delayed at the Custom-house under a very heavy charge.

Solid Eye-pieces.

READE (No. 254A, p. 436) exhibits two solid eye-pieces. They consist of three lenses, the anterior and posterior being double convex of crown glass, and the intermediate one double concave of flint. The contact surfaces are cemented together, and consequently the action upon the rays of light is similar to that of a single lens. They are applicable to all astronomical instruments, micrometers, and microscopes, and also as a general magnifying power. The novelty of the solid eye-piece consists in its construction, by which a large and flat field of view is obtained, together with the removal of spherical and chromatic aberration. These advantages are obtained by means of the great thickness of the flint lens, which is a perfectly new feature in the construction of eye-pieces.

Sir David Brewster's achromatic sphere which he proposes to use as an object glass for the microscope, approximates to this form, but the field is not flat. The general mathematical expressions for the curves of the solid eye-piece have not as yet been fully worked out; but it may be stated as a rule for the practical optician, that the radii of the outer curves of the two convex lenses, must be in the proportion of the dispersive ratio of the crown and flint glass employed on each eye-piece, and the inner contact surface must be such as by experiment will perfect the achromatism. The solid eye-pieces exhibited have focal lengths of 0·5 inches and 0·75 inches, and it happens that while the eye-piece of shorter focal length is barely brought up to a flat field of view, the one of longer focal length is carried rather beyond, and is therefore slightly over corrected. These small errors are upon the whole satisfactory, inasmuch as they show that a truly flat field is attainable.

Sir David Brewster observes in his "Treatise on Optics," that "achromatic eye-pieces, where one lens only is wanted, may be composed of two or three lenses, exactly on the same principle as object-glasses; such, indeed, as the cemented triple object-glass made for the microscope, which was described by the Rev. J. B. Reade some years ago, in a paper read before the Royal Society, as being an efficient eye-piece for telescopes;—in fact, the then best known form of a vertical single lens; but, the smallness of the field is an insuperable objection to its use with a micrometer. The larger field of view now obtained in the solid eye-piece is solely due to the thickness of the flint, which causes the image of the object-glass, where the eye is placed, to be formed so near the eye-piece that its diameter is seen under a considerable angle; and it is found that in the lower powers the diameter of the field of view is larger than in the ordinary negative eye-piece."

The positive eye-piece almost universally used, is known as Ramsden's: the field is flat, which is requisite for a measuring instrument, but it is far from being free from colour.

The Astronomer Royal states* that the positive eye-piece at present used is not achromatic, and cannot be made so; and considerable inconvenience is occasioned by this defect, for when the object is not far from the centre of the field, the chromatic confusion is much greater than that produced by spherical aberration; since it varies as the distance from the centre, and in this confusion there is nothing to point out the centre of the coloured line.

The new solid eye-piece is therefore looked upon as an important addition to the working apparatus of an astronomer, inasmuch as the great evil of chromatic confusion, which prevents any accurate measurements at the extremities of the field, does not here exist at all, but the webs of the micrometer, though ever so distant, may be seen as fine black lines. The field of view is also free from illumination by false light; no light is lost, as in the usual construction by inner reflection from the surfaces of the lenses,—and there is no formation of the false image or ghost of planets, nor of the bright stars, which injures the best part of the field.

An examination of this eye-piece, as applied to a telescope, in comparison with the action of the ordinary eye-pieces applied to the same telescope, made by Mr. Glaisher, extending over a period of three hours, fully impressed him with its superiority; the field of view was black, and the stars appeared as very bright points. In consequence of the purity of the achromatism it will probably be found that in determining the colours of fixed stars, these eye-pieces may be of essential service. The Jury awarded Mr. READE the Prize Medal.

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* See "Cambridge Philosophical Transactions," vol. iii. p. 56.

Optical Glass.

The disc, of 29 inches in diameter, exhibited by Mr. CHANCE (p. 477*) having undergone a partial examination by the Jury, it was considered that a satisfactory opinion could not be formed of it, owing to the irregularities in its surfaces, until it had undergone the operation of polishing, so as to give it a plane, or nearly plane figure. This operation having been performed by Mr. Ross, and the disc being reported by him fit for further examination, it was agreed to subject it to such on Tuesday, the 9th of September 1851, for which day (it being considered by the Committee desirable to have the attendance of as many of the Jury as could be brought together) a Jury summons was issued, which was responded to by Professors Potter and Colladon, who attended with the Committee, consisting of Sir J. Herschel, Mr. Glaisher, and Professor Miller. Mr. Ross, Mr. Simms, and Mr. Bontems (the latter on the part of Mr. Chance) were also present at the examination.

The dimensions of the disc were as follows:—

Largest diameter	29½ inches.
Shortest ,, ...	29 ,,
Thickness, from	2·2 to 2·25 inches.

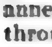
Its weight was stated to be somewhere about 200 lbs. The specific gravity about 3·56 .... 3·58. The surfaces were highly polished and brought to a figure very slightly deviating from true planes, so that no deceptive appearance of striation could possibly arise from irregularities in their surfaces.

The disc was first examined by inspection through faces cut upon its edges. These faces had not been repolished, or brought to a true figure; so that nothing could be gathered from this examination, but that no offensive striæ were seen through them.

The state of the disc, as to tension from imperfect annealing, was then tried by passing polarized light through it at right angles and at obliquities, and analyzing the emergent beam by tourmalines and Nichol prisms. It was found to be very remarkably free from indications of tension, only a feeble gleam of whitish light becoming perceptible on some portions of the edges, which might have arisen from the heat of the hands of the persons employed to lift and keep it in position.

It was then placed on edge, and tested by looking very obliquely through it at objects offering broad lights and shadows. During this examination a group of striæ became visible at a spot whose position on the glass was marked, and to which and its near neighbourhood they seemed to be limited.

To trace the limits of this group, and to subject the whole disc to a more rigorous and delicate scrutiny, it was set upright on a table; the room (the Indian tent) darkened, a candle placed 7 or 8 feet behind the disc, and a convex lens of about 5 feet focus and 6 inches diameter, of extremely pure glass, held between the candle and the lens close to the latter. The eye of the observer being placed before the disc in the place of the image of the candle, so as to cover the lens with a glare of light; striæ, it is well known, become distinctly apparent, if existing, in any part of the disc so covered.

Every part of the disc in succession, beginning from the centre, and proceeding outward in radii, was thus carefully examined for striæ. With the exception of a hair or thread, perfectly definite, and of a looped form,  thus, near the centre, and not of the smallest importance in an optical point of view, and a few other trifling threads, originating apparently in minute sand-grains, in various points, and also utterly inoffensive, no appearance of striæ whatever could be discerned over any part of the disc, but at and in the immediate neighbourhood of the place marked.

No *bubbles* of any consequence were noticed in this examination, or on ocular inspection.

Attention being concentrated on the group of striæ thus pointed out, it was found to occupy a space (at its utmost extent) of 6½ inches in length and 2½ inches in breadth, beginning at about 1½ inches from the edge, and having its longer dimension directed towards the centre. The whole of this space was by no means equally affected, and the most objectionable portion was much more limited. This was situated not far from the middle of the space in question; and it was proved decisively that the seat of the worst portion (or nucleus) of the group was almost close to one of the surfaces, by the test of parallax, viz., by placing a mark on the surface *next the eye* on the apparent place of the nucleus, and then tilting the disc right and left. One side (A) being towards the eye, the mark and nucleus remained coincident; and on reversing the disc, and bringing the other side (B) nearest the eye, and making a fresh mark (effacing the former), they coincided only when the visual ray passed perpendicularly through the disc, the nucleus passing parallactically behind the mark, from side to side, on inclining the disc.

As the disc would have to be worked into a concave or convexo-concave lens, by which its thickness in the centre would be reduced at least an inch, there is little doubt, therefore, that by acting on that surface near which the nucleus is situated, it, and much of the neighbouring striæ, which are evidently connected with it, would be ground out. Such is the decided opinion of Mr. Ross. In that case, as the whole area occupied by the striated region does not exceed 0·019, or less than one-fiftieth of the total surface of the glass, it might very reasonably be expected that, if worked into an object-glass, the mass of good light would so far overpower the injurious effect of what striæ might remain, as to give a very satisfactory result, and that for many purposes of high astronomy it might prove extremely efficient.

On the other hand, if it should be resolved to sacrifice the defective portion, or so much of it as to leave but a very trifling part of a comparatively inoffensive region still encroaching on the edge (suppose a spot of an inch diameter), it would be practicable to cut out from the whole disc a smaller one of 22 inches (29 — 1½ — 5½) diameter, apparently quite perfect in every other part, and of 2·2 inches in thickness. But as this thickness is superfluous, it might be found practicable, by cautiously heating the glass to the softening point, and applying pressure, to extend it in surface whilst reducing its thickness to 22-29ths of its present amount. Supposing this operation successfully performed, and that in the manipulation some portion of the good glass adjacent to the striated part being retained could be pressed inwards, so as to drive out the small striated corner, a disc of 25 inches diameter, of apparently perfect flint glass, would be produced.

The great object-glasses of Pulkowa, and of New Cambridge in the United States, do not exceed 16 inches. Compared to this, a 25-inch, or even a 22-inch object glass would be as great a stride in advance, as the Pulkowa lens is beyond the largest achromatics previously constructed.

On these grounds the Committee have had no hesitation in recommending that a Council Medal be given to Messrs. CHANCE for this disc. They desire it to be clearly understood, however, that no examination to which a disc of glass *unworked* can be subjected, will afford more than a reasonable probability that a telescope *worked* from it shall turn out perfect; since, independently of peculiarities in the glass which this kind of examination may fail in detecting (though no better has yet been devised), the perfection of the resulting instrument will still be dependent on that of the crown lens and of the optical workmanship.

MAËS (France, No. 656, p. 1209) has exhibited specimens of a new kind of glass; the basis of which is the oxide of zinc, a certain quantity of borax, a boracic acid being added, to give the glossy character for which the boracic compounds, no less than the silica, are so eminently remarkable, combined with an easier fusibility. As a material in the arts, the Jury have no further concern with this glass, than as regards its probable utility in the construction of telescopes, prisms, and other optical apparatus, for which it extreme limpidity and total freedom from colour, and, so far as appears, from veins and striæ, seem eminently to fit it, and which have induced them to propose its being rewarded with a Medal. The low dispersive power of the zinc compounds, points to its use as replacing the crown glass in achromatic telescopes. Suppose it should be found practicable (and the experiment is recommended to the attention of artists, as one in which, when tried on a very small scale, some success has actually been obtained) to form colourless and uniform glasses in which fluorine enters as a distinguished ingredient, in combination with silica, alumina, or other materials; the combination of such glass, as a convex lens, with this new material of Mr. Maës, or with ordinary crown glass, as a concave, might be expected to produce achromatic object-glasses of a very perfect description. The coloured dispersion to be removed, being much less than that of crown glass, owing to the peculiarity of the fluoric compounds, which beset the manufacture of flint glass, arising from the intense solvent power of the oxide of lead on the crucibles, and give rise to striæ and veins, would be evaded. Mr. Maës, besides two prisms of his new glass, of the most limpid purity and perfect freedom from veins or striæ, has exhibited two discs of 4½ and 7 inches in diameter, prepared for optical use. In an examination, through faces cut on their edges, no veins or striæ were detected, and, consequently, should there arise no objection to this material, either in point of durability or facility of working, it will probably prove very valuable for the use of the optician. Some small astronomical lenses, in which zinc is substituted for crown glass, are also shown. Its refractive index is 3·285, and its dispersive ratio, as compared with a flint glass of specific gravity, is as 3·55, to 0·6502.

It has been long a theorem in every treatise on optics, that the achromatic union of the *whole* spectrum cannot be accomplished by any combination of dispersive media, and that two media of different dispersions enable us to unite but two rays precisely, the rest only approximating, leaving two masses of uncemented colour, the one converging to a longer, the other to a shorter focus than that of the united rays. A fitting combination of three media, admits of the exact union of three rays at different points of the spectrum, and a very much greater approximation to union among all the rest, provided their *scales* of action on the different rays of the spectrum differ sufficiently. In this point of view, the new glass, whose dispersive action on the spectrum, from the introduction of a new metallic oxide, may very reasonably be expected to differ from those of the crown and flint glass, will, perhaps, become available in this third medium, so long a desideratum in optics; and its use may open a new field in the theory of the construction of telescopes. Should it prove (owing to the boracic acid it contains) less durable, or more open to atmospheric corrosion than the other media, its place in a compound lens will be intermediate, as a defence from air or moisture, and one of the conditions of the structure may be that of a perfect coincidence of one or of both its surfaces, with those of the adjacent lenses, to allow of cementing them. A Prize Medal was awarded to M. Maës.

DAGUET (Switzerland, No. 75, p. 1271) has exhibited discs of flint glass of 15¼, 12⅝, 10¾, 9⅞, 7½, 7, 6½, and 4⅝ inches in diameter respectively. On examination, by chords and diameters, they were all found to be good; striæ were suspected to exist in the largest; but, if so, it was in one diameter only, and but to small amount. A disc of crown-glass, of 7 inches diameter, and one of 4⅝ inches, were examined, and found to be good; another, of 6½ inches, was less perfect. The specific gravity of the flint was stated to be nearly 4, and that of the crown to be from 3·5 to 3·6.

Mr. Daguet, by a process of his own, gives to flint-glass a degree of hardness not attained by any other manufacturer; his glass, particularly the flint, is in general use among all the best opticians, being distinguished both by its homogeneousness and its peculiar property of resisting all decomposition by the action of air. The Council Medal was awarded to Mr. Daguet.

Lenses and Prisms.

BEYERLÉ (France, No. 765, p. 1217) exhibits many lenses ground with cylindrical surfaces; they are free from spherical aberration, and give a true view on their whole surface: also long lenses, with the axes parallel, equally true throughout: they are useful in photographic registration of changes in the position of magnets, &c., as adopted by Mr. Brooke.

M. Beyerlé also exhibits lenses ground on curves of different foci, &c.; also many achromatic lenses of short focus. The working of these reflects high credit upon M. Beyerlé, and the Prize Medal was awarded to him.

JAMIN (France, No. 548, p. 1204) exhibits a fine assortment of prisms, chiefly crown; a large flint disc, and plane and concave reflectors, mounted on brass swing frames, of large dimensions. Honourable Mention was made of M. Jamin.

BERTAUD, Jun. (France, No. 1549, p. 1251) has exhibited some of the finest possible Nicholl's prisms; some slices of crystals, prepared to show that, in certain crystallized bodies, heat is unequally transmitted in different directions; with many other specimens of most difficult, yet beautifully cut prisms, reflecting the highest credit upon the maker. The Prize Medal was awarded to him.

BURON (France, No. 443, p. 1199) has exhibited various prisms.

Lighthouses.

CHANCE (Class XXIV., p. 477,* Class X.) has exhibited a design for a lighthouse, consisting of a dioptric apparatus of the first order, and constructed with revolving lenses and catadioptric zones.

This apparatus combines the principles upon which the fixed and revolving dioptric lights of Fresnel were constructed, with an improved method of reflection, by which the use of metal reflectors is entirely superseded.

In the fixed dioptric light of Fresnel, the flame is placed in the centre of the apparatus, and within a cylindric refractor of glass, of a vertical refracting power, the breadth and height of the strip of light emitted by it, being dependent upon the size of the flame and the height of the reflector itself; above and below is placed a series of reflecting prismatic rings, or zones, for collecting the upper and lower divergent rays, which, falling upon the inner side of the zone, are refracted, pass through the second side, where they suffer total reflection, and, passing out on the outer side of the zone, are again refracted. The effect of these zones is to lengthen the vertical strip of light, the size of which is dependent upon the breadth of the flame and the height of the apparatus.

The system adopted by Fresnel, in his revolving dioptric lighthouse, is open to some objections. A large flame is placed in the centre of a revolving frame, which carries a number of lenses, on a large scale and of various curvatures, for the avoidance of spherical aberration. With the view of collecting the divergent rays above the flame, an arrangement of lenses and silvered mirrors is placed immediately over it. By this compound arrangement the simply revolving character of the apparatus is destroyed, as, in addition to the revolving flash, a vertical and fixed light is at all times seen; added to which a great loss of light must be sustained from the use of metallic reflectors.

The lighthouse constructed by Mr. Chance may be described as Fresnel's revolving light, rendered holophotal. It is divided into three compartments, the upper and lower of which are composed respectively of thirteen and six catadioptric zones, which produce the vertical strip of light extending the whole length of the apparatus, and is similar to that described as Fresnel's fixed dioptric light. The central or catoptric compartment consists of eight lenses of three feet focal length, each of which is the centre of a series of eleven concentric prismatic rings, designed to produce the same refractive effect as a solid lens of equal size. These compound lenses are mounted upon a revolving frame, and transmit horizontal flashes of light as they successively rotate. The motion is communicated to the frame by a clock movement, and performs one revolution in four minutes; consequently, as there are eight lenses, a flash of light is transmitted every thirty seconds to the horizon. The system of a fixed light, varied by flashes from prisms, originated with Fresnel.

The apparatus is lighted by an Argand lamp, with four concentric wicks: it is provided with four sizes of burners, the largest of which is 3½ inches, and the smallest 1·6 inch in diameter, and is stated to consume 1 pound 10 ounces of oil per hour; carcel oil being employed.

The interior edges of the framework, carrying the catadioptric zones, are silvered; the workmanship is not characterized by any great degree of finish; a fact in its favour, as any great degree of finish, or adoption of ornament, would involve an increased outlay of capital without compensating advantages.

The glass of which the apparatus is manufactured is dark and of a greenish colour; this we are informed is due to its having been subjected, in melting, to a very high temperature, with a view of draining off the alkali, which, by rendering it dryer and harder, would prevent the exuding of moisture from the surface, a defect to which glass is liable when exposed to the air; it is, however, probable that the colour will have no injurious effect, as it is known that such tinge does not affect the transmission of light. The presence of striæ, which are observable in many points, will, by scattering the rays, cause a loss of light to some amount.

WILKINS (Class VII., No. 157, pp. 326—328) has exhibited a revolving catadioptric apparatus for a lighthouse of the first class.

This, also, is constructed upon the holophotal system, and does not differ very materially from that exhibited by Chance. For the moveable cylindrical lenses, is substituted a single revolving cylinder composed of four lenses, alternated with an equal number of fixed ones, according to the succession of flashes to be produced during each revolution. A new arrangement is also introduced, whereby the friction rollers which revolve on two parallel planes, may be so fitted on an iron axis with regulating screws, that, when one part of the plate becomes worn, they may be adjusted to another part. The glass, though white in colour, is not more free from striæ than that exhibited by Mr. Chance, and though great finish and ornament are discernible in the manufacture of the apparatus, these would seem to be rather objectionable than otherwise. For a detailed description, see Illustrated Catalogue, Class VII.

The Jury make Honourable Mention of this lighthouse.

Physical Optics.

DUBOSQ-SOLEIL (France, No. 1197, p. 1235) has exhibited Silberman's heliostat. The principle of this instrument is quite different from that of S'gravesandes, which is that of making the perpendiculars to the reflecting plane, describe an oblique cone. In the instruments exhibited, the reflector, by a peculiar gimbal suspension, is always kept equally inclined to two axes, one of which is fixed, and directed towards the line which the reflected ray is to take; the other is kept by a clock motion always parallel to the sun's direction, the plane of the reflected ray being by the same gimbal suspension, kept perpendicular to the plane in which both these axes lie; thus the incident ray parallel to the one will be reflected parallel to the other.*

DUBOSQ-SOLEIL (No. 1197, p. 1235) has also exhibited a saccharometer. A double gauge is formed by a rotato-polarizing plate of quartz and Iceland spar, of which two semicircles, juxtaposed, and viewed through a telescope of about double magnifying power, are brought to exact coincidence of colour, by turning the spar. In this situation, the images are viewed through an empty tube, closed at either end with glass, and of a given length. The saccharine solution is passed in, and the quality of colour disturbed: the semicircles no longer match: they are then re-adjusted by sliding one upon the other two achromatized prisms of Iceland spar acting against each other, so as to leave their difference of thickness outstanding, the amount being estimated in parts of a finely divided scale, which is graduated so as to show, by inspection, the saccharine matter present. This is a beautiful and delicate instrument, carefully executed and well-finished.

DUBOSQ-SOLEIL (No. 1197, p. 1235) has also exhibited Bravais' haloscope, for the exhibition of all the phenomenæ connected with halos, parhelions, &c. This beautiful instrument consists of a clock-movement for the purpose of giving a rapid revolution to a vertical axis; two glass prisms (one hollow for the reception of water); a quadrangular prism, and a small arm carrying a mirror, all adapted for mounting on the vertical axis; two opaque plates of glass for the purpose of obscuring one or two sides of the prisms, as necessary, and a plate of glass mounted. To produce a representation of the parhelion, it is necessary to place a candle in a darkened chamber, on a level with, and 10 or 12 feet distant from, the glass prism on its axis of rotation, the prism having two sides covered. On looking in a horizontal direction, the parhelion circle will become visible. By obscuring one side of the prism, only three horizontal lines are seen; two being formed from the exterior and one from interior reflection.

To produce an imitation of the white parhelion, the candle is placed in the same position, and two sides of the prism are again darkened; when, on looking at the parhelion circle, at a distance of 120° from the candle, the white one will be perceived.

Coloured parhelions may be exhibited by means of the prism of water, viewed at an angle of 20° or 25°. One side of the prism being obscured, the coloured parhelion, red on the side near the candle, with a white train prolonged to 15° or 20°, will be seen.

To imitate coloured parhelions, formed at a distance of 98° from the sun, the arrangements are the same. By obscuring the prism, and looking at the distance of 98° from the candle, a coloured spot will be observed, red on the side opposite to the candle, and less bright than the parhelion.

The circumzenithal tangent of the arc may be imitated by means of the prism of water, the candle being lowered from its original position, and two sides of the prism darkened; on placing the eye in a proper position, the image will then appear reflected upon the ceiling. Several changes may be produced by simply turning the prism. The circumzenithal arc may be produced by the above arrangement, the position of the eye only being altered.

To imitate the anthelion, it is necessary to make use of the quadrangular prism; its large transparent surface is turned towards the observer, and the candle placed a little above the prism, at the distance of six or eight feet from it. A small circular mirror is then so placed that its centre is on a level with the top of the prism. The eye, being situated behind the prism, will perceive a luminous circle described beneath its edge. If a little slip of paper be placed beneath, it will be perceived more distinctly without *moving*. By moving the position of the eye, several distinct phenomena will become visible. There are means of adjusting the apparatus, to render the image for a time permanently fixed. Other phenomena besides those detailed can be shown by this instrument, and great merit is due to M. Bravais, the inventor.

Dubosq-Soleil, besides these, exhibits a very great variety of delicately constructed philosophical instruments, for exhibiting the phenomena of polarized light and other physical experiments; such as a cyano-polarimeter, for observing the polarization of the sky; Arago's apparatus for exhibiting the interference of polarized light; Fresnel's screw for polarizing glass by compression; Babinet's goniometer, Brewster's stereoscope, &c.; M. Dubosq-Soleil also exhibits an apparatus, invented by himself, for fixing the charcoal points for electric light.

A Council Medal was awarded to M. Dubosq-Soleil.

Spectacles and Opera Glasses.

It is with regret we observe that exhibitors of spectacles in the British portion of the Exhibition have done nothing more than exhibit a collection of shop goods, and have regarded the improvement of the glasses themselves as a matter of little moment. They have vied with one another in mounting spectacles in the finest and most flexible frames, and have produced articles finer and more delicate than any which have before been made. They have, however, with this exception, been content to follow in the steps of their forefathers, and have lost sight of the main object, in their desire to render these useful appurtenances to the sight as little visible and unsightly as possible. In the Foreign Section how pleasing a contrast is afforded by Henri (France, No. 262, p. 1189) who, viewing the subject in the proper light, has possessed himself of a thorough physiological knowledge of the eye, whether healthy or otherwise, and using this knowledge as a basis for the exercise of his skill as an optician, has succeeded in making great advances, and, by a skilful adaptation of the principles of optics, has been enabled to manufacture glasses, the foci of which are so arranged as to suit almost every peculiarity of vision. The glass, itself, is also of great purity, and removes a fruitful source of the uneasiness and fatigue incident upon the use of spectacles.

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* See "Comptes Rendus de l'Academie," 1843, tome xvii., p. 1319.

Upon spectacles, as constructed by M. Henri, we have no objection to report, combining as they do the work of the optician with a knowledge of optics; but we cannot consider we are called upon to report upon spectacle-frames, or articles which have evidently been manufactured and exhibited with a purely commercial view.

Rowley (No. 290, p. 439) has exhibited spectacles of various kinds, chiefly remarkable for their durability of mounting, both as regards material and construction, some being of no greater weight than 11 grains; the whole weight, including glasses, not amounting to more than 2 pennyweights. The steel frames of these last resemble hair lines, and are imperceptible at no great distance.

Weaber (No. 279, p. 438) has exhibited several pairs of spectacles, many of them distinguished by a mounting of extreme lightness; also a steel hand frame, to be adjusted before the eyes, without pressing upon the nose.

Braithwaite (No. 283, p. 438) has exhibited several ventilating eye-shades, designed to allow a current of air to circulate freely between the shade and the wearer, and thus to obviate the collection of heated air in the neighbourhood of the eyes.

Chadburn Brothers (No. 259, p. 436) has exhibited several pairs of elastic steel-framed spectacles, designed to combine lightness with durability, and spectacles for various purposes. These, as well as everything exhibited by Messrs. Chadburn, are remarkable for extreme cheapness, and in this respect they deserve Honourable Mention.

Bayley (No. 273, p. 438) has exhibited various spectacles, in mountings of gold and silver.

Hyams (No. 278, p. 438) exhibits a solid piece of glass of a conical shape, or rather of the form of a frustrum of a cone, ground at the base or larger end to a convex surface, and at the smaller end to a concave surface, intended for opera-glasses.

Dixey (No. 271, p. 438) has exhibited a variety of spectacles, some of them remarkable for their lightness, a variety of eye-glasses, and several binocular opera-glasses.

Clark (No. 276, p. 438) has exhibited spectacles adapted for use, if required, as an opera-glass.

Elliott and Sons (No. 320, pp. 443, 444) exhibit specimens of blue steel and gold spectacles of a very light and flexible kind; also gold hand-spectacles, intended for use with one hand, and various specimens of opera-glasses.

Horne, Thornthwaite, and Wood (No. 220, p. 434), exhibit Smee's optometer, for ascertaining the refractory humours of the eye, and the required focus of spectacle glasses.

Braham (No. 289, p. 439) has exhibited various kinds of spectacles.

Callaghan (No. 268, p. 437) a pair of steel spectacles.

Solomon (No. 288, p. 437) a pair of eye-protectors.

Whitehouse (No. 280, p. 438) various spectacles; a pair for sketching, mounted without a rim to prevent obstructing the vision.

Yeates (No. 332, p. 446), of Dublin, spectacles of the ordinary kind.

Henri (France, No. 262, p. 1189) has exhibited several kinds of improved spectacles, for correcting the defects of vision; those for rectifying obliquity of vision (orthostrabique) are made of steel, bronzed, and furnished with a moveable diaphragm, which may be shifted either right or left at will. They are designed for the cure of squinting, either converging or diverging. Spectacles for both requirements are exhibited.

M. Henri has also exhibited spectacles for preserving the eye-sight (conserves gardes-vues) designed for the use of persons suffering from weak eyes, ophthalmia, &c., and particularly adapted for the use of those who work much at night by artificial light.

With the skill of the optician, M. Henri has combined the knowledge of the oculist, and great praise is due to him for the improvements he has made in spectacles adapted to peculiar states of the eye; he has the further merit of being the only exhibitor of such spectacles in the Exhibition. The Jury considered him well worthy of Honourable Mention.

Poullot (France, No. 966, p. 1226) has exhibited various spectacles in very fine and slender mountings.

As M. Poullot considers a great part of the inconvenience experienced in the use of spectacles to be due to the weight of the mounting or frame-work, he has been induced to make various trials for its rectification, by endeavouring to combine stability with the least possible weight. He first contrived a pair of spectacles mounted in steel frames, filled with lead; but the steel proved to be too soft and the lead too heavy. After various attempts he completed several of tempered steel, and entirely without seam or solder, the weight of which did not exceed a quarter of an ounce—a weight in itself insufficient to cause inconvenience to the wearer. The exceeding lightness and comparative elegance of these glasses is designed to remove the prejudice existing against spectacles in general, owing to the reason before mentioned.

M. Poullot considers that he has made spectacles which always preserve the visual ray in the centre of the glass; he has also exhibited metallic woven spectacles for the free admission of air to the eyes, which subdue the light and serve as a screen against dust, insects, &c., or any extraneous substance which might be injurious to the eye.

Lebrun (France, No. 298, p. 1191), exhibits many very cheap spectacles and opera-glasses.

Prudent (France, No. 1412, p. 1243) exhibits a fine collection of opera-glasses, some of which have large object-glasses.

Buron (France, No. 443, p. 1199) has exhibited a number of opera-glasses, both single and double, of which the mountings are of various materials, such as enamel, ivory, tortoiseshell, &c.

Busch (Prussia, No. 89, p. 1053) exhibits various spectacles, differently mounted; single and double opera-glasses, lenses, &c.

Latinie (Belgium, No. 184, p. 1157) has exhibited various pairs of spectacles.

Bagen (France, No. 25, p. 1172) spectacle glasses.

Plagniol (France, No. 1679, p. 1257) spectacles of various kinds.

Pick (Russia, No. 170, p. 1372) exhibits a pair of spectacles.

Dissolving Views Apparatus.

Abraham and Co. (No. 263, p. 436) exhibit a trinoptric prismatic lantern. The three lanterns are illuminated by a small circular wick, through the centre of which a tube passes for the purpose of supplying oxygen gas, by which means an intense light is obtained. A disc of 25 feet for each tube may be obtained, and each can be darkened to any extent, without any shadow on the picture. The three discs, by means of the prisms, can be thrown together, or they can be placed at various distances on the screen, forming one panoramic picture.

Abraham and Co. also exhibit a dioptric prismatic lantern, with two discs, which can be used as a dissolving apparatus.

Carpenter and **Westley** (No. 270, pp. 437, 438) exhibit a pair of phantasmagoria lanterns; a lantern with the addition of a microscope, together with a set of lenses to be used in conjunction with them; a series of subjects in outline, and various paintings adapted for dissolving lanterns.

Horne, Thornthwaite, and **Wood** (No. 220, pp. 434, 435) exhibit a dissolving apparatus for the oxyhydrogen lime-light, showing the contrivance for dissolving the pictures; also an oxyhydrogen microscope, and a series of paintings for dissolving views. The novelty of this arrangement consists in the shutters being placed so that they cut off the rays where they cross in front of the lenses, by which means a more perfect dissolution takes place. The quality of the manufacture and the general arrangement of the various parts are good.

Photographic Cameras.

The camera is the principal instrument of the photographist, as by its means light is made to become a chemical agent.

This instrument, the invention of Baptista Porta, towards the end of the sixteenth century, was simply a dark chamber furnished with a single double-convex lens, fitted in a tube, and serving for the focal adjustment of the image. So constructed it was first applied to the copying of different objects, the outlines of which, as given by the camera, were traced upon the paper by a pencil; but the image was reversed. After a time this inconvenience was rectified by the use of a mirror; with an instrument of this kind, A. Canaletti, at the beginning of the eighteenth century, made the drawings for his fine pictures of Venice, which he consequently executed with a perfection of perspective so great as to be regarded as an illusion.

By degrees a lens concave towards the object and convex towards the image was adopted; the picture was thus rendered clearer, but the colours of the spectrum were not corrected. At length an achromatic lens was used, the flint glass being towards the object. M. Daguerre went a step further, and determined those relative proportions of the camera, which, for the most part, are still adopted; the interior being carefully darkened, for the purpose of avoiding casual reflection upon the field of view.

Mr. Ross, in addition, prepares those for portraiture with the greatest intensity yet produced, by procuring the coincidence of the chemical actinic and visual foci. The spherical aberration is also corrected very carefully, both in the central and oblique pencils.

One of the exhibitors of photographs, M. **Everard Blanquart**, proposed the use of a white chamber, for accelerating the process; but there are serious objections to its adoption, and it therefore is not used.

The object-glasses exhibited are, for the most part, achromatic and double, and consist of two lenses placed at a distance from each other. A photographic object-glass without defect is yet a desideratum.

Ross (No. 254, pp. 435, 436) has exhibited the best camera in the Exhibition. It is furnished with a double achromatic object-lens, about 3 inches aperture; there is no stop, and no part of the field employed which does not receive plenty of light; so that the corners as well as the middle of the picture are well illuminated. The field is flat, and *the image is very perfect up to the edge.* It has a *revolving* and *adjusting* back-board for the reception of two plates. The same exhibitor has a second camera, furnished with a single achromatic lens of small aperture. The glass of this instrument having been removed, the image could not be examined.

Henneman and **Malone** (No. 297, pp. 441, 442) exhibit a camera by Ross. It is furnished with a single object-glass, aperture 4½ inches, the light is admitted through apertures 0·2 inch, 0·4 inch, 0·8 inch diameter, at about 4½ inches, or at about one diameter of the lens from its surface, the combination being mounted on a brass cone attached to a mahogany plate, which slides and revolves on the front of the box, to allow any given point of the picture-plate to become the centre of the field. The picture-board is 8½ by 10 inches; the focus varies from 10 inches to 17 inches according to the distance.

Knight and **Sons** (No. 453, pp. 462, 463) exhibit a camera, the oak stand of which is solidly constructed and pretty firm. It has adjustments for height and azimuth, but not for angular altitude, and has no level. It is furnished with a double picture-plate. The box expands from 9½ to 14 inches. There is no lens, and consequently the image could not be examined. The same exhibitor has a second camera, in a neat, flat, folding mahogany box, with hinges, which closes up lengthways. It is on a slight, unstable tripod stand, made by cross bracings. The aperture of the object-glass (a single achromatic for landscapes) is about 2¼ inches; the aperture in front of the glass is 0·6 inches, placed at 3½ inches in front of the lens. A projection placed in front of the aperture keeps off stray light. The lens is mounted on a slide to adjust to focus, and its focal length is about 12 inches. No ray can reach the corners of the picture when the lens is brought home, and *only very little light* when out as far as it will go.

Horne, Thornthwaite, and **Wood** (No. 220, pp. 434, 435) exhibit a camera with a double achromatic object-glass, whose aperture is about 2½ inches. The size of the picture is 8 by 7 inches. The frame allows of two papers being placed in at one time. The box is made to fold together, and is a fine specimen of beautiful, neat, mahogany work, with many good contrivances to keep out light. There is no speciality in the construction of the daguerreotype and calotype apparatus of these exhibitors, excepting a mode of iodizing and bromizing the plates, by sliders of great neatness; the exquisite workmanship of their several articles; and the general arrangements for their use in daylight. Some very fine specimens of chemicals used in the process of photography are also exhibited. A Prize Medal was awarded to Messrs. Horne and Co.

Claudet (No. 296, pp. 440, 441) has exhibited cameras; the largest has an aperture of 3 inches in diameter, double achromatic object-glass; when the whole aperture is open, about one-third of the breadth of the lens is cut off on either side, so that only about one-third of the breadth of the picture receives full light from the lens, and the illumination is in consequence very unequal. The image is good and the field is flat.

In Claudet's multiplying camera, the multiplying is performed by cross-sliding motions of the picture-plate, performed by two racks, working at right angles to each other, so as to present different parts of the picture-plate successively to the axis of the lens, exactness being secured by the division of the racks into inches and tenths of inches. The camera is short focussed, to give small miniature portraits, either presenting the same individual in different aspects, or several grouped together. The object-glass is double achromatic: its aperture is 3 inches, separated by 6 inches on a slide-rack to work in and out of the box; there are no diaphragms interposed. The front of the box carrying the object-glasses opens with a hinge. The tube projects one-eighth of an inch in front, outside of the object-glass, to cut off stray light. The focus is very short, having about 5 inches, extensible to about 8 inches by approach, within limits of motion. By focus is meant the distance of the picture-frame from the hinder surface of the hinder lens.

Willatts (No. 265, p. 437) exhibits a portable photographic camera with a flexible cloth body instead of a wooden one; it is furnished with horizontal movement, and is adjustable to lenses of various focal lengths; it has, also, an angular adjustment of the frame of the lenses, the latter for the purpose of keeping the image in the centre of the frame without altering the position of the camera. The size of the photographs is 10½ by 8½ inches. The cloth body of the instrument is mounted by flexible vulcanized caoutchouc bands at each extremity, and is thus firmly attached to the ends of the camera. The whole instrument is easily taken to pieces and put together, and occupies but a small space. The image was not examined.

Varley and **Son** (No. 257, p. 436) exhibit a single reflecting camera. This is a plain speculum with thin edges, placed at an angle of 45°, and designed for making reversed copies of drawings on lithograghic stone or wood blocks. It may also be fitted with lenses for enlarging or reducing copies, and for sketching from nature upon the stone. A Prize Medal was awarded to Messrs. Varley and Son.

Abraham, Abraham, and Co. (No. 263, p. 436) exhibit a portable sketching camera, furnished with a meniscus and prism in the place of a lens and mirror. When down, the size of the box is 15 inches in length, 8 in width, and 3¼ in depth.

Plagniol (France, No. 1679, p. 1257). This is by far the largest camera in the Exhibition; the picture-board is 24 inches square, and the object lens is 8 in diameter, double and achromatic. The picture was clear and distinct, as far as unfavourable circumstances would allow of the examination. It is furnished with a clear guard-tube in front of the object-glass, of 4 inches projection, amply sufficient to cut off side light. The object-glasses are separated by 15 inches, or about double their aperture. The clear space which *all* the object-glass illumines, scarcely exceeds 6½ inches in the centre of the picture; at the edges and corners the defalcation of light is very great. This, however, seems to be unavoidable.

Large as is this camera, it is very far from being the largest that has been constructed. The use of great cameras for copying photographic plates and MSS., especially tables, is becoming common in France. We have heard of some cameras which give pictures nearly a metre in length. A Prize Medal was awarded to M. Plagniol.

Schiertz (France, No. 999, p. 1227) exhibits a camera, the object-glass of which is 2¾ inches in diameter. There is a stop, and the light is so effectually intercepted by the cell and tube of the second object-glass, that the sides of the field are rendered obscure, and the top, bottom, and corners *very* dark; not one-fifth of the central light is effective. The plate for receiving the image is 9 by 7 inches, and the focal distance from the hinder lens about 8 inches; the field is flat, and the image clear and good. The mahogany stand is good, but is not well adapted for taking panoramic views. A Prize Medal was awarded to M. Schiertz.

Harrison (United States, No. 223, p. 1450) has exhibited two or three cameras, but as they are not mounted in boxes, and consist only of the brass-work and lenses, there were no means of trying their performance. They are constructed on the usual principle of double achromatic object-glasses, to give a flat field. The largest is about 4 inches aperture.

Albert (Frankfort-on-Maine, No. 7, p. 1121) exhibits a camera, with a double achromatic object-glass, 5½ inches clear aperture: there is a slight stop placed between the two glasses, but it cuts off only the reflected light at the sides. The pictures produced are 14 by 11 inches; but the area fully illuminated is only 4½ inches in diameter, and the corners are very dark. With the full aperture the image in the centre of the field is somewhat imperfect; it will not bear magnifying, and sharp clear definition cannot be attained. Honourable Mention was awarded to Mr. Albert.

Rouget de l'Isle (France, No. 1455, p. 1245). A camera-lucida for copying drawings, by reflection and vision at the same time, through a large vertically-placed sheet of plate glass. The drawing to be copied is laid horizontally on one side of the glass, and the paper to receive the copy on the other; the outlines are then traced by hand with freedom and facility, there being no necessity for using only one eye, or for fixing the position of the head. It is the simplest form of the camera-lucida. It inverts right and left; but this may be obviated, in some cases, by a looking-glass. The adjustments are easy and simple. Honourable Mention was awarded to M. Rouget de l'Isle.

Photographic Glass.

Messrs. Chance and Co. (Class XXIV., No. 22, pp. 700, 701) have exhibited flint glass, in discs and in plates, adapted for the construction of object-glasses for Daguerreotype and Talbotype apparatus and cameras. Of these discs one is as large as 20 inches in diameter, and there are some thin plates of the same kind of glass for cutting up.

The density of this glass is 3·20; the index of its refractive power is 1·60.

Buron (France, No. 443, p. 1199) has exhibited a collection of glasses of 6, 8, 10, and 12 inches diameter, for dissolving views.

Photography.

Rapid as have been the discoveries connected with Photography, and great as are the improvements it has received since the invention of M. Daguerre, there is yet much to be done to enable it to rank amongst the sciences of the age. It holds a place at present intermediate between an art and a science, a position eminently favourable to development in either direction. Its pursuit, as an elegant and most extensively useful art, affords a strong motive for inquiry and experiment in the improvement of its processes; in the course of which, an infinity of facts, new and unexpected, come forward, every one of which may turn out to be the embodiment of some pregnant scientific principle; nay, even the smallest minutiæ of manipulation on which it is found that success or failure in the production of artistic effect depends, may, if duly observed and reasoned on, afford indications, linking together the known and the unknown in optical science, and tending to bring these mysterious operations of light within the pale of exact reasoning. On the other hand, science is too much in the habit of repaying to art, with interest, every assistance of that nature, to leave room for doubt of similar results in this instance, when once the principles of operative chemistry shall have assumed a definite form and subjective connexion. It is this which affords us full assurance that Photography is yet in its infancy, and that all which has been hitherto accomplished—marvellous and exquisite though it be, is as nothing to what will be performed when the veil shall be removed, which, for the present, obscures its true scientific principles. In this point of view the photographic study of the prismatic spectrum *per se*, apart from all artistic combinations and coloured media, cannot be too strongly recommended to experimenters, and we lament to observe only one instance, in the whole Exhibition (that of M. Claudet) in which this study appears to have been in any way followed up, so as to afford *exhibitable* results. Mr. Ross is understood, also, to construct the object-glasses of his photographic cameras, with especial reference to the excessive development of the actinic spectrum beyond the luminous one, in the direction of the violet rays. When bromine is used in the preparation of the plate or tablet, it may be questioned how far this is really an improvement? Should means be discovered of truly representing the colours of objects, and limiting the action to the luminous ray, the conditions of achromaticity for the photographic camera will be the same as for the telescope.

The fine collection of Photographs now exhibited will tend much to the advancement of this beautiful art, by showing us what has been done, and also by indicating that which it is necessary yet to do; and it will doubtless mark an era from which to date many improvements.

Since the epoch when M. Daguerre and Mr. Talbot first divulged their respective processes for impressing photographic images on silver and on paper, scientific men, both at home and abroad, have, by their increasing researches and improvements, brought Photography to a degree of perfection, which, however short of what it may one day acquire, yet seems incredible, considering its brief existence. Perhaps its advance cannot be more strongly proved than by the fact that the method, first adopted but a few years since, for procuring daguerreotype portraits, required that a person should sit without moving for twenty-five minutes in a glaring sunshine. The improvement developed in the almost instantaneous process of the present day is most striking.

It is not the object of this report to trace the history of inventions, nor to decide on claims of priority, especially in relation to a subject which has received accessions from such innumerable quarters, and called into action the skill of so many eminent chemists and photologists of every nation. Suffice it to say, that, after the introduction of M. Claudet's accelerating process by the application of chloride of iodine and chloride of bromine (an invention which he liberally gave to the public through the medium of the Royal Society and the Académie des Sciences); the Daguerreotype process, as publicly practised, became reduced to some system, and two Daguerreotype establishments were formed in London. The portraits taken, at this time, were, however, deficient in expression; but in spite of all deficiencies, the receipts of these establishments several times amounted to 60*l.* in one day.

At a somewhat later period that remarkable variety of the Talbotype process, designated by its inventor by the name of "Kalotype" was also publicly employed for the production of portraits by Mr. Collen: the artistic effect in these representations was susceptible of being much heightened by the brush and the defects of expression might be removed, and the likeness in consequence greatly improved by one or more subsequent sittings.

M. Claudet, who, from the earliest time of the Daguerrian invention, displayed great genius and ability in perfecting the various processes, first perceived the necessity of aiding the artistic effect of his representations by subsidiary adjuncts of a different kind. He it was who first practised the placing of painted back-grounds behind the persons whose portraits were to be taken. Thus an infinite variety of scene might be afforded by the operator simply providing himself with a few subjects skilfully adapted to the requirements of the occasion. To him also we owe that extremely pleasing adaptation of mechanical adjustments for bringing many miniature representations of the same individual under different aspects, to be impressed in regular compartments of the same plate and framed together,—of which we find specimens exhibited in his collection.

It is not necessary to detail, step by step, the successive improvements in the different processes and apparatus for Daguerreotypic Photography, though we may mention that to the exertions of Messrs. Claudet, Gaudin, Fizeau, and Draper, the public are indebted for many improvements. To M. Fizeau is due the reproduction of the proofs of electrotype; also a new process for engraving the Daguerrian image, and of preserving that image from destruction by gilding the surface.

The Exhibition presents many fine calotypes, or as they are sometimes called in the Catalogue "sun-pictures," for the production of which the preparations of MR. TALBOT hold the first rank. M. BAYARD, also, has been celebrated for his achievements in this line, and has contributed many splendid proofs, obtained on various sensitive papers. Mr. Talbot has, himself, exhibited nothing; but many of his productions will be recognized among those exhibited by HENNEMAN and MALONE, as adapted to the practical wants of travellers, collectors, &c. This branch of the art offers inestimable advantages, viz.: 1st, That the papers may be prepared at leisure, some time before an occasion for using them arrives; 2ndly, That when pressed and fixed, they may be carried without injury in a portfolio, like other drawings; 3rdly, That from one good negative original, any number of positive copies may be taken, to the extent, indeed, of two or three hundred copies in a *rainy day*, as proved by the practice of M. EVERARD BLANQUART (France, No. 1551), and supplied to the public at a cheap rate; 4thly, That they may be wholly obliterated so as to reduce them apparently to the original condition of white paper, and carried about in that state for an indefinite period, though susceptible of revival at any instant. Considering it probable that the following communication, addressed by M. Arago to the Academy of Sciences, on the granting a national recompense to M. Daguerre, may be as useful to a portion of the public, now, as then; we subjoin it in the words of M. Arago himself:—

"A short time after the law was voted, granting a national recompense to M. Daguerre, some opinions, which in my idea were very erroneous, were entertained by a small portion of the public, which rendered it necessary for me to show that the discovery, newly made, was not to be estimated in respect to art only, but to the very valuable subjects for investigation which it presented in reference to the physical sciences."

Without further remark, we proceed to the discussion of the Potographs exhibited.

Daguerreotype Pictures.

CLAUDET (No. 296, pp. 440, 441) has exhibited a large collection of daguerreotype portraits, both plain and coloured. Amongst various excellences of which they are possessed, we may particularly mention that of their *non-inverting*. This is a great improvement, and by it M. Claudet has annulled the superiority which the sun-pictures have so long possessed, in this particular, over the daguerreotypes.

On examining the uncoloured specimens exhibited by Claudet, it will be found that they are distinguished by artistic arrangement, judicious distribution of light and shade, and great clearness of definition. The general tone is good,—M. Claudet having uniformly avoided violent contrasts of light and shade; a circumstance to which much of his success may be attributed. In this collection are several female portraits in white draperies, which pictures deserve commendation for their beauty of detail and freedom from solarization. Many of the above remarks apply, equally, to the coloured specimens, most of which are portraits, and are distinguished by careful and harmonious colouring, the focus having been so judiciously selected, and most of them present an artistic and natural appearance, seldom hitherto obtained by Daguerreotypists.

Photography may be said to be too faithfully exact in its results, for the purposes of art; detailing, as it does, the accessories in the back ground and the main object of the group with equal fidelity. When blending colour with photographic works, or in visibly uniting art and science on the same plate, the operator should be possessed of knowledge and feeling sufficient to know the proportions in which art and science should intermingle so as to be subservient to each other: in this knowledge, which is chiefly dependent upon the proper focal adjustments of the picture, M. Claudet excels; and the admirable manner in which he sacrifices the details, afforded him by science, to the requirements of his subject, is the result of long and laborious investigation.

An uncoloured daguerreotype by Claudet is worthy of particular mention; it represents various articles of vertû, pictures, &c., grouped together: the perfect focus of each part and general relief of the whole prove it to be a successful application of his focimeter.

M. Claudet also exhibits the dynactimometer* and focimeter. He also exhibits the effects of the spectrum on the daguerreotype plate, as prepared by him, and a variety of curious and instructive specimens illustrative of the different refrangible rays. The Council Medal was awarded to M. Claudet.

KILBURN (No. 294, p. 440) has exhibited a case containing several carefully-selected specimens of coloured daguerreotypes. The subjects of these pictures are confined to groups of figures of small size, and are very brilliant and elaborate in their details,—too much so for artistic effect. For novelty of design we may mention a small picture of the interior of a room, including a whole length portrait of Jenny Lind: beside, and near her, is a large mirror, in which the figure is reflected. That the reflection in the glass is equally perfect with the original is the point worthy of remark and commendation. Towards the centre of this case is a plain daguerreotype portrait of the Queen. The finish and execution of this little work are very great. The Jury awarded a Prize Medal to Mr. Kilburn.

MAYALL (No. 291, pp. 439, 440) has exhibited in this department a large collection of daguerreotypes, uncoloured. They are characterized by great contrasts of light and shade, disposed in large masses. Among the subjects exhibited are four tableaux from the "Soldier's Dream," and several groups from Nature, variously arranged. Mr. Mayall's strong and broad masses of light and shade are better adapted for landscape scenery, of which the "Falls of Niagara" is a favourable specimen. His "Bacchus and Ariadne," 24 in. by 15 in., is, perhaps, the largest *daguerreotype* which has yet been executed. The difficulty of duly preparing so great a surface must be extreme. He has also exhibited a crayon daguerreotype, produced by a process of his own invention.*

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* The reader is referred for an account of the dynactimometer to the "Reports of the British Association," August 1850, and to the "Philosophical Magazine," June 1851, and for the focimeter, to the "British Association Reports," September 1849, and "Philosophical Magazine," November 1849.

Beard (No. 292, p. 440) has exhibited a case of daguerreotypes, some of them enamelled, according to a process invented by himself.†

Laroche (Class XXX., No. 252, p. 837) has exhibited three small daguerreotypes: two are coloured: the third, a group of statuary, is good.

Voigtlander and **Evans** (Class XXX., No. 254, p. 837), Knightsbridge, have exhibited coloured daguerreotypes.

Of the remaining exhibitors in England,—**Griffiths** and **Le Beau** (No. 404, p. 453) have exhibited a case of daguerreotype miniatures, coloured. **Paine** (No. 295, p. 440), a series of photographic pictures, intended to show the processes of the art. **Tyree** (No. 299, p. 442), coloured daguerreotype portraits; and **Craddock** (Class XXX., No. 227, p. 834), photographic copies of various engravings.

On examining the daguerreotypes contributed by the United States, every observer must be struck with their beauty of execution, the broad and well-toned masses of light and shade, and the total absence of all glare, which render them so superior to many works of this class. Were we to particularize the individual excellences of the pictures exhibited, we should far exceed the limits of space to which we are necessarily confined. Where all is good, it follows that remarks must be restricted to peculiar excellence alone.

Before speaking of the several works exhibited, it is but fair to our own photographists to observe, that much as America has produced, and excellent as are her works, every effort has been seconded by all that climate and the purest of atmospheres could effect; and when we consider how important an element of the process is a clear atmosphere, we must be careful not to overrate that superiority of execution which America certainly manifests.

Lawrence, of New York (United States, No. 151, p. 1446), has exhibited several daguerreotype portraits, uncoloured. They are remarkable for clear definition and general excellence of execution. In this series two large portraits of General J. Watson and W. Bryant, Esq., each of which measures 12½ in. by 10½ in., deserve particular commendation. Notwithstanding their large size, they are, throughout, perfectly in focus, and are beautifully finished in all their details. These are two of the best pictures in the American collection. A portrait of General J. W. Wells, and of a lady in a black silk dress, of a smaller size, are also remarkable. A Council Medal was awarded to Mr. Lawrence by the Jury, but not confirmed by the Group.

Brady (United States, No. 137, p. 1441) has exhibited forty-eight daguerreotypes, uncoloured. These are excellent for beauty of execution. The portraits stand forward in bold relief, upon a plain background. The artist having placed implicit reliance upon his knowledge of photographic science, has neglected to avail himself of the resources of art. The portraits of General Taylor, Calhoun, General Cass, and James Perry, are strikingly excellent; but all are so good that selection is almost impossible. The Jury awarded the Prize Medal to Mr. Brady.

Whipple (United States, No. 451, p. 1464) has exhibited several specimens of daguerreotypes, amongst which one of the moon may be mentioned with the highest commendation: this is, perhaps, one of the most satisfactory attempts that has yet been made to realise, by a photographic process, the telescopic appearance of a heavenly body, and must be regarded as indicating the commencement of a new era in astronomical representation. The same exhibitor has included in his collection three pictures, containing several full-length figures, well grouped, and artistically arranged. Each part is well in focus, and the definition is admirable. An agreeable tone pervades all these pictures. A Prize Medal was awarded to Mr. Whipple.

Mayall (United States, No. 491, p. 1465) has contributed largely to the American collection,—his works here being characterized by the same broad masses of light and shadow as those which he has exhibited in the British Department (No. 291). The subjects of the pictures in the present series consist chiefly of small groups and portraits; also two cases containing illustrations of the Lord's Prayer. The majority of these (most of which are uncoloured) are effective, verging upon the theatrical in point of style, but they are not all equally well defined. We should be doing Mr. Mayall an injustice, were we not to mention, as a brilliant exception to the above criticism, a small figure of a female reclining: it is exquisite in delicacy of execution, harmonious distribution of light and shade, whilst an admirable tone pervades the whole picture; this, the finest of Mr. Mayall's contributions, is free from colour, and is daguerreotyped from a classic work of art. The Jury awarded Honourable Mention to this exhibitor.

Evans, New York (United States, No. 105, p. 1440), has exhibited several portraits of great merit. Those of the Rev. — Ingersoll, Dr. Nott, Dr. Lord, and Dr. Shelton, are characterized by peculiar excellence; also two portraits, each of a lady sitting near a table upon which a group of flowers is displayed, deserve to be noticed as fair specimens of the perfection to which this application of science, to the purposes of art, has been carried.

Meade Brothers (United States, No. 109, p. 1440) have exhibited a series of portraits of more than ordinary size. Conspicuous among this collection are the heads of Wallack and H. W. Meade. The modulation of light and shade upon these last is admirable, as well as the details of the features, and the total absence of all harshness: the artistic effect is excellent. Greater credit is due to this collection of portraits, than to the series of allegorical subjects exhibited by Mr. Meade.

Pratt, Richmond, and Co. (United States, No. 264, p. 1452), have exhibited several daguerreotypes, of various degrees of excellence. The profile of an old man, assisted by colour, is the best.

Whitehurst, Virginia (United States, No. 377, p. 1461), has exhibited twelve views of the Falls of Niagara. These are admirable, and possess a degree of reality not always attained in landscapes produced by the daguerreotype process.

Among the remaining exhibitors of daguerreotypes in the United States Department are—

Gavit (United States, No. 125, p. 1441), **Root** (United States, No. 42, p. 1435), **Whitehurst** (United States, No. 525, p. 1467), and **Hogg** (United States), all of whom have exhibited daguerreotypes, but not distinguished by any striking degree of excellence. **Langenheim** (United States, No. 62, p. 1437) has exhibited two large Talbotypes, one of which is a panoramic view of Philadelphia, executed in compartments, but wanting unity of effect. This artist, also, exhibits a series of subjects on glass, designated by him under the name of hyalotypes, being delicate miniatures, excellently adapted for magic-lanthorn subjects. The material would appear to be collodion, albumen, or some similar preparation, forming a film on the glass, capable of receiving the impression. A daguerreotype view of Cincinnati, by **Fontyne** and **Porter** (United States, No. 550, p. 1468), is more successful. This is also taken in separate compartments: it is clear and good in colour, and forms an effective picture. **Harrison** (United States, No. 223, p. 1450) has also some daguerreotypes of a very superior description.

In turning our attention to France, we find several daguerreotypes, which, in contradistinction to those of America, are characterized by large masses of light, in which is expressed the greater amount of detail and minutiæ. They are not so entirely free from glare as those of America.

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* See the Illustrated Catalogue, and the Athenæum for 1850, p. 1048.

† See the Illustrated Catalogue, note ii. p. 428.

Thierry (France, No. 1038, p. 1228), has exhibited eight daguerreotype views of Lyons; they have a sunny look, and are very brilliant, but are wanting in artistic effects of light and shade. A portrait of M. Thierry himself deserves particular commendation, and is far superior to the above-mentioned pictures. The Jury considered this exhibitor as deserving Honourable Mention.

Maucomble (France, No. 620, p. 1207) has exhibited a case of very highly-coloured daguerreotype portraits. These are excellent, but possibly belong more to the fine arts than to photographic science. It is difficult to say whether the harmonious and rich colouring of the French school, as applied to these portraits, or the masterly blending of the colour and daguerreotype, deserve the most commendation. Art is here engrafted on science, the latter being merged in the former, and the impression left on the mind is that naturally produced by the view of a beautiful artistic production. They are charming, but we repeat belong more to art than to science. The Jury have awarded these works Honourable Mention.

Sabatier (France, No. 1467, p. 1246) exhibits a single daguerreotype portrait of large size (8 in. by 6 in.), which is every way excellent. It is entirely free from glare (to which its low position contributes not a little, the light coming from above), and in expression, freedom from constraint, and perfect representation of texture, may rank with any single piece in the Exhibition.

Plaignol (France, No. 1679, p. 1257) exhibits daguerreotypes rather as specimens of the production of his large camera (though not of the full size which that instrument is capable of producing), than as claiming especial distinction in this particular department of art.

Gouin (France, No. 241, p. 1188) exhibits a series of coloured daguerreotypes, which, however, want brilliancy and purity of colour; the back grounds are also out of focus. An uncoloured portrait, 7½ in. by 6 in., does better justice to the powers of this exhibitor.

Kohnke (Hamburgh, No. 103, p. 1140), and Von Minutoli (Prussia, No. 191, p. 1058), have exhibited daguerreotypes.

Vogel (Austria, No. 739, p. 1044) exhibits daguerreotypes, to which Honourable Mention was awarded by the Jury.

Talbotypes—Calotypes—Sun-pictures.

Buckle (Class XXX., No. 301, p. 840), of Peterborough, has exhibited a great many calotype pictures, all of which are characterized by great delicacy of tint and exquisite *cleanness* of execution, and deserve to be ranked among the finest specimens of photography in the Exhibition. The process adopted by Mr. Buckle, he has described at some length; it is not subjoined here, from want of sufficient space, but the beauty of Mr. Buckle's calotypes sufficiently testifies to the superiority of his method. He observes that, with regard to the adjustment of the focus, no rule can be laid down; but, having himself a knowledge of art, practical as well as theoretical, he applies it to the arrangement of the subject and to deciding on that point of the picture best calculated to be put into focus. The size of the aperture of the lens, as also the time of exposure, are so much matters to be decided on at the time of taking the picture, as to render the laying down any fixed rule next to impossible. The paper employed, Mr. Buckle observes, is made by Mr. Turner, of Chafford Mills, and is, he considers, unequalled. Mr. Buckle's negative originals, it should also be observed, are *on paper*. He does not employ the albuminous process. A Council Medal was awarded to Mr. Buckle.

Ross and Thomson (Class XXX., No. 299, p. 839) have exhibited several beautiful Talbotype pictures, consisting of views from nature, interiors, groups, &c., and they are the only exhibitors, in the British section, of photographs by the albuminous process; which, in practice, they appear to have carried to a high state of perfection, having not only substituted it for the old method of taking the negative proofs on paper, but having, in more than one instance, exhibited the positive proof upon the albumenized glass itself. In addition to the extreme clearness observable in the details of their landscape scenery, and the great delicacy of their delineation of objects in general, we may take notice of the excessive beauty of the tints which their works exhibit. Not only are the shadows deep and Rembrandt-looking, where suitable to the effect required, but the middle distances display a beauty of colour nowhere equalled, excepting in the very superior works by M. Martens, in the French Department.

As an illustration of the variation of tints which these works present, in contradistinction to the fine Vandyke brown and deep shadows, we may mention a small picture (a group of statuary), the peculiarity of which consists in the colour, which is blue, an effect produced by taking the negative proof on albumenized glass, and rendering it positive by repeated washing in hyposulphate of soda, the proof being originally laid upon a black ground. By this process the whites become black, and *vice versâ*. The hyposulphate of soda is a most useful agent in the colouring of both negative and positive proofs, and affords a vast range of beautiful tints of inexhaustible richness; but it is difficult of application, and is available only in the hands of a skilful operator.

The coating of the glass with albumen is a difficult operation; the method adopted by Ross and Thomson differs from the French process (which is due to M. Niepsce, and is usually called the "albuminous process"); and consists in pouring a quantity of albumen on the plate and revolving it over a slow heat, for the purpose of ensuring its even distribution. As shown in the practice of these exhibitors, this method would seem to be perfectly successful; and indeed the beautiful and extreme delicacy and variety of tint, the aërial perspective by which the background is made to recede by imperceptible gradations into the horizon, all amply attest the powers of Messrs. Ross and Thomson.

A number of Talbotypes, also exhibited, display equal variety of tint, and a depth and richness of tone without any straining for effect.

A Council Medal was awarded to Messrs. Ross and Thomson.

Hill and Adamson (Class XXX., No. 300, p. 839) have exhibited very many Talbotype groups, remarkable for easy and graceful arrangement. They are, in effect, after Rembrandt, being made out in broad and deep-toned masses of light and shade. As a whole, they are very sketchy and spirited. The tints are rich and varied both in depth and colour, and are of a rich sepia. They have received Honourable Mention from the Jury.

Henneman and Malone (No. 297, pp. 441, 442) have exhibited Talbotypes on paper, consisting of copies of small intaglios, portraits, both plain and coloured, and various small groups, &c. These are all natural and pleasing, and great delicacy is observable in the lights and shades, the tone of which is a fine warm sepia brown. The greater part of these pictures are small portraits; one, however, which is 8 in. by 6½ in., is very good, and evenly illuminated. The coloured portraits in this collection are very good, and no little credit is due to the artistic skill which they display.

Messrs. Henneman and Malone also exhibit specimens of the cyanotype and chrysotype processes of Sir J. Herschel, the chromotype of Mr. Hunt, and Talbotypes tinted by the application of caustic potash and a lead salt. A Prize Medal was awarded by the Jury to Messrs. Henneman and Malone.

Colls, R. and L. (No. 303, p. 442), have exhibited several sun-pictures on paper. They are rather blotty in appearance, but are good in colour. Views of Windsor Castle and Stoke Church deserve high commendation.

Harmer (Class XXX., No. 298, p. 839) has exhibited two calotype pictures, one a landscape; the reflections as shown in the water are excellent. The fluctuation of the reflections caused by the ripple of the water is very beautiful, and true to nature. The execution of the picture is good, and the tints are clear and delicate.

Owen (No. 670, p. 467*), of Bristol, has exhibited a series of calotype pictures, most of them landscapes and wood scenery. They want clearness of definition, being somewhat black and heavy. Mr. Owen states himself to have been able to execute in a single day, in a journey of 300 miles, ten large-sized Talbotypes of local scenery, each paper being prepared on the spot. The preparation is greatly facilitated by a glass spreader, of his own invention, by which the solutions are evenly applied.

COLLIE (No. 22, pp. 941, 942), of Jersey, has exhibited a frame, containing several calotype pictures, chiefly portraits and domestic scenes. These are not all equally good; many of them are blotty and wanting in depth.

RIPPINGHAM (Class X., No. 304, p. 442) has exhibited several Talbotypes, being a series of untouched positives, from collodion negatives, on plate glass. He also exhibits other photographs from paper negatives, but they are blotty and want more light.

BINGHAM (Class X., No. 302, p. 442) is an exhibitor of Talbotype pictures, landscapes chiefly. Being near objects, such as cottages, trees, &c., there is no room for aërial perspective. They are very cleanly executed.

FIELD and SON (No. 250, p. 435) have exhibited calotypes.

MARTENS (France, No. 610, p. 1207) has contributed several large and beautiful photographic proofs, on glass and paper, obtained by an apparatus made by Lerebours and Secretan; also several large photographs from negatives on glass, five of which (views of "Nôtre Dame," the "Louvre," and "St. Germain-de-l'Auxerrois"), measure 12 in. by 9¼ in., and are pre-eminently beautiful. Two pieces of sculpture, from the "Arche de Triomphe, Barrière de l'Etoile," call forth the highest admiration. One of these groups contains seven full-length figures, together with their accoutrements, in a space of 3¼ in. by 3 in.; the great finish and beauty of execution here displayed have never been excelled. Space does not permit us to individualize all M. Martens' works, most of which are equally good, such as the "Ceiling of the Louvre," the "Château de Vincennes," &c.; but we may say that, for richness of effect and perfection of definition, they are the finest specimens which it seems possible to produce, exhibiting as they do a most successful combination of careful execution, delicacy of colour, and great artistic merit. No trace of the brush is visible. A daguerreotype view of Paris, by the same exhibitor, is good, and evidently not retouched. A Council Medal was awarded to M. Martens.

BAYARD (France, No. 414, p. 1198) has exhibited several sun-pictures, the subjects of which are chiefly selected portions from the public buildings of Paris. One of the cases exhibited by M. Bayard contains five pictures, all excellent; though to the "Bibliothèque de Louvre" we may give the preference for its judicious arrangement of light and shade and elaborate representation of detail. The interior of a church is deserving of separate mention; the figures, which are numerous, are admirable, and their perfect delineation, even when remote from the eye and in deep shadow, is worthy of commendation. Also a calotype of "Venus and Cupid," from a bas-relief, is worthy of mention, owing to the beautiful tint which pervades the picture. In M. Bayard's representations of sculpture, the difference of surface and texture between the plaster cast and marble statute is marked with perfect distinctness. A Prize Medal was awarded to M. Bayard.

FLACHERON-HAYARD (France, No. 836, p. 1220) has exhibited several sun-pictures of ruins in Spain, Rome, and Paris. These are all excellent; the colour is good, and the artistic effect admirable. They appear to be possessed of nearly equal merit. The "Arch of Titus" deserves especial mention for the perfectly artistic expression of the whole, combined with a singularly accurate representation of the superficial texture of the material. A Prize Medal was awarded to M. Flacheron.

LE GRAY (France, No. 585, p. 1206) has exhibited several sun-pictures. Some of these are good, but many are heavy and wanting in detail. These pictures vary, in tint, from sepia to olive citrine.

HENRI LE SECQ (France, No. 592, p. 1206) has exhibited several calotypes; the subjects are architectural. These pictures may be mentioned with great commendation as regards their photographic finish; but nearly all of them exhibit a degree of negligence in adjusting the visual axis of the camera to the true horizontal direction, which, by making all the vertical lines of the buildings *visibly convergent* in the picture, contravenes the rules of perspective, and produces an effect highly unpleasing. This is the most common fault of photographic representation by the aid of a camera, and it is right to notice it to put artists on their guard. Every photographic camera ought to be provided with a small spirit-level to secure this adjustment in the field, independent of trial.

EVRARD, BLANQUART (France, No. 1551. p. 1251) has exhibited several Talbotype pictures, the positive proofs being obtained by a process which admits of 200 or 300 impressions being taken from the same negative proof; the price varying from five to fifteen centimes, according to the size. These are not wholly successful; several of the pictures are dark and blotty, and somewhat resemble engravings taken from a worn-out plate.

COUSIN (France, No. 1572, p. 1252) exhibits a series of positive Talbotypes, from negatives on paper, in all seven subjects, six of which are of exquisite beauty.

ALBERT (Frankfort-on-the-Maine, No. 7, p. 1121) has exhibited sun-pictures of large size, but they are "fuzzy," being ill-defined and void of effect. Two specimens of smaller size, one of them coloured, are good.

CHEVALIER (France, No. 1729, p. 1259) exhibits some photographic proofs.

MAYER (France, No. 622, p. 1207) has a series of miniatures, coloured on Talbotype grounds. They are of exquisite beauty, and give the idea of perfect likenesses; but the use of the brush being obvious, they are rather to be regarded as works of art than of science.

PRETSCH (Austria, No. 362, p. 1027) has exhibited several large photographic pictures from nature. The subjects are various, comprising groups of statuary, architectural buildings, landscapes, &c. The subjects are well chosen, and show good execution and artistic management. Mr. Pretsch was awarded the Prize Medal by the Jury.

In closing our remarks on this department of the Exhibition, we may be permitted to record some degree of disappointment at the absence of specimens of the application of photography to any departments of representation, other than such as please the eye or administer to personal feelings. As regards its application to an infinity of useful and instructive purposes, we have literally nothing! We find, for instance, no specimens of copies of ancient inscriptions (a few incidentally occurring on the Roman ruins, perfectly familiar to every one, only excepted)—no delineations of tropical or remote scenery—no specimens (for the single exception of Claudet's spectrum is hardly to be cited) of the actinic spectrum on chemical preparations, or on natural vegetables or animal colours,—no impressions of the lines in the photographic corresponding to those in the luminous spectrum,—no magnified representations of the microscopic products of nature, or of the dissected parts of plants or animals,—no copies of pages of ancient manuscripts,—no miniatures of printed books (holding out the promise of future publications in miniature), or that of condensing in volume for preservation in Museums,* &c., the enormous mass of documentary matter which daily more and more defies collection from the mere impossibility of stowage, but which will one day become matter of history,—and a thousand other applications that it would be tedious here to mention.

Connected with photography, we may also notice the absence of any specimens of scotography, or the art of copying engravings by simple juxtaposition in the dark by obscure inter-radiation, invented by Moser.

Magnets.

Exhibitors of magnets are few in number; among them **LOGEMAN** (Netherlands, No. 87, p. 1147) and **HENLEY**

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* We are informed that a catalogue of the National Library of Paris, in which the photographic fac-simile of the title-page of each work, in miniature, is registered, is actually in progress.

(England, No. 428, pp. 457, 458) have exhibited the most powerful steel magnets; it is satisfactory to learn that both these exhibitors are still applying themselves to their further improvement.

HEARDER (No. 439, p. 461) deserves special notice for the attention he has devoted to ascertaining the receptive and permanent magnetic powers of cast iron, both in separate plates and in their combinations.

As early as the year 1832, Dr. Scoresby commenced a series of experiments on the magnetic properties of cast iron, but which, owing to the thickness of the masses employed, did not yield decisive results; prior to the year 1844, he repeated his experiments upon different kinds of cast iron, and found that "cast iron possesses considerable powers of magnetism, both in capacity and retentiveness, though greatly inferior in both qualities to those of properly-hardened steel;" with several other interesting results.* The general results arrived at by Dr. Scoresby, though calculated to show the unsuitable character of the specimens and forms of the cast iron employed by him to general magnetic purposes, were yet of such an encouraging nature, as to lead to the hope that more important results might be obtained by the employment of cast iron in large masses, and in different forms.

Mr. Hearder was led, in the course of his experiments, to consider that cast iron had not been subjected to a sufficient variety of tests, and he was still more confirmed in this opinion, by observing how its mechanical properties varied, according to the temperature of the different kinds of iron, and he concluded that the conditions which acted against its being used as a bar magnet might be made available for one of the horse-shoe form. In 1843, he made the magnet now in the Exhibition, which is still possessed of considerable power, as determined by the Jury.†

The following are the particulars of the magnets exhibited:—

LOGEMAN (Netherlands, No. 87, p. 1147) has exhibited the most powerful permanent magnets in the Exhibition.

The following are the results of the experiments:—

One whose weight was 1 lb. ½ oz. carried a weight of 16 lbs. 9½ oz.
One whose weight was 6 lbs. ½ oz. carried a weight of 66 lbs. 3½ oz.
One whose weight was 101 lbs. 12 oz. carried a weight of 436 lbs. 12 oz.

A Council Medal was awarded to Mr. Logeman.

The exhibitor of the next best magnets was **HENLEY** (No. 428, pp. 457, 458), and the results of the experiments are as follows:—

A magnet weighing 2 lbs. 5 oz. carried a weight of 31 lbs. 5½ oz.
A magnet weighing 8 lbs. 4 oz. carried a weight of 56 lbs. 14 oz.
A magnet weighing 32 lbs. 6 oz. carried a weight of 120 lbs. 4½ oz.

SHAW and SON, Sheffield (Class XXII., No. 216, p. 617), exhibited several magnets:—

One whose weight was 7 oz. carried 4 lbs., and
One whose weight was 7 lbs. ¾ oz. carried 61 lbs. 7½ oz.

HEARDER (No. 439, p. 461) has exhibited a cast-iron compound horse-shoe permanent‡ magnet. This magnet was constructed with a view to its being applicable to every purpose requiring high magnetic power. It consists of 24 plates, 2 inches wide and 0·19 inch thick, cast in the form of a horse-shoe, which is 16·75 inches in length. The 24 plates are strongly fastened together; the poles, which are distant from each other 1·25 inches, are capped with soft iron, for the purpose of concentrating the magnetic power; at the same time it renders the grinding of the poles unnecessary.

The construction is simple. The bars being made of iron, hardened as much as possible, require no preparation to adapt them for magnetization.

The economy of construction, as compared with a steel magnet of the same dimensions, is estimated as 4 to 1.

It is designed to be made available for the construction of electric machines for telegraphic or electro-chemical purposes, and was manufactured at Mr. Hearder's establishment at Plymouth.

Mr. Hearder observes that, whatever be the relative powers of the plates previously to their being put together, as a mass they are found to undergo a considerable change; the two external magnets having their poles slightly reversed, the two next being neutral, and the rest having direct polarity, being strongest in the centre, and gradually diminishing towards the two external plates. On testing the individual powers of each magnet, after their several combinations, for three years, the sum of the whole was less than 15 lbs., whilst collectively they were capable of lifting a weight of more than 100 lbs.

Other particulars concerning this magnet are to be found in the Report of the Royal Cornwall Polytechnic Institution for 1850.

This magnet was found to weigh 71 lbs. 8 oz., and to carry a weight of 120 lbs. 9 oz.

Mr. Hearder has exhibited a powerful horse-shoe permanent steel magnet, intended for all purposes requiring high magnetic power.

It is composed of a large number of wide and extremely thin horse-shoe plates, cut out of thin sheet steel, tempered and hardened sufficiently to admit of their being flattened with a hammer. The magnet weighs 39 lbs., and Mr. Hearder says will support nearly 250 lbs., with a round-faced keeper. It is intended for magneto-electric purposes, where great power is required in a small space. This magnet was found to weigh 39 lbs., and to carry a weight of 112 lbs. 9 oz.

RUNDELL (No. 438A, p. 461) exhibits a carbonized cast-iron magnet; the carbonization having been performed by prussiate of potash and oil. This magnet is offered as an improvement on Mr. Hearder's cast-iron magnet, as shown at the last Polytechnic Exhibition. On trial, this magnet was found to weigh 27 lbs. 8 oz., and to carry 35 lbs. 9 oz.

Magnetical Instruments.

BROOKE (No. 144, pp. 422—426) exhibits photographic apparatus for the self-registration of the changes of position of the declination magnet, of the horizontal force magnet, and of the vertical force magnet.

The three magnets are so placed, that the residual effect of each pair upon the third is a minimum, which is to be determined by experiment.

The principle is the same for all, viz., wrapping prepared photographic paper around a cylinder whose axis is placed parallel to the direction of movement to be registered, and which is turned round uniformly by clockwork.

The light, from a gas-lamp, passes through a small aperture placed near it, and falls upon a concave mirror of speculum metal, which rests in a stirrup firmly connected to the magnet, so that it partakes of all the angular movements of the magnet. The pencil of light is then deflected from the mirror to a plano-convex lens, placed parallel to the axis of the cylinder, and near to it: this lens condenses the line of light to a definite spot of light on the paper. This spot of light, therefore, moves with the movements to be registered,—to the right and left, in a horizontal plane, in the case of the declination magnet and horizontal force magnet; and up and down, in a vertical plane, to register the movement of the vertical force magnet; the cylinder, as before stated, being turned round by clockwork. Consequently, there is traced upon the paper a curve, of which the abscissa, measured in the direction of a line round the cylinder, is proportional to the time, while the ordinate, measured in the direction of the axis of the cylinder, is proportional to the movement of the magnet.

A base line, or a line from which to measure the ordinates, is traced upon the paper by the action of a spot of light proceeding from another gas-lamp placed near the cylinder, and passing through a slit fixed to the carrier of the cylinder.

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* See Scoresby's "Magnetical Investigations," Part II., Chap. viii., pp. 330-347.

† It was described in the "Electrical Magazine," October, 1845, vol. ii., p. 137.

‡ These magnets are termed "permanent," in contradistinction to the temporary electro-magnets.

To the horizontal force magnet there are attached apparatus for correction of temperature.

That for the horizontal force magnet, which is described in the Illustrated Catalogue, page 411 (Second Part), is based upon the following consideration:—

Let (b) be the lower interval between the two divisions of the suspension skein, the equation of equilibrium being—

$$m X = \frac{a b}{h} \sin t;$$

then the arrangement adopted is to make the variation of b, by the effect of temperature, equal to the variation of m, arising from the same cause. This is attempted to be effected by clamping to the magnet a glass rod, the ends of which are inclosed in two zinc tubes, whose adjacent ends are separated by the width of the clamp. The zinc tubes and glass rod are clamped together at such a distance from the centre of suspension, that the ratio of the difference of linear expansion of the length of glass and zinc, intervening between the clamps to the interval (b), may be equal to the temperature coefficient.

The clamps are adjusted in order that, when their position has been approximately determined by calculation, the error of position may be corrected by experiment.

As the expansion of glass and zinc are both taken to be uniform, and are at any rate far beyond the limits of atmospheric change, this method cannot serve to represent the coefficient of (t), and the residual error of the corrected instrument must be experimentally determined.*

The arrangement for the correction of the vertical force magnet is made by clamping a small thermometer to the magnet, parallel to its axis, and in the same plane as the knife-edges. The middle point between the freezing point of the thermometer and the centre of the ball is placed opposite the centre of the magnet.

Let ν be the weight that at a distance q from the line of suspension would be equivalent to the temperature correction for 1° Fahrenheit, or 32°; w the weight of mercury contained in one degree of the scale of the thermometer; p the distance of the freezing point from the centre of the ball, and 2ν the length of one degree of the scale; also let $c x + \epsilon x^2$ be the temperature coefficient of the magnet; then if

$$q \nu = p w, \text{ and } c : \epsilon :: p : \nu.$$

The statical moment of the mercury displaced from the ball at any temperature x° above 32°, will be equivalent to $c x + c x^2$, and will represent the temperature correction.

We will now proceed to detail the process of preparing the paper, bringing out and fixing the photographic impression.

The paper used should be of a strong even texture, and prepared with attention, to the exclusion of all foreign substances which might combine injuriously with the chemicals used.

The first preparation of the paper is with—

Isinglass 4 grains.
Distilled water 1 fluid ounce.

The water is boiled, and a portion then poured upon the isinglass, which, when dissolved, is poured into the remaining water, and all is boiled together. To this solution, filtered, is added—

12 grains of bromide of potassium, and
8 grains of iodide of potassium.

One side of the paper is then washed with this solution, and dried quickly before a fire. The paper thus prepared will keep in a dry place for two months.

When the paper is required for use, it must be washed with the following solution, in a darkened room with a yellow light:—

Crystalline nitrate of silver 50 grains
Distilled water 1 fluid ounce.

To bring out the impression, the paper is washed with the following solution:—

Saturated solution of gallic acid 1 ounce.
Acetic acid a few drops.

To fix the impression, first wash the paper well with water, then with the following solution:—

Hyposulphate of soda 1 drachm.
Distilled water 5 ounces.

And, lastly, wash carefully with water, and leave the paper to soak for a short time. The impression is then fixed, and light may be admitted.

A Council Medal was awarded to Mr. Brooke for this beautiful application of photography to the registration of natural phenomena.

WILTON (No. 402, pp. 452, 453) has exhibited three Fox's dipping-needles, furnished with needles of 6½ inches, 4 inches, and 2 inches in length respectively. Those with the longer needles are identical in all particulars with those which have been used successfully on board of ships, both for the observation of dip and relative magnetic intensity.*

PARKES and SON (No. 671, p. 467) exhibit a number of pocket-compasses.

GREEN (No. 446, p. 462) has exhibited several magnetic sun-dials, with metal and agate caps, adapted to every degree of latitude. They are mounted in boxes made of various materials. Mr. Green has also exhibited various other sun-dials, some of which are fixed in round mahogany boxes with levels and adjusting screws, and others fitted up for north and south latitudes; also several horizontal sun-dials, and ivory circular thermometers, with compass or magnetic sun-dials attached to them. Mr. Green also exhibits pocket-compasses with metal and agate caps, and others also with floating cards, &c., variously mounted in round boxes with improved hinges. Several compasses are fitted up in variously constructed boxes of ivory, brass, German silver, &c., together with others in the form of a watch, of various materials, some being made of leather, others in gilt and silver cases.

Mr. Green also has exhibited cone-compasses and brass gimbal-compasses, intended for use in small boats.

YEATES (No. 332, p. 446) exhibits a prismatic compass adapted to measure both horizontal and vertical angles, with spiral level attached in such a way as to be applicable in both cases.

Electrical Instruments.

The electric instruments are few in number, and there is not one adapted for the purpose of determining the quantity of atmospheric electricity for meteorological purposes. This is a matter to be regretted, as the present state of meteorology greatly needs a simple, inexpensive instrument, adapted for the observation of atmospheric electricity, and one which would be uniform in its action under uniform circumstances.

One exhibitor, **WESTMORELAND**, (No. 444, p. 462) has, however, the merit of exhibiting a gutta-percha electrical machine, which holds out the hope of obtaining electricity of tension on a large scale by the application of steam-power, and thus a motive force, which may serve for the movement of machines, or enable us to accomplish objects at present quite unforeseen, but which the habitual use of an electric power commensurate with that of lightning may bring into view.

WESTMORELAND (No. 444, p. 462) exhibits a gutta-percha electric machine. It consists of two rollers of equal diameters, placed one above the other, over which a band of gutta-percha, 4 inches in width, is stretched;

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* The correction for temperature has hitherto, at nearly every place, except at Greenwich, been applied to magnetical observations, on the supposition that the decrease of magnetical force was proportional to the increase of heat; but this is found to be very far from being the case. The correction for temperature of the horizontal force magnet at Greenwich is represented by $0{\cdot}00009050\,(t - 32) + 0{\cdot}000000626\,(t - 32^2$; the second term here becomes very large, when the temperature departs much from 32°, and in Mr. Brooke's arrangement is not taken into account.

* For description, see Illustrated Catalogue.

opposite to the axis of each roller, and on either side, are placed two brushes of bristles. There is a double conductor connected by a curved brass rod hanging over the top of the machine, similar in form to the conductor of plate-glass machines, and also a simple means of tightening or loosening the band, to correct the expansion and contraction of the gutta-percha.

It is stated that the electricity given off appears to be of high intensity, and, under favourable states of the weather, nearly as much in quantity as that from an ordinary plate-glass machine. The machine exhibited, when in good order, gave off sparks from about three-quarters of an inch to an inch in length.

This application of gutta-percha is quite new in practice,* and indicates the discovery of a new motive power, which promises to be a means of obtaining a supply of electricity of almost unlimited extension: this application of gutta-percha opens a new field in electrical research well worth exploring. A Prize Medal was voted to Mr. Westmoreland.

Watkins and **Hill** (No. 659, p. 466*) exhibit an electrical machine with a glass plate of 3 feet in diameter, furnished with both positive and negative conductors; they also exhibit a dry pile apparatus, furnished with a pair of Zamboni's dry electric piles, with a tangent screw, for the purpose of regulating the distance between the piles, and their position with respect to the suspended gold leaf. This is a beautiful instrument.

They also exhibit a delicate astatic galvanometer, for estimating minute currents of voltaic electricity; the lower needle is surrounded by a coil of wire 230 yards in length and $\frac{1}{120}$th of an inch in thickness. It is furnished with a rack-work motion, and a microscope for reading. And they also exhibit Harris's thermo-electrometer, for estimating small currents either of atmospheric or voltaic electricity, by the heating of a fine metallic wire.

Deleuil (France, No. 160, pp. 1178—80) exhibits an electrical machine for medical purposes, furnished with an arrangement to vary the strength of shocks. It is simple and effective in its operation.

Meinig (No. 437, p. 460) has exhibited hydro-electric chain batteries, consisting of the metallic combination of various galvanic elements; so arranged as to be very portable.

They are designed to be worn on the body for the purpose of effecting the cure of various chronic diseases by means of the electric current, which in its passage from one pole to the other passes through that part of the body encircled by the chain.

Thermo-Electricity.

In 1821, **Lubeck**, of Berlin, found that, if two metals of different kinds be in any way brought into close contact, and heated at the points, a current of electricity flowed through the metals, which continued passing in the same direction whilst the heat increased, ceased to flow when the temperature was constant, and flowed in the opposite direction on the cooling of the metals; whence heat was found to be connected with electricity, and like other natural forces, capable of mutual reaction.

Suss (Prussia, No. 482, p. 1078) exhibits a very large thermo-electric battery, with electro-magnet heating apparatus and apparatus for exhibiting chemical reactions.

A central ball of heated iron, 2½ inches in diameter, supported on a brass stand, radiates on five thermo-electric combinations, each composed of many elements united by soldering, and are enclosed in brass cylinders about 4 inches in diameter, and connected by copper rods with each other, either directly or indirectly, or through a coil passing round a core of soft iron. The circuit thus completed, the magnetic power is developed. Each cylinder has also a chamber for the reception of hot water or hot oil, whose radiation on a similar compound thermo-combination, placed as a diaphragm within the cylinder, develops the thermo-electric current. Honourable Mention was awarded by the Jury.

Hoffmann and **Eberhardt** (Prussia, No. 88, p. 1053) exhibit an apparatus for showing the action of the earth's magnetism on electric currents, in illustration of the well-known experiments of Ampere, in which helices and frames of copper wire, delicately suspended, when in the act of transmitting the electric current, place themselves in the magnetic meridian.

Application of Electro-Magnetism to the movement of Machines.

The great discovery of Professor Oersted in 1819, to which we have before referred, opened a new field for philosophic inquiry, and, especially for the application of an active force, produced, without external influence, to the movement of machines. This application, which has since engaged the attention of scientific men, is pretty well represented in the Exhibition: although no great power has as yet been obtained, many important difficulties in its practical application seem to have been overcome, particularly by Mr. **Hjorth** (Denmark, No. 47, pp. 1359, 1360), and we cannot help flattering ourselves that the attainment of this mysterious motive force will soon be followed by the making it available for practical purposes.

Joule (No. 440, pp. 461, 462) exhibits an electro-magnet, constructed of a plate of well-annealed wrought-iron, 1 inch in thickness, 1 foot in breadth at the centre, and 3 feet at the poles, which are 3 inches in breadth. The iron is rendered magnetic by transmitting the voltaic electricity through a bundle of copper wire (50 yards in length and 1 cwt. in weight) with which it is enveloped; an armature, and a pair of tapered armatures, are also exhibited for the purpose of concentrating the magnetic force when the electro-magnet is excited by a feeble voltaic current, and of directing the magnetic action to any required object. The superiority of this over other electro-magnets consists in the attainment of much greater magnetic force from a given voltaic battery than has hitherto been procured. Its use is to magnetise bars of steel and compass-needles, to which it instantaneously imparts a larger and more regular dose of magnetism than can be obtained by the usual means. It may also be employed to exhibit the phenomena of magnetism and diamagnetism.

Mr. Joule also exhibits a surface electro-magnet, consisting of a thick piece of wrought iron enveloped by a bundle of copper wire. The exhibitor observes, that a battery of moderate power produces such a powerful attraction between the above electro-magnet and its armature, that a weight of more than one ton is necessary to be applied in order to draw them asunder. This illustrates the extraordinary attractive power of iron when fully magnetized.

Harrison (No. 420, p. 455) exhibits an electro-magnetic engine which acts on the principle of the induced magnetic power of a compound coil of insulated wire conveying the current to a series of plates of soft iron, and attracting them within a suitable aperture.

As there is only one body of wire in connection with each coil, the retarding influence of the electro-magnets acting upon each other, after the current from the battery is cut off, is avoided, and by this arrangement the effects of the secondary currents are much reduced. The coils are made of short lengths of wire, and the whole are enclosed in metallic cylinders: it is presumed that a considerable saving in the consumption of the battery materials is effected. The advantages, Mr. Harrison says, are:—

1st. An almost unlimited power and length of stroke.

2nd. The greatest possible amount of power from the battery, by reducing the influence of the secondary current to a minimum.

3rd. Avoiding the retarding influence caused by the retention of magnetism in the ordinary method of application by magnets; and from the body of iron acted upon by the coils exposing a large surface, an instantaneous and powerful induction of magnetism ensues, and thus the highest speed is obtained.

4th. By the employment of a compound conducting material, a strong current of electricity is transmitted, and a much greater magnetic effect within the same space is obtained.

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* The electric power of vulcanized caoutchouc is even more powerful than that of gutta-percha, and is excited with singular facility.

5th. The larger the iron plates, and the greater the power of the battery, the greater is the economy of this engine.

KNIGHT and **SONS** (No. 453, pp. 462, 463) exhibit an electro-magnetic engine. This is probably the simplest form by which an electric current can be made to work by its action on permanent magnets, though not the most effective. Four coil-magnets are fixed rectangularly on an axis, and revolve within a circle formed of four fixed magnetized quadrants. The contacts are made and broken by rubbing springs on an axis (so it appeared on examination); the nicety of construction consisting in the adjustment of the moments of union and disruption, so as to obtain an effective difference of action always in the direction between the two opposite poles of the permanent magnet.

Knight also exhibits another electrical machine, in which a bar is alternately pushed and pulled, and so working on a crank and turning a fly-wheel. In all these machines the mechanism itself provides for the necessary alternate making and breaking of the circuits. It is probable that little power is obtained, for the greatest care appears to have been taken to destroy friction, by making the fly-axis revolve on friction-rollers.

WATKINS and **HILL** (No. 659, p. 466*) have exhibited an electro-magnetic engine. Two horse-shoe electro-magnets are alternately excited by two electric currents, and each as it becomes a magnet attracts one of the arms of a rectangularly bent iron bar, which is thus kept in a state of oscillation round a pivot from one magnet to the other. The ends of the bar carry rods working on joints which are connected with cranks rectangularly placed on an axis. Thus the dead point of one crank coincides with the quiescent state of its own magnet and with the active state of the other, and the axis is maintained in rotation with its fly-wheel. The magnet, bars, and crank are so arranged along the axis as to give room for the cranks, of which there are two, though, in fact, there might be any number of magnets and cranks working simultaneously.

The alternation of the circuit is kept up by a mechanism worked by the machine itself.

ALLEN (No. 413, p. 454) exhibits an electro-magnetic railway-train alarm; it consists of a copper chain, intended to be placed over every carriage, the connection between each being established by the guard-chains; on the circuit being completed, the ordinary steam-whistle discharges the steam. The arrangements are as simple as well can be.

CRESSWELL (No. 417, p. 454) exhibits an electro-magnetic engine for the production of motion; it consists of two pair of electro-magnets, between which a keeper vibrates and communicates motion to a wheel and crank.

FROMENT (France, No. 1609, p. 1254) exhibits an electro-magnet acting alternately, by elevating a lever, which communicates motion to a crank. He also exhibits a circular arrangement of coils, two of which are in action successively.

BRETON (France, No. 1113, p. 1231) exhibits an electro-medical apparatus with a double current; but as this instrument is intended for medical purposes, and not as a motive power, it scarcely falls within the province of this Jury.

HJORTH (Denmark, No. 47, pp. 1359, 1360) has exhibited an electro-magnetic engine. It consists of two sets of hollow horse-shoe electro-magnets, conical inside, with a corresponding number of solid electro-magnets, which, by mutually attracting each other, make a double stroke of 4 inches in length. The power has been found, by means of a spring-balance, to be about 30 lbs. at the commencement of the stroke, when the distance of the respective poles is about half an inch, decreasing slightly by degrees as the piston enters the hollow electro-magnet. The current is broken by the end of each stroke, and the destroying effect of the spark prevented by moistening the surface of communication with diluted sulphuric acid; no repelling power is applied.

Mr. Hjorth also exhibits a diagram and plan for an improved arrangement, consisting of only one hollow electro-magnet, the respective poles of which are divided into three or more square rings, which are somewhat conical inside, and are connected outside with the armatures (?) of the magnet, which form the connection between the respective poles. From the upper and lower part of the arrangement extend withinside four iron plates with ribs, which in the centre are connected with corresponding diamagnetic plates and ribs. These plates are applied for guiding the motion of the piston, and serve at the same time as a means by which metallic contact may during each stroke be established and broken between the piston and any one of the respective plates. For this purpose, four pairs of rollers are placed withinside the piston or hollow shafts, which are arranged on the fourway-cock principle, with a ring inlaid with a diamagnetic metal between the rings and shafts, that the magnetic bearings may be brought into contact either with the similar or diamagnetic parts of the same rings.

The required motion of these rings is produced by small cranks inside the piston, joined to the connecting-rod in such manner that each pair of cranks moves in opposite directions.

Whilst the engine makes a down stroke, magnetic contact is established between the north pole and piston; the polarity thus acquired causes it to attract the south pole. When the down stroke is performed, the magnetic contact between the north pole and the piston is broken by turning the upper pair of cranks in one direction, whilst similar contact is established between the south pole and piston by moving the lower pair of cranks in the opposite direction. A reciprocal motion being obtained in the above manner, the electric current passes continuously in one direction round the piston and each of the poles, the motion of the piston being reversed by simply breaking and establishing magnetic contact. On the piston passing out of the one pole it enters the other, and induces thereby, according to the law of the secondary currents, two currents in opposite directions, and thus both are neutralized. The advantages assumed are:—

1st. The obtaining a stroke of any length with one hollow electro-magnet, the piston being a moveable extension of either of the poles, attracted by a succession of polarities, the acting surfaces of which extend to the whole circumference.

2nd. The arranging the piston in such manner that it may be extended to any size, without its being heavier than a piston in a low-power steam-engine of the same size, the power being expressed in pounds per square inch.

3rd. A prevention of the destroying effect of the electric spark.

4th. A neutralization of the secondary currents and a prevention of their reaction.

The following table, as obtained by Mr. Hjorth, shows the attractive power obtained with a horizontal electro-magnetic engine of 16 inches stroke, the poles of the moveable magnet being separated 6 inches, or, in other words, the piston being 6 inches square:—

Distance of the respective poles. Inches.	The attractive force was lbs.	And the angle of magnetic force was ° ′
5	72	75·58
4	80	72·39
3	98	67·22
1½	140	50·12
1	160	42·34

A Prize Medal was awarded to Mr. Hjorth.

Electric Telegraphs.

As might have been expected, there are exhibited voltaic batteries; galvanometers; electro-magnets; telegraph wires; wires for submarine purposes; printing telegraphs: in fact, the Exhibition is rich with a large number of very ingenious contrivances, applicable to every stage of electric telegraphic communication.

The Electric Telegraph Company, which was established in the year 1846, have evidently used much diligence in possessing themselves of numerous patents, commencing with Cooke and Wheatstone's five-needle telegraph, patented in 1837, up to the present time. In the fine collection they exhibit are some of the most valuable inventions, in point of real practical utility, that have yet occurred; but they include also many forms of telegraph which, judging from their not being made use of, have been, it is presumed, found to be of little practical value.

It would seem that the needle telegraph, giving conventional signals, has obtained a firm standing in this country; and with the recent improvements in the galvanometer, it has certainly attained a high degree of perfection.

The form of the needle in most general use is that of a small rhomboid, into which much magnetism can be imparted, and which vibrates with great steadiness and rapidity. It, however, has the disadvantage of parting with its magnetism much more readily than longer needles, and requires to be re-magnetised more frequently.

When we reflect how very few years have elapsed since all that was known upon this subject (now the science of the age) was confined to a few scientific men, and regard its subsequent rapid progress, and probable great extension,[*] it cannot fail to be both interesting and instructive to trace briefly its progress, and to examine somewhat in detail the essentials of electric telegraphs, with the view of seeing how far such are attained in those exhibited. It is not the purpose of this report to trace the history of inventions, but one of its principal objects is to give merit wherever it is due, and it is hoped that the following attempt to classify telegraphs, being the first which has been made, is well within its province. In drawing it up we have to acknowledge our very great obligations to Charles V. Walker, Esq., the Telegraph Engineer to the South-Eastern Railway Company, for the kind assistance which he has freely given.

The idea of utilising the electric form of force, so as to have the means of rapid intercommunication between places far apart, is coeval with the discovery of the exceeding velocity with which this force travels through good conductors; and hence, as far back as 1782, we have a M. Lesage proposing to deflect twenty-four different leaves of gold, at the end of twenty-four distinct wires; and in 1787 we have a Mr. Lomond passing signals from room to room, by means of a Leyden jar and an electroscope, experiments useful enough as scientific illustrations, or as philosophical toys, but of no practical value. Indeed, so long as we were in possession of no other form of electric force than that which is obtained in a state of high tension from the joint friction of suitable bodies, there were no hopes, even had man been ready to take up such an invention, of an electric telegraph, properly so called. We find Reizen and Salva at the close of the last century, and Ronalds at the commencement of the present, doing their best to render this wild and wayward form of electric force subservient to their purposes; and the latter effectually controlling it within certain limits, and making a telegraph that did some actual work. It was not, however, until Galvani's discoveries had opened out a new field of electric research, which was so successfully trodden by Volta, when it was found that certain relations existed between heterogeneous bodies, attended always by the production of electric force in a new and much more manageable form;—it was not until this discovery of voltaic electricity that the idea of an electric telegraph became developed with any distinctness. We then perceive an advance: and although the applications that first occurred were sufficiently clumsy and impracticable, as compared with the knowledge we now possess, there was enough in Soemmering's decomposing points, in Coxe's decompositions, in Vorsselman de Heer's electric shocks, and in other original ideas, to prove that the prospect of ultimate success was still entertained.

But when Oersted had discovered that this new form of force, voltaic electricity, had a constant relation to magnetism, and that its presence caused the compass-needle to deflect according to unvaried laws; and when M. Arago had discovered that the same force would endow an inert mass of iron with all the wonderful properties of a magnet, we became possessed of powers, which only required rightly to be handled and controlled, for the solution of the problem; and when, further, Faraday had discovered that the mere motion of conducting bodies in the neighbourhood, or within the sphere of magnetic influence, gave rise to electric force; and Pixii first, and Saxton ultimately and effectively had worked out this discovery, and had produced the magneto-electric machine, there was a choice of means for producing the actuating force, and we could use at our pleasure this or that means of generating, what is popularly termed the electric current. A third source from whence might be obtained the means of actuating the signalling apparatus, was found in Faraday's further discoveries of the induction of currents in one set of conductors, by original currents passing near them in other sets of conductors. It may be supposed that during this last stage in the history of electric telegraphs, extending as it does to this very hour, many unsuccessful attempts were made, and many discoveries were introduced to the public eye, only to be abandoned as futile, and as wanting many of the essentials to real success;—the name of these is almost legion.

The Exhibition contains many inventions which are most valuable. Perhaps it would be well to consider here the essential or fundamental points of an electric telegraph; they are three in number and are as follows:—

I. *The generation of the force.*
II. *The insulation of the force.*
III. *The utilization of the force.*

We will proceed to speak of them separately.

I. *The generation of the force.*—In the majority of electric telegraphs in actual use, batteries composed of heterogeneous metals, moistened by a liquid or liquids, are employed for the generation of force. We find that Grove's combination of zinc and platinum, excited respectively with dilute sulphuric acid and nitric acid; Daniell's of zinc and copper with dilute sulphuric acid, and sulphate of copper; Smee's of zinc and platinized silver, with dilute sulphuric acid only; Cooke's original telegraph battery of zinc and copper with sand, and dilute sulphuric acid; Walker's graphite battery, in which the corrosion from gas retorts is substituted for the copper of Cooke's; and other forms, have been used by different inventors. But where a telegraph really requires the more expensive and complex form of battery first described, there is a *primâ facie* case against it; for in the maintenance of a large establishment, the cost of such battery power would be proportionably great, and unless compensated by some very great advantages on the part of the telegraph would be regarded in no very favourable light. Siemen's telegraph (Zollverein 310A), for instance, is most ingenious and is well constructed; but whether it possesses advantages over other known plans, that will compensate for its requiring to be worked with Daniell's battery, remains to be proved. Again, though as a reading telegraph it should not hold this rank, its printing powers, as compared with other printing telegraphs, might be greatly in its favour.

The ordinary acid battery has been almost invariably used in England. It is the least costly in construction, and is maintained at the least expense: it remains active for a considerable time, but suffers ultimately more during its resting than during its working periods, on account of the combinations that occur between the sulphuric acid and the copper, with the subsequent decompositions. With graphite plates this defect is remedied. The Prussian telegraph has the peculiar advantage that the batteries, both at the sending and receiving stations, are simultaneously in the circuit; and for long distances it avails itself of battery power at intermediate stations. The American telegraphs, in like manner, throw local batteries into circuit to do the actual work. This peculiarity occurs in some of the English patents, but does not seem to have been introduced into actual practice.

Perhaps the most curious proposition for the conversion of battery power into language is that of M. Botto, whose signals depend on the number of pairs of battery plates employed to deflect the distant needle, and are interpreted at the receiving station by turning on pair after pair of plates in the reverse direction until the needle comes back to zero, when the number of cells required to do this gives the letter or signal. The idea is original; but in order to carry it out the batteries must be precisely of equal power, and no portion of the force must be lost in transit.

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[*] At the time of our writing, the wires are being laid from Dover to Calais, thus connecting the Continent with our system of telegraphic communication; and arrangements are being made to connect the observatories of Greenwich and Paris.

The earth itself has been made to furnish a supply of electric force; in other words, a single pair of zinc and copper plates have been buried sufficiently below the surface to be in the wet subsoil, when the earth, saturated with water, represents the sand saturated with acid water, of an ordinary battery cell; by this means a current of low intensity is obtained, even when the plates are some miles apart. It was thought by some that this feeble current might be made available for telegraphic purposes, by laying one metal at one station and the other metal at another, and very exaggerated propositions were put forth. Steinheil rejected this mode of obtaining the current, which is only available, and that very indifferently, at the place where both plates are buried.

The means of turning on the electric force, or setting the current in motion, are as various as are the different inventions: in one case, consecutive depressions of a single stud are made, and a current is sent in one direction only; in another, handles or levers are moved in either direction, and two directions of current ensue; in another, the current is turned on in a constant direction, and the action of the instrument breaks and renews the circuit; in another, the whole force is sent along one wire, or is divided between two, and is directed this way and that as the case may be.

The magneto-electric machine is a constant fountain of force; it does not vary in power, as do batteries, nor ultimately become exhausted, but remains for an unlimited time capable of generating the induced electric current. It consists essentially of a set of powerful permanent magnets, and a coil or coils of copper wire wound upon iron cores; the ends of the copper wire being led off to adjustments proper for distributing the force in the right direction. The current is obtained by briskly moving the coils in presence of the magnet, making, in fact, the conducting wires to move among the lines of magnetic force. Where single currents are required, one motion of a lever on the other arm of which the coils are fixed, gives an instantaneous current. Where, as in Wheatstone's instrument, a number of consecutive currents are required in rapid succession, the coils are mounted on an axis which can be made readily to rotate, and to rest at any required point. Where, as in Henley's instrument, the force is required along one or other, or both of two wires, coils are mounted on levers near each end of bar magnets. Steinheil, Dujardin, and Hatcher are among those who have employed the currents from this source. When the current of high tension, induced from an ordinary current of low tension, is wanted, a cell or two of the more constant form of battery is employed to pass a current along a coil of stout wire surrounded by a long coil of thin wire, which latter is permanently in the telegraph circuit, and out of which is generated the active force.

II. *The Insulation of the Force.*—This is unquestionably the most difficult part of electro-telegraphy. It has engaged the attention of practical men from the outset. It is in vain that an abundant supply of electricity is obtained; it is in vain that the best measures are contrived for turning on this supply, and vain is the expenditure of thought, and contrivances for converting this electricity into a representation of our ideas, if the means are defective for conveying it in its integrity to its destination. Electricity of high tension, such as was employed for the early illustrations of signalling, might have been sufficiently well passed by Lomond from room to room, if his wires were carefully suspended, and the atmosphere tolerably dry; but when Ronalds proposed to pass the same agent along a distance of only 175 yards, he was compelled to surround his wires by thick glass tubes, well coated with wax at the joints, and placed underground in wooden troughs lined within and without with pitch. Frictional electricity, as is well known, requires perfect insulation to prevent it passing off in the form of the electric spark. Weber, in 1833, had found the voltaic current to be retained in wire of about a mile and a half in length, which was merely suspended from the steeples and house-tops of Göttingen. Steinheil, in 1837, erected and worked his telegraph at Munich, through a distance of about six miles, with no other insulation than a piece of felt placed between the wire and the support; but he found the insulation imperfect, and the more so in wet weather; and saw clearly that the force would have been altogether dissipated, had the circuit been longer.

The suspended wires are, at the present time, occasionally insulated from their supports by glass, but more commonly, as in England, by hard, well-glazed stoneware. Much ingenuity has been exercised in the form to be given to the insulators, of which there are many in the Exhibition. The barrel-shape, pierced longitudinally, universally prevailed here until long circuits called for some more perfect form; and now in the bell or mushroom, the bold, open-mouthed cone, or other analogous forms, we can discover that the actuating idea has been to keep the points of contact dry, and to let the interval between the wire and the pole be a maximum. **Walker** (No. 430) has gone a step further, and has placed a closed roof over his insulators. Cases occurred in which it was found convenient, even in the early days of telegraph, to lay the wire on or near the ground, and eventually under the public streets, when it was covered with cotton saturated with tar and pitch, and protected by leaden pipes. This was found to be very inefficient, nor did much better success attend the use of caoutchouc, which was not only expensive, but neither manageable nor durable under the conditions to which it was subjected. By a most happy coincidence, gutta-percha appeared in the market at the time, when resins and varnishes, and the known gums had been tried and found wanting. It was appropriated by Siemens in Prussia, who employs buried wire very largely, and by Walker in England, who used it at first between Dover and Folkestone, and now extensively in tunnels and under water, and who demonstrated its value for submarine purposes, by sending signals to London with two miles of gutta-percha wire (a piece of which wire is exhibited) in circuit, in the sea at Folkestone, in January, 1849. The street wires and tunnel wires, as well as those submerged in England, Belgium, America, and elsewhere, are now perfectly insulated by a coating of this valuable material. It is applied warm, either by powerfully pressing it upon the wire, or by causing it to follow the wire through a hole of the given size. In the streets the wires are sunken, and protected by being enclosed in iron-pipes, which proves to be very necessary, for in Prussia, where they are buried without protection, they suffer so frequently from the attacks of vermin, that it is in contemplation to suspend them as we do.

Under rivers or harbours they are protected by pipes, or are secured in a mass of timber, or otherwise. In all the tunnels on the South-Eastern line, Mr. Walker has laid them in grooved boards, which method has been since followed by the Telegraph Company, and is also adopted by the Belgian Government on their lines. It is unquestionably the simplest and safest of all methods.

The protection required for submarine wires is very great. The wire, by means of which a telegraph communication was obtained for a few hours between the coasts of England and France, was not calculated, neither was it expected to remain perfect for many days. It was clearly not laid down with the intention of remaining permanently, but for some special object. It was a copper wire, coated in the ordinary way, but thickly, with gutta-percha, and where it reached the shore, protected by a leaden pipe.

McNair (No. 421, p. 455) has exhibited some excellent specimens of his process of covering gutta-percha wire, first with cotton and then with an outer coat of gutta-percha, and finally with lead, in the application of which latter the cotton becomes impregnated with gutta-percha from the outer coating.

Wrought iron chain-pipes, with swivel joints, have been constructed by **Wishaw** (No. 419), and are exhibited as means of protecting submarine wires. Brett shows a sort of vertebrated hollow iron chain of considerable strength, which is proposed to be built about the wire. But there appear practical difficulties in the application of these plans. We see some insulated wire, protected by a strong net-work of wire woven over it, which imparts great strength and elasticity, and will often be found useful. The wires prepared for establishing communication between England and France, are coated first with gutta-percha, and then twisted together, being four in number, thickly covered with rope-yarn saturated with tallow and pitch, and finally protected with galvanized iron-wire of the thickness of a quarter of an inch.

A plan worthy of commendation for its simplicity, and for combining the leading essentials of a submarine wire, has recently appeared. A chain cable of sufficient strength to resist any strain to which it might be exposed, is galvanized; gutta-percha wire is covered with tape, or a similar material, saturated with creosote and other matters offensive to animalculæ; outside this is another coating of gutta-percha, and around the whole galvanized iron wire is wound, like the wire of a harp-string. One or more wires are enclosed in the outer coating of gutta-percha, before applying the galvanized wire, as may be required. The chain is arranged regularly, that is, with the links alternately vertical and horizontal: and in the four corners or angles presented, is laid one of the wires prepared as above, which is retained *in situ* by simple slips of galvanized iron, from which it can be readily released. The full strength of the chain is thus increased by the addition of the wires, and the combination is very elastic and manageable.

Insulation is not a little dependent on the state of the circuit, that is to say, on the relative amount of *resistance*, opposed to the passage of the force. In short distances defective insulation is not much felt, for the resistance offered by a few miles of wire, which is a very good conductor, is far less than that presented by the films of water or other bad conducting material near the insulators; the relations of these resistances vary with the length of the wire, and also greatly vary if the resistance of the wire is increased by badly-made joints. In early days the lengths of wire were joined by mere contact, and the pressure of a nut or bolt; and the winders by which the wire was tightened formed part of the circuit. This plan was found by no means to satisfy the conditions essential to long circuits; and now the joints are made with scrupulous care, and the lengths of wire are soldered together from end to end, the winders not being allowed to enter the circuit.

Steinheil had discovered, in 1837, that it was not necessary to lead a wire from each pole of the battery, to the respective sides of the telegraph apparatus at the distant station, as would be done in all experiments on a small scale, but that the conducting powers of the earth could be advantageously substituted for one of the wires. The saving of one out of every two wires, important though it is, is not the only advantage derived from this discovery. The earth is found so far to surpass the wires themselves in conducting power, that it adds nothing to the resistance; so that equal effects may be produced at double the distance with the same initiative force. The resistance therefore for any given distance is one-half, and the tendency towards defective insulation is reduced. The earth acts as the return wire, to any given number of distinct wires, without in the least affecting the regularity of the action of any of them.

III. *The Utilization of the Electric Force.*—Almost every effect by which the presence of electric force is made manifest, has been in turn enlisted for the purpose of transmitting our ideas to a distance—not excepting even the heating effect of electricity, which have been employed by Horn to ignite wire and singe signals on paper.

1. The spark was employed by Reizen, who pasted strips of tin-foil on glass, and cut out the letters by dividing the strips, which intervals were illuminated by the spark. Salva used the spark, but how converted into language was not known.

2. Recession of similarly electrized bodies occurred to Lesage, who proposed twenty-four wires, with a pair of gold leaves at the end of each; one or other of the pairs was to diverge by an electric charge. Triboaillet proposed something similar, with only one wire and conventional signals. Lomond used a common electrical machine and a pair of pith balls and conventional signals. Ronalds employed pith balls, and two well-regulated time-pieces, which carried round similar discs of signals, each presenting the same signal at a fixed point at the same time. He deflected his pith balls, and discharged the electricity, allowing them to fall when the right signal arrived at the given point.

3. The *physiological effects* of electricity, in other words the electric shock, was proposed by Vorsselman de Heer, and actually tried in 1839. He had ten wires, and ten keys or studs, on which the fingers of the hands were to be placed; and the shocks felt in the various fingers constituted the signals. Instead of an alarum to call attention, the clerk had merely to connect himself up in the telegraph circuit, when he might safely rely on being feelingly reminded when his attention was required. O'Shaughnessy proposed giving shocks from the induced current, one shock and a group of shocks being the distinctive marks, and each station being provided with time-keepers, having a disc of signals, a shock to be given when the index pointed to the letter intended.

4. The *decomposing powers* of electricity suggested themselves to Soemmering. Some twenty or more wires terminated in gold points, within a vessel of acid water, and according as the circuit was made by one or other of the wires, a small stream of gas ascended from its terminating point, and hence the alphabet. He also contrived that an inverted cone should collect the gas, and would then float and cause a little ball to fall on a detent to liberate a clock mechanism and a bell. Coxe proposed the decomposition of water, but gave no plan. Davy impregnated cotton with hydriodate of potassa and chloride of calcium, and having marked it off in chequers, secured it on a cylinder that rotated by a clock movement. The current has to be directed through the cotton, and to produce a spot; the chequer on which this spot fell determined the signal. The clock-work was released by an electro-magnet, actuated by a current in other wires. Bain's printing telegraph depends on the same principle, applied, however, to the decomposition of more sensitive bodies, and reduced to actual practice. He acts upon a mixture of sulphuric acid and prussiate of potash, with which he moistens paper bands. The paper is interposed in the circuit, and receives a mark wherever the current passes and decomposes the solution. The alphabet consists of a combination of short and long marks, produced respectively by instantaneous currents, and by currents of short duration. These currents are sometimes sent by hand, by mere making contact; at other times short and long holes are punched in a dry paper band, and this is drawn by clock-work between the metal point and cylinder, which closes the circuit, and thus the current is cut off, when the sound part of the paper intervenes, and passes when the presence of a hole allows the point to touch the cylinder, and complete the circuit—the moist paper receiving the spots is made to move on at a like rate. Bakewell places his solution in like manner in a paper band; but he writes his messages with varnish upon tin-foil, and places this between the point and cylinder, and causes the latter to revolve, and hence the current is intercepted wherever the varnish intervenes; the moistened paper revolves at a like rate, and both progress axially, so that a fac-simile occurs of what had been written.

5. The *galvanometer* has been most successfully pressed into telegraph service, and forms the essential part of the needle telegraphs which have obtained so marked a reputation in England.

Steinheil used one galvanometer coil containing two needles, which carried ink-cups, and made dots as they were deflected. Alexander had thirty wires and galvanometers, the needles of which carried screens and disclosed letters on their being deflected. Schilling, according to one account, used thirty-six wires, and galvanometers, and, according to another account, only one;

and he had a plan for checking the oscillations of the needle. Davy showed, in 1836, what was apparently a needle telegraph, somewhat similar to Alexander's. Gauss and Weber had a single needle telegraph, the deflections to be observed with a spy-glass. Fechner suggested twenty-four galvanometers and their respective wires. Botto's plan of one galvanometer, whose deflections were to be neutralized by an adverse current, has been already named. Mason suggested a single galvanometer. Galton has published a description of a very complex apparatus, the electric parts of which are three galvanometers, whose office is merely to present needles as mechanical obstacles in certain spots among a train of machinery. Cooke and Wheatstone at first used five needles on a lozenge-shaped dial, two of which were always used for a signal; and the letter was found where the points produced met. The needle instrument now in common use, and in which one or more deflections of either or both needles in one or other direction, gives all the combinations necessary for conducting rapid correspondence. The details of these instruments have been much improved, and there is little wanting to make them perfect. There is also a single needle instrument, which gives all necessary signals, but not so rapidly. The success of the needle telegraph has led to many modifications of the galvanometer. Brett and Little coil the wire on a circular bobbin, and make a crescent-shaped needle, the poles of which are properly presented to the coil; instead of reading from the prime motion of the needle itself they read from indices, which are moved by a tap from the needle. Highton's galvanometer needle is horse-shoe shaped, and the coil also circular and duly adjusted to the needle. He reads from an index carried on the same axis with the needle. He has also three needles, each carrying a screen, transpierced in such sort that by a combination of motions twenty-six different letters can be exhibited to the eye. Little has suspended an ordinary needle to the pole of the magnet, and withinside a tube of alcohol. The galvanometer coils are flat bobbins.

The *electro-magnet* has been used by Bain, Bakewell, Barlow, Breguet, Brett, Cooke, Davy, Dering, Dujardin, Garnier, Hatcher, Henley, Highton, House, Lodefink, Morse, Nott and Gamble, Palmieri, Siemens, Smith, Vail, Wheatstone, Wishaw, and others. In the hands of some of these inventors it has been made to give direct signals; for instance, in Henley's instrument the armature carries the index needle, and the combination of the deflections of two needles gives the alphabet. In Morse's the armature carries a point which impresses permanent marks on paper; it is also connected with wheel-work for moving the paper onward. In Dering's the magnetized armature carries the index needle. In Dujardin's the armature carries a point that dips in ink and makes dots. Siemen's prints by the direct blow of a hammer carried by the armature, although his type is brought in by a secondary action. In the hands of others it communicates motion to the index, as in Breguet's semaphore instrument, where the armature acts upon scape-wheels, and gives to the indices the eight positions of the ordinary semaphore. In Nott and Gamble's the armatures carry claws that draw a wheel round, and with it the index, till it points to the given letter. In Siemens', the armature acts in a similar manner. We also find a third class of instruments in which the motion of the armature releases a detent, and liberates a clock-train, the motion of which produces the signals. Cooke and Wheatstone's alarum is sounded in this way, the hammer in some cases representing the pendulum bob, and in others, being carried on the produced radius of one of the wheels. Brett prints by the successive action of a detent liberating clock-work. It would be no easy task to follow the several inventors through the essential details of their apparatus; nor would it be very practicable to prepare a complete list of all that has been either conceived, contrived, or constructed, together with all that has been tried, and proved successful or otherwise in this wide field of research. It may well be supposed that many of the plans to which we have referred, have existed only in imagination—that many are absolutely useless—that many others are too complex for actual service—that some perform badly and with uncertainty that which others accomplish rapidly and successfully.

The French Government required signals to resemble those of the old semaphores, and they have extensive codes. We have in England preferred conventional signals, thinking it better to train young men to read a new alphabet than to have an index going through the comparatively slow operation of pointing to every letter. In Prussia the latter plan is preferred. There has been also a choice between reading and printing instruments: in America the latter have prevailed; in England the former. But whatever be the actual sign by which we obtain possession of the ideas transmitted to us, it would seem that the instruments that have obtained a standing, are, almost without exception, those whose action is direct, and are not the result of any extraneous mechanism.

We will now proceed to a careful description of the several telegraphs.

The **Electric Telegraph Company** (pp. 477*, 478*) exhibit many telegraphs.

I. Patent 1846, a rhomboidal needle. The galvanometer coil is in two halves, mounted on arms, which are made to open for the reception of the needle, and to close again. On the same axis is mounted the index-needle that is presented to the eye on the face of the telegraph, and which oscillates between ivory studs. The studs are now made moveable, as first proposed by Charles V. Walker, Esq., Telegraph Engineer to the South-Eastern Railway Company, for the needles to work between, so as to keep the neutral position, by adjustment, half way between them during periods of magnetic disturbance.

II. **Wheatstone.**—The instrument marked "Magnetic-electric Induction Machine," consists of a strong horse-shoe magnet, of eight plates, and 10 inches from either pole to the centre, fixed on a board; over it is placed a handle, which raises and depresses two coils of soft iron core and armature. On breaking contact, by depressing the handle a current of momentary duration passes out from one coil along the wire to the other *in one direction*. This gives a single impulse only, and always one way; and is used to excite an electro-magnet, and ring a bell.

III. **Hatcher's** magneto-electric induction machine to send currents *ad libitum*, in either direction. This is effected by the same application of coils to a horse-shoe magnet and breaking contact; but there are two handles, and according as one or other is used to break the contact, cross communication takes place. "Hatcher's Current Director" affords a mode of making and breaking contact by cross communication, as an appendix to any telegraph. In this machine the horse-shoe is 12 inches in length, and consists of eight plates.

IV. **Wheatstone's** patent rotating induction machine, for working the disc telegraph (1841). A dial wheel with spokes and letters. Each letter as it is wanted is brought to a given point. The wheels work a pinion, which causes a pair of coils and armature to revolve over the poles of a great horse-shoe magnet. Every letter brought past the given point makes half a revolution of the coils and breaks, and renews the circuit opposite ways. The currents thus established and sent off to a distance, pass through coils and actuate local electro-magnets, which alternately attract to and fro an iron plate, and thus alternately release and lock a detent. A clock, driven by a spring or weight, being thus allowed to act at intervals, drives round a dial-hand, click by click, at the other station, and thus imitates the motion of the original dial-wheels. This clock, however, requires to be wound up, and it does not seem to provide for any notice being given when it is down.

V. **Barlow's** patent, 1848. A printing telegraph, consisting of a circle of letters brought round in succession till the letter wanted comes to a given place; contact is broken as each letter passes, and the current is reversed; the currents so established act (at the other station) as four coil magnets, &c., between which a soft iron bar is thereby caused to oscillate, and to lock and unlock an escapement, and cause a wheel to imitate the motion of the letter circle. This wheel brings round type punches, and on coming to rest, a hammer strikes the punch (worked by a coil-magnet), and impresses a paper ribbon, which is drawn uniformly along by clockwork.

VI. **NOTT** and **GAMBLE**'s telegraph presents two double alphabets; the one direct, the other inverse, and the digits are many times repeated on a circular dial, having an index, which moves with a step-by-step motion, and is brought to rest at the letter required. The force is derived from the voltaic battery; and current after current is set in action by the successive depression of an ivory key by the finger; it is made available by means of two U-shaped electro-magnets, acting simultaneously and in the right direction upon two levers, furnished with clicks, which work in a scape-wheel that carries the index, and propel it, notch by notch, as each contact is made.

VII. **HATCHER**'s induced current machine, patent 1847; to produce currents in either direction by one motion of a handle.

Two make and break circuit arcs of brass and ivory-pieces, alternating with rubbing-springs, so arranged that when the springs on the right are connect brass and brass, that on the left shall connect ivory and ivory, and *vice versâ*. In either state, a depression of the handle breaks contact of coils of magnets, and throws a shock along the wires.

VIII. **COOKE**'s patent, 1845. A portable telegraph, for the guard on a railway to *receive* messages in case of an accident, by making a contact with the regular wires along the line.

IX. **BRETT** and **LITTLE**'s patent. A conventional alphabet by needle oscillations, in which the handle at the first station, by working to and fro, establishes alternate cross communications, and thus directs the current alternately one way or other. There are two needles, but each needle oscillates in only one direction.

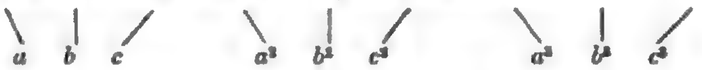
X. **WHEATSTONE** and **COOKE**'s patent, 1840. In this arrangement the rapid alternation of circuits is effected by the dial-wheel turning a pinion, half of ivory and half of brass. The motion of the dial-wheel is imitated at the second station by an escapement-wheel, driven by the oscillation of a pair of detents worked by a four-coil local magnet apparatus, alternately urging a piece of soft iron to and fro. It is an imitation telegraph, and reads the actual letters.

XI. **HATCHER**, 1847; electro-magnet printing telegraph. The usual reciprocating action between coil-magnets, instead of carrying round a wheel, makes a series of dots on paper constituting a conventional alphabet.

XII. **BAINS**' patent, 1846; chemical printing telegraph. Signals are given by marks arranged in one line of different lengths and intervals by the pressure (on prussio-muriated paper) of a link of iron wire, which deposits prussian-blue, the paper being adjusted by clockwork.

A Prize Medal was awarded to the Electric Telegraph Company for the exhibition of this fine series of telegraphs.

The **BRITISH ELECTRIC TELEGRAPH COMPANY** (No. 432, p. 459) exhibit **HIGHTON**'s patent, dated 1848. The principle is economy of wire by encircling the poles of a horse-shoe rather than going round a straight magnet. The power gained is stated to be as 7 to 1. An improvement is also claimed in the mode of throwing two lines into connection by a single spring and cross bars, so as to halve the risk of a spring breaking. Thirdly, carrying a coil all round a horse-shoe, and thus causing each part of the magnet to act on each part of the coil; but this is in opposition to the first principle, so far as a saving of half the wire is concerned. Fourthly, application of the principle of the arrangement of the letters on the rim of a dial-plate, not according to alphabetical order, but according to frequency of occurrence in writing: but arrangements of this kind have been in use in printing-offices, on the principle of the more frequent letters being placed the most within reach. Fifthly, a ready mode of bringing the needle on the alphabetical-dial to zero, by touching a key. The step-by-step current which works the needle round is thus thrown out of gear, and its power thrown on another magnet, creating a force which lifts the detents of the escapement, and lets it pass round to the stop in the same direction. Sixthly, is exhibited a very ingenious piece of mechanism for locking the printing-wheel, so that it cannot by any possibility run on two letters for one motion of the alphabetical needle. Seventhly, since $3^3 - 1 = 26$, the number of letters in the alphabet, and since $3^3 - 1$ is also the number of electric combinations of three oscillating needles; thus—



of which b, b^2, b^3 is an inactive combination arising from a quiescent position of all the needles; a conventional alphabet may be constructed by a simultaneous use of any three of the combinations, except b, b^2, b^3; thus, \ \ \ may indicate A; \ \ / may indicate B; and so on.

This principle is worked out by a system of cross combinations of three batteries, acted on by keys, as in a piano. The key *a* being depressed brings simultaneously into circuit the three positive currents; *b* brings into action the positive current of battery 1 and 2, and throws battery 3 out of action.

Another application of this principle to a reading alphabet consists of three pendulums, each carrying screens, with orifices pierced so that by each combination (bringing the screens into twenty-seven different relative positions behind one another) only one orifice shall be exposed, showing the desired letter. This principle is also applied to printing telegraphs; thus, no type can be pressed till three conductors conspire, and these are directed and ensured by the three positions of the needles, and, which comes to the same thing, by the combinations of the three currents creating twenty-seven electro-magnets.

HIGHTON, patent of 1850. Use of a permanent magnet to keep up the magnetism of a soft-iron moveable magnetic needle (as a security against lightning destroying the magnetism of this needle), by continually re-magnetising it. A lightning strainer is also exhibited. The circuit-wire, covered only with bituminous paper, is made to pass through a box of iron filings. This is found to be insulation enough for the galvanic current, but not for the tension electricity of lightning, which is therefore carried into the earth by the filings.

The use of the secondary battery, the $3_3 - 1$ combination principle, is made applicable to printing, by touching keys carrying the letters to be printed; and a patented application of the chemical principle, that sulphate of alumina in solution may be advantageously used, instead of sulphuric acid, to keep the battery in action.

A Prize Medal was awarded to the **BRITISH ELECTRIC TELEGRAPH COMPANY** for the exhibition of their ingenious telegraphs.

HENLEY (No. 428, pp. 457, 458) exhibits two powerful compound linear bar magnets. The electric force is produced by a semi-rotation of a double electric coil and armature opposite either pole. The movement is extremely simple and neat, and the shock delivered very powerful. It has worked through 560 miles of wire, also through 60 feet of water. Experiments on the Serpentine were made, when several feet of the wire under the water were stripped of the gutta-percha coating without dissipating the current; and when (as the Jury were told afterwards), on further trial, the wire was divided under the water, yet the shock passed between the ends sufficiently to deflect the needle effectually.

The principle of using permanent magnets as a substitute for a battery is not new. At Göttingen, in 1839, Sir John Herschel was present when Gauss telegraphed from his house to his observatory by its means.

This is a double-needle telegraph, but the needles move only in one direction. The magneto-current employed actuates electro-magnets, the armatures of which carry the index-needle, and move it as they move. These currents do not need so good insulation as do battery currents.

A Council Medal was awarded to Mr. Henley.

J. Brett (No. 429, p. 458) exhibits an electric printing telegraph, which consists of two parts, called by Mr. Brett the communicator or key-board, and the printing machine; the former is supposed to be at the station from which intelligence is to be transmitted, and the latter, the place to which it is to be sent.

The machinery is propelled chiefly by the power of weights, or by ordinary clock-springs. The motion of the printing-machine is regulated by the galvanic current, by means of an escapement, and which requires much less power than is necessary to impel the machinery; thus both the advantage of the instantaneous action of the current, and the greater power of the weights, combine to accomplish the work for which this machine is designed.

The key-shaft is about five inches in length; the finger-keys act upon pins by means of rods and levers. The circuit-wheel is fixed to the axis of the key-shaft, which works upon a hollow axis with ratchet-wheels and clicks, so as to move forward in one direction with the circuit-wheel. Immediately after it has revolved the desired distance, a number of points, to correspond to the letter or character indicated by the finger-key, and required to be printed by the printing-machine, are released and return to zero, by means of a pulley and weights, independently of the circuit-wheel. The type-wheel is so attached to the key-shaft that a message may be printed in duplicate.

There is another arrangement by which the type-wheel or wheels is attached to a hollow axis, which carries the type-wheel backwards or forwards by a pinion acted upon by a train of wheels in connection with it: this train communicates motion to an arbor, to which a disc is fixed firmly: against the disc a ratchet-wheel is placed, mounted loosely on the arbor, between a fixed washer, and adjusted by a spring-catch, so that it can turn a short distance only on its axis. A slot is cut in the disc of this ratchet-wheel, and also through the adjoining disc, in which a pin works, connected with the tail of a click; this click is so adjusted as to catch into the teeth of the ratchet-wheel. Therefore, when the click is locked into one of the teeth, it causes the type-wheel to travel with the axle and pinion; but when the click is released, the type-wheel returns to zero, by the assistance of a pulley with cord and weight, or of a spring connected with the hollow axis. A lever is put into action by a pin attached to the common wheel of the printing train of wheels, and by its means the type-wheel is returned to its starting-place immediately after a letter or sign has been printed. Mr. Brett considers this arrangement very important, as it insures safety from the derangement to which the type-wheel, by a continuous step-by-step movement, is liable, on account of the accumulation of errors, arising either from atmospheric or other causes. From the momentary effects of lightning or atmospheric influence the machine immediately corrects itself, and the sense of the subsequent correspondence is not disturbed.

The train of wheels which give motion to the type-wheel is controlled by means of a secondary train of wheels, fixed to the back of the frame-plate, which controls and reduces the force of the escapement, and relieves the galvanic or magnetic power required for its regulation.

The type-wheel upon this arrangement may have any desired number of letters and characters without retarding the operation, as they would be so economically placed in the order fitted for their general application. Mr. Brett has adopted an arrangement of letters on the type-wheel in the order of frequency of occurrence. The arrangement is as follows:—*e, t, a, i, o, n, s, h, r, w, d, l, c, f, m, e, u, b, g, p, j, y, k, v, x, q, z.*

In Mr. Brett's patent of 1845 the key-shaft was worked by means of a bevelled friction-wheel, set in motion by a train of wheels and a weight. The barrel was made the length suited to the number of the finger-keys, and the pins were fixed in a uniform helical row, extending its entire length. In the arrangement exhibited, the circuit-wheel is fixed to the end of the key-shaft, as before stated. Connected with this wheel are two pieces of metal, which form the conductors of the current; one of these rests upon the periphery, and the other upon the collar of the circuit-wheel, being alternately upon one of the teeth and over one of the spaces. Whilst resting on the tooth it completes the circuit, and when over a space the circuit is broken, and so on alternately.

In connection with the printing train of wheels of the printing-machine, is an eccentric or cam-wheel, which revolves upon the shaft, and is connected with an hydraulic regulator; so that when a piston is raised by the revolution of the type-wheel, a partial vacuum is formed in the valve-chamber, and water passes through holes into the chamber, and momentarily takes off the dead weight of the piston, and some of the friction of the lever, from the escapement. On the type-wheel being arrested, a lever descends, releases the cam-wheel, and the paper is pressed against the letter upon the type-wheel.

Plumbago or vermilion is preferable in use to printing-ink, as it does not require replenishing for a considerable time.

Mr. Brett also exhibits a small instrument which he calls a pocket communicator, designed for the use of guards of railways, to communicate with the nearest station on the occurrence of accidents, or on assistance being required. In use it is placed in connection with the lines on the railway, and a galvanic battery on the tender, the wheels of the carriage completing the circuit.

It consists of an axle, to which is fastened a ratchet-wheel, over which is fixed a circuit-wheel, with teeth and spaces suited to the number of letters and characters required. On its face is placed another ratchet-wheel, which causes the circuit-wheel to rotate when the click is put into operation, by moving forward a handle, connected with which is a pointer, by which the letters or signs are pointed out.

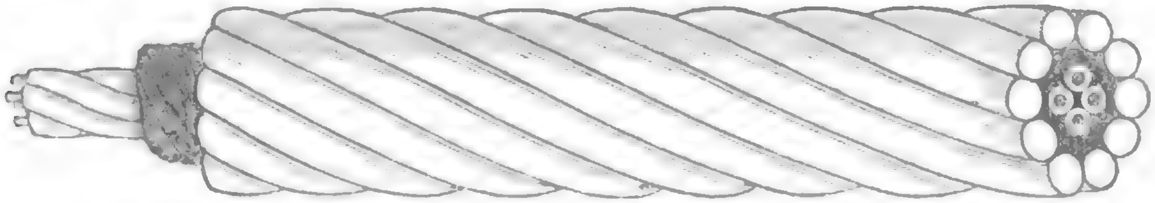
The arrangement admits of a double circuit-wheel being employed, for the purpose of reversing the poles of the battery, and thus changing the direction of the current of electricity.

An electric circuit regulator is also exhibited by Mr. Brett. Its purpose is to give a controlling power over all the stations on any line of electric telegraph, so that any important telegraphic information could be transmitted to one or more distant or intermediate stations, without the knowledge of such communication transpiring to any other place than the one intended; the other stations on the line being put out of circuit for the time, by means of a separate wire in connection with a very small apparatus at the different stations. This apparatus it is necessary to construct with a full knowledge of the number and relative importance of the stations upon the line, for the purpose of making the calculations correctly: it will be necessary to exemplify this. Take, for example, five stations,—London, Dover, Calais, Amiens, and Paris; and suppose the remaining stations to indicate upon the dial a *universal* communication with all the five stations. Ten other divisions will give all the changes of one station to another, thus:—London to Paris, London to Dover, London to Calais, London to Amiens, Calais to Amiens, Calais to Dover, Amiens to Dover, Paris to Dover, Paris to Calais, Paris to Amiens and London, Calais and Paris; making in all twelve points or changes. At each of the stations should be a small apparatus having a dial, similar to a watch, having indicated upon it the number of points, or the names of the respective stations. At the number indicated a small hand or pointer would show that station which was engaged with another in the occupation of the line, as all these would be acted upon simultaneously; and thus any unnecessary interruption would be prevented.

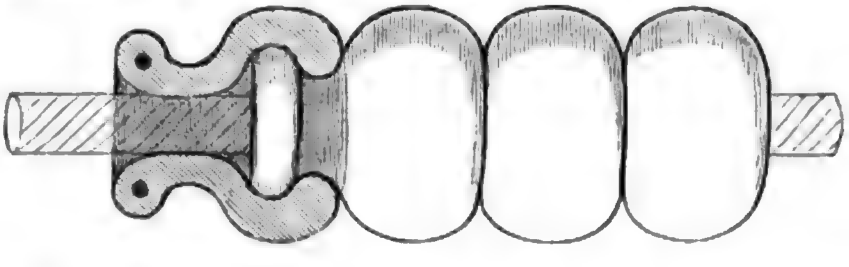
By the use of Mr. Brett's telegraph, communications are made in any language, and printed upon paper with considerable rapidity and precision; the paper and ink are self-supplying, and sufficient may be placed in the apparatus of both to last for some time. Mr. Brett says, that the letters may be printed at a greater speed than a well-practised person could write them, and that a clerk, after some experience, might manipulate upon the finger key-board upwards of 150 letters per minute.

Mr. Brett has also exhibited a specimen of the line used in the first experiment, across the Dover Strait, after having been submerged in very deep water for more than six months, and is part of the same wire through which the first galvanic current was transmitted from the coast of England to that of France. The experimental line was formed of a single copper wire, insulated by a layer of gutta-percha about five-eighths of an inch in diameter.

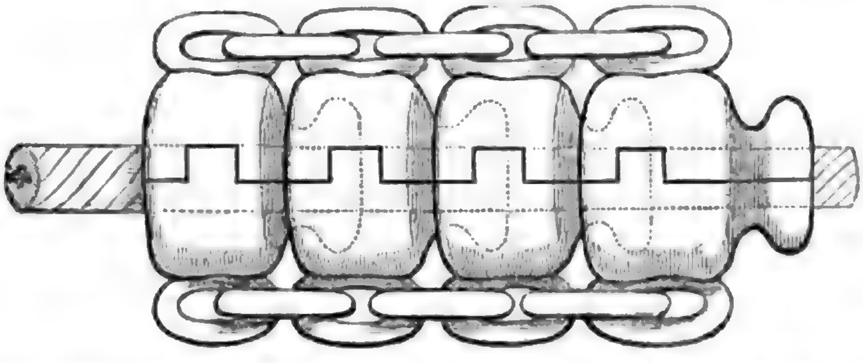
Mr. Brett also exhibits a specimen of wire cable. This is a portion of a permanent line, now being laid down from the South Foreland to Sangatte, near Calais; the core of the cable is formed of four copper wires (No. 16), each of which is insulated and covered with two separate layers of gutta-percha. As in the experimental wire, the tightening of the line elongated it to a considerable extent, and caused the gutta-percha to divide, so destroying the perfect insulation of the wire; it was therefore resolved to obviate this source of failure by twisting the four wires together spirally, before encasing them in the hempen yarn, well saturated with tar and bituminous compounds, with which they are completely enveloped. The core thus formed, is protected by ten galvanized iron wires (No. 10 gauge) twisted together, the whole composing a cable 1¼ inches in diameter, as shown in the annexed cut.



Mr. Brett also exhibits a vertebrated iron tubular cable. This is designed to protect a cable of submarine telegraphic wires, when situated near the sea-coast, from sustaining damage by anchors, or by casualties likely to occur when situated in the vicinity of shipping, and may be made of great strength, and of considerable curvature, without either damage or derangement, as in the following figure.



One of the iron cables exhibited, is constructed with the addition of a chain of links, for the purpose of giving a greater degree of strength in dangerous situations, as shown in the annexed figure:—



A Council Medal was awarded to Mr. BRETT.

BAIN (No. 434, p. 460) has exhibited an electro-chemical telegraph, depending, like that of Mr. Bakewell's, on the development at a distance of the chemical effects of electricity. The effect produced is the precipitation of Prussian blue on paper, duly prepared by impregnation with prussiate of potash and weak acid, on the contact of a steel pointer, at the signal station; this contact being determined by the attraction of an electro-magnet on the arm which carries it. The breaking and renewal of contact at the station of departure, is effected by the interposition of a band of paper, drawn uniformly along by clock-work, and punched out in holes and slits of different lengths, which allow of more or less prolonged contacts, in conformity with a conventional alphabet. At the station of reception, a large circular disc of the prepared paper is made to revolve uniformly, by simultaneous clock-work, while the iron point, which on every renewal is pressed into contact with the paper, is carried to or from the centre current uniformly by a screw motion, along a line to the centre of the disc, and leaves traces on the paper as it passes beneath it, in Prussian blue corresponding to the stamped line in the original paper band, and which may therefore be read off at leisure; other preparations, such as that of starch with iodine, potash, &c., may be used for preparing the paper. There is much mechanical ingenuity and skill displayed in every part of this apparatus.

A Council Medal was awarded to Mr. Bain.

BAKEWELL (No. 433, pp. 459-60) exhibits a copying electric telegraph, which is fully described in the Illustrated Catalogue, with the method of use, excepting the method of transmitting invisible messages, which is effected by using paper moistened with diluted acid alone, when a deposition of iron from the steel point is made on the paper without any mark, the writing being subsequently made visible by a solution of the prussiate of potass.

A Council Medal was awarded to Mr. Bakewell.

WALKER (No. 430, pp. 458, 459) has exhibited a *mode* *of insulation* of telegraphic wires. The great practical difficulty in telegraphic operations is to overcome the defective insulation consequent on the dampness of the climate. To speak first of the wires suspended in the open air, Mr. Walker has substituted for the old form of cone, to which there were many objections in practice, a large open-mouthed cone, or rather hollow double cone, so constructed that the wire and the cone should be in contact at the smallest possible surfaces; also that, as the place of contact is as far as possible withinside the cone, it should be as inaccessible as possible to wet; also from its shape, that any wet attaining to the cone would, by mere gravity, run away from the place of contact; also that the part of the cone, where in contact with the wire, should be at the furthest distance from the timber of the pole sustaining all. After suspending the wires, Mr. Walker has the cone covered in with a roof, having sides and ends.

The wires from Red Hill to Shalford, a distance of 19 miles; from Ash to Reading, 19 miles; from Ashford to St. Leonards, 28 miles; and from Tunbridge Wells to Robertsbridge, 15 miles, are all suspended in this way. These lines are remarkable for their perfect insulation and good working order. It was feared that the birds would build nests in the roofs, but such, as yet, has not been the case. This plan involves no additional expense.

I. *In regard to Tunnel Wires.*—The deposit of damp and dirt on the suspension apparatus of Mr. Walker's tunnel wires, on the South-Eastern Railway Company's lines, as first erected for him, caused so great a loss and distribution of the voltaic force, that without some improvement a total obstruction of telegraph business would have ensued, and messages to Dover, instead of passing direct, must have been transmitted through an intermediate station.

About the time that Mr. Siemens, of Berlin, was contriving wire covered with gutta percha, it occurred to Mr. Walker to direct Mr. Foster's attention to that substance, and to request that a specimen should be prepared for him. The result was, that Mr. Foster obtained a patent, of which the Telegraph Company have the monopoly. It was first used in Mr. Walker's tunnels, where, instead of the old mode of suspending, it is now laid in a grooved board covered in. The grooves are ploughed by machinery; the board is prepared with mineral varnish, and is secured close to the tunnel walls, remaining, when once nailed on, in good working order, and in a perfect state of insulation. This grooved board, simple as it is, will doubtless prove a valuable invention, and those who have felt the charge of badly insulated wires will appreciate the improvement. Compared with suspended wires, it is important to the safety of trains and passengers. The old wires have many times been entangled with trains, not only being torn down, but putting the lives of all exposed in jeopardy. Several narrow escapes of this kind have occurred. The last tunnel on the South-Eastern Company's lines, that between Higham and Rochester, is now being fitted up with grooved boards; and this board is used on all sustaining walls, of which there are many on the North Kent line; in leading in to stations sometimes down the wall, at other times under the floor. Being prepared by machinery, it is not at all costly.

II. *Compound Needle.*—The first telegraphs made were furnished with long coils and needles. Mr. Holmes introduced the needle, now in general use, in the form of a rhomboid, with a much smaller coil of silk-covered wire. By means of this improvement, legible signals are obtained through longer distances, and can be conveyed very rapidly and distinctly. But the great inconvenience with this needle is the readiness, as we have already mentioned, with which it parts with its magnetism, losing it by little and little during the ordinary use of the instrument, at times suddenly and often totally when lightning discharges occur near the wires. With a view of obviating these inconveniences, Mr. Walker has substituted for it, in the same small coils, an ivory disc, having several short rectilinear needles placed side by side upon it, and at small distances apart. These needles possess all the good qualities of the rhomboidal; but they give a more dead beat, and are less disposed to part with magnetism. They have not yet been tried *in extenso;* but Mr. Walker has tested them for long periods at important stations, and is now about to use them extensively on account of the serious interruption that has occurred simultaneously in all parts of the country from loss of magnetism. During this summer it was not of unfrequent occurrence to have two or three magnetizers, travelling as rapidly as possible from station to station, to remagnetise; and sometimes before their day's work has ended, demagnetization had again occurred at some stations.

III. *Bell Transferers.*—This application is not generally employed, and is constructed specially for the chief office at Tonbridge. It is for placing the bell, when one part of the line is in use between London and Dover, on the part or side not in use, so that its ring may be heard, and thereby notice given that the line is wanted. By this arrangement the necessity of cutting short the communication, or rendering it as brief as possible, is indicated.

The bell and needle being on the same wire, this wire is cut at Tonbridge in the three proper places, viz., between London and the bell, between the bell and the needle, and between the needle and Dover, making six ends. These ends are made to terminate in springs, which rest on brass plates, inlaid in a wooden cylinder. In one position of the cylinder the springs are connected in the order, London, bell, needle, Dover; so that when talking to Dover, having the line cut off between the needle and the bell, by connecting the wire here with the earth, the bell can be heard to ring, should London send a current along the wire. In the other positions of the cylinder the springs are connected in the order, London, needle, bell, Dover; and similar advantages are experienced in respect to Dover. This plan works well. On the same principle of combination Mr. Walker constructs all his turn-plates, of which he has many varieties: the following is one:—

IV. *Branch double Turn-plate.*—This apparatus is used at junction-stations for putting branch lines of telegraph in communication with either end of a main line. It is constructed by intercepting the branch wires before they terminate in the earth, and by cutting the main wires and providing springs at the intersections. The springs are so arranged that, in the normal position of the drum or cylinder, the terminal stations of the main line are open to each other, and the branch line terminates at the junction-station. In another position of the drum, the London terminus of the line is connected with the branch line, and the wires from Dover end at the junction-station. In a third position of the drum, the Dover terminus is in connection with the branch line, and the wires from London end in the junction-station. This is in daily use at the stations on the line, and acts well.

V. *Lightning Conductor.*—This consists of a small hollow metal cylinder connected with the earth, its purpose being to conduct away the discharge. The line-wire, in its passage from the railway to the telegraph, passes within this cylinder; traversing which it is first presented to the inner surface in the condition of a thick wire, furnished with spurs, whose points are in the closest possible proximity to the cylinder, without being in actual contact; it is then continued on and presented as a short coil of very fine wire,—finer, in fact, than that of the instrument coils, wound on a bobbin,—the outer convolution of the coil being very close to the cylinder. Thus a better means of escape is presented to the lightning than is to be found in any part of the instrument, consequently it always escapes by this conductor either through the points or by burning the fine wire. As yet no instance has occurred in which these conductors have failed to act, and to preserve the instrument; while instruments in the same office, not thus protected, have on several occasions been damaged.

VI. *Graphite Battery.*—The ordinary telegraph battery consists of plates of amalgamated zinc and clean copper, in cells filled with pure sand, saturated with diluted sulphuric acid. The majority of telegraph batteries are in actual use during a small portion only of each day, remaining at rest for the remainder of the twenty-four hours, ready for use and in good working order when required. During this time of inactivity there is a continuous slow action between the diluted acid and the copper, whence is produced sulphate of copper, which in its turn becomes decomposed, and the copper released upon the zinc, induces local action, greatly reducing the power of the battery and destroying the zinc, so that it requires to be changed and cleansed more frequently than would otherwise be the case. To obviate this, Mr. Walker sought for a substance that might possess the good properties of the copper-plate, but which should not be acted upon by the acid. The corrosion deposited on the interior of old gas retorts is admirably adapted for this purpose, and he has had it cut into plates by circular saws, worked by steam machinery. He has preserved the history of a 12-plate battery, which was connected up to do telegraph duty, where the waiting-time was very great as compared with the working-time. It was charged in the usual way, with diluted sulphuric acid, on April 5, 1849, and remained efficient till the middle of February, 1851, without having been washed or having had the sand changed. It was supplied with about a dessert-spoonful of acid water twenty-one times during the above period of ninety-seven weeks, and six times with merely warm water. It suffered most from mere evaporation; in some cases it did duty for thirty-four, thirty-nine, and forty days, and in one instance for seventy-seven days, without having been touched. On September 15, 1851, it was dusted and had a little acid water poured in, when it still gave a feeble working current.

VII. *Moveable Studs.*—This is a very simple arrangement, and originated with Mr. Walker. The motion of the telegraph needle is limited within a certain angle by two small ivory studs. In the year 1848 there were so many magnetic storms and other abnormal conditions, that the needles were very frequently deflected in either direction, and often hard up to the studs, so that the power of deflecting in that direction for the purpose of signalling was lost, the needle being already there, and thus the telegraph was rendered nearly useless; indeed, quite so in the hands of inexperienced clerks. To remedy this, Mr. Walker has mounted the studs on a circular and moveable disc, so that in proportion as the needle is deflected abnormally, the studs may be moved after it by the motion of this disc, and the needle, though not hanging vertical, may still maintain its position of equilibrium midway between the studs. This contrivance works well, and the Telegraph Company have adopted it.

VIII. *Ringing Handle.*—This is used at stations where the bell has a distinct wire to itself. It enables an intermediate station to send the electric force in the direction only of the station whose attention it is required to call. This improvement is Mr. Walker's, as are also the essential details of the apparatus; before the introduction of which it was found difficult to keep the circuit good. The line wires are cut between the ringing key and the bell, and strong springs are inserted, which press on brass studs and keep good the circuit when the apparatus is in a state of rest. To the handle is attached a moveable cylinder, furnished with two strong studs in proper connection with the respective poles of the battery. By moving the handle, one of these studs, and consequently one pole of the battery is put in connection with a strong brass boss, connected by a wire with the earth, and the other stud, according as the handle is moved to the right or to the left, raises the spring on either side the bell, and sends the current up or down the line, as the case may be. This arrangement is used throughout the South-Eastern Company's lines, and works well.

A Prize Medal was awarded to Mr. WALKER.

ALLAN'S Patent (No. 201, p. 431) consists of a circular dial plate, arranged in a sloping position, with an alphabet and a pointer, which by a handle is brought round to the letter required; at the same time it makes, breaks, and reverses the current. By this means the pointers on the second or telegraph dials are made to indicate the same letter at distant stations.

The chief feature is the form and disposal of the many-poled permanent magnet which works the ratchet-wheel arrangement, thereby giving motion to the pointer or index of the telegraph. The power in this instance is created by two electro-magnets, having their poles projecting between the arms of the many-poled permanent magnet, each pair of arms being so magnetized as to act collectively in conjunction with the poles of the temporary magnets; by this means the frame acting upon the ratchet-wheel is made to alternate in coincidence with the changing of the current, and so cause the axis of the index-hand to rotate.

To impart a rapid movement to the index-hand, the current changer is formed of three metallic discs, insulated from each other, and so arranged as to the number of letters on the dial-plate, that the current is made, broken, and reversed accordingly, and causing the index-hand to pass round at once to the letter required, with great rapidity.

Allan's needle telegraph consists of four electric cylinder coils, placed between the arms of a many-poled magnet of four pair of arms; each arm of each pair is magnetized so as to possess the same polarity; thus when the current passes through the coils, the combined magnet is attracted or repelled in either direction, according to the movement of the current, thereby giving deflection to a needle with great rapidity and precision.

The system developed by these improvements consists in forming magnets out of one piece of steel, with any number of poles required, and placing cylinder-coils, or electro-magnets, between the poles, thereby not only obtaining a much greater amount of magnetic power within a small compass, but also a greatly diminished resistance to the electric current: as each turn of wire in each coil is so placed that the current passing is within effective influence of a magnetic pole, none is lost, whilst the length of wire, and consequent resistance is greatly reduced; the action, too, being direct, likewise prevents the loss or waste of the current power.

The great advantages gained by these combinations are shown by the fact of there being surplus power sufficient to overcome the friction of the ratchet-wheel arrangement, without the assistance of weights or machinery, also with as little battery power as the common needle telegraph now in use.

A Prize Medal was awarded to Mr. ALLAN.

DERING (No. 436, p. 460) has exhibited an electric-telegraph. Mr. Dering suspends his indicating magnet (which is deflected) not by the simple action of the current, but by coil-magnets on either side, so as to have its centre of gravity below the points of suspension: either by elastic bands, by the attraction of a permanent magnet, or by such an adjustment of a straight bar, or pair of watch-springs, as shall give it a decided tendency to a vertical position when not under lateral influence.

Mr. Dering has also exhibited an apparatus for conveying secret signals without extra wires; viz., signals which shall be read off only at given localities without passing along the whole line included in the primary wire. This he has accomplished by placing at each station a step-by-step revolving disc, included in the primary line of wire, but so arranged as not to be set in rotation except by a galvanic force greatly superior to that which makes the ordinary signals, or, when only currents in one direction are used for these signals, then, by the reverse current. This disc, being brought at every station to correspondence in point of position with its position at the initial station, is made by a system of non-conducting interruptions to the continuity of its circumference to establish a break, according to its position, cross connections, or *short cuts* by which the signal current can pass (and therefore will pass) from one point to another of the primary line of wire, without running through the length of wire constituting the local working coil of the station, so that the working of the telegraph at that station is temporarily suspended, the electricity finding for a time a shorter and easier passage. Besides this ingenious contrivance, Mr. Dering has exhibited modes of preventing the disturbing action of atmospheric electricity and the destructive effects of lightning.

Mr. Dering considers—

I. The steel best suited for the electric magnets is that employed to form the balance-springs of watches.

II. As regards the mode of suspension for single telegraphic needles, instead of suspending the needle in a round hole by a round pivot in the middle, or nearly so, Mr. Dering finds it in all cases better in practice to use a triangular-shaped hole at the *upper end* of the needle, with a round pivot on which to suspend it. This allows freedom of motion quite sufficient, whilst it entirely checks vibration. The instrument on this principle exhibited, shows the great rapidity in the change of place of the needle combined with freedom from vibration.

III. By a peculiar arrangement of coils for producing motion in telegraphic needles, with the same number of convolutions, the total length of wire is lessened, and thus the battery force required is diminished.

IV. In the apparatus for the transmission of secret messages, by throwing stations out of the line of communication, there is a means provided of instantly restoring the revolving discs at any moment desired, and from any position, to the starting point.

V. In case of a telegraphic needle being deflected by the aurora borealis, or other slight atmospheric influence, Mr. Dering places in the circuit of the line-wire a battery of sufficient force (regulated by the number of galvanic elements) to counteract the disturbing influence, and thus restore the needle to its ordinary position of equilibrium.

VI. An instrument for protection against atmospheric electricity is also exhibited, as described under the eighth head of specification in Mr. Dering's patent. In this the size of the balls may be increased to any extent, provided their distance from the opposed plates be in a proper proportion diminished. This would prevent the chance of the destruction of any part of the safety apparatus.

The Jury considered Mr. Dering as deserving of very Honourable Mention for the great ingenuity he has displayed in these inventions.

BRETT (No. 422, p. 455) has exhibited a patent electric telegraph alarum-bell, bell-handle, and battery. The various letters or numbers represented on the face of the dial of the electric telegraph are made by the motion of either or both of the indicators, the number of which motions for each letter or number is defined by the figures on the centre of the dial, commencing at all times with the indicator on the side next the letter or number, and when both indicators are used, finishing with the opposite one. The helices being double and of a circular form, the greatest amount of electricity is concentrated in their centre, and the magnet being in the form of a ring or horse-shoe, suspended in the centre of the helices, its poles are acted upon by the maximum amount of force, by which great certainty is attained, and the magnet is deflected to the right or left according to the direction taken by the current. The poles of the magnet being equidistant from the earth, the magnet is rendered static, and is not affected by terrestrial magnetism.

LITTLE (p. 455) suspends a common sewing-needle within a tube containing alcohol by means of a permanent magnet at the upper end, so that it can deflect without friction, and does not jar against the electro-magnetic coil on either side which deflects it, while the permanent magnet keeps up the magnetism of the needle.

ALEXANDER (No. 426, pp. 455, 456) exhibits a model of an electro-magnetic telegraph, described in the Illustrated Catalogue. It is interesting as representing an early development of the idea of a needle telegraph. It has 30 line-wires, 30 galvanometers, and 30 needles; the latter carrying each a paper-screen, which, when moved, unveils a letter, &c. The galvanometers are not calculated for actual work in real practice; and, as only one wire is used as a return wire, common to all the galvanometers, there must follow a distribution of electricity among the rest of the wires, fatal to real signalling. The earth is the return circuit in all practical plans.

SMITH (No. 424, p. 455) exhibits a comic electric telegraph. This is a three-wire telegraph, and the author considers that, by three combinations, all that is necessary in telegraphic communications can be performed.

MCNAIR (No. 421, p. 455) exhibits specimens of electric-conducting wires for subaqueous purposes. The process of making this wire is by first placing a coating alternately of gutta-percha, or caoutchouc, and braiding of cotton-thread, till the cumulation is of a given thickness: after which it has an outer coating of gutta-percha, and is then placed down a hollow mandril, and by means of a great hydraulic pressure, a lead covering is placed around it, embracing it so firmly that the whole is one compact body. This article seems to answer its purpose well; and, although there were many specimens of subaqueous wire in the Exhibition, yet, for the most part, their base is Mr. McNair's wire.

WHISHAW (No. 419, pp. 454, 455) has exhibited well-made gutta-percha tubes, furnished with ivory mouth-pieces, useful for talking across rooms, or in a railway carriage, or for deaf persons: an early specimen of gutta-percha tubing and lathe-bands: submarine, insulated electric copper wire, covered with gutta-percha, braided with linen, and painted or varnished. These specimens would not bear the wear and tear incident upon the knocking about they would meet with. A long wooden box, to be used as a battery protection; a private code box—this is a box with a sloping front perforated with slits; letters are arranged vertically on the side, and horizontally on the top. Within the box are as many rollers as there are slits in front, around which are wrapped long bands of paper, each having a communication printed thereon, and repeated many times. The end of each band projects so that it may be easily drawn out. By looking at the two letters corresponding with those sent from the Telegraph Office, the communication is at once discovered. A model to illustrate the hydraulic telegraph. The hydraulic telegraph was invented in the year 1837, and from that time there have been several modifications; some have been furnished with floats and indexes carrying letters, &c., some with floats and metal-rods, which, on being either elevated or depressed, point to letters, &c. A reservoir for the supply of the water, and a tank for the waste are required at each station. In the model exhibited, a syphon-tube shows the application of the water itself, which rises and falls in the tubes by opening or closing the respective cocks. Patent glass tubes, to insulate and protect the wires of the electric-telegraph when placed under ground. The use of these would be found to be expensive, and probably, hazardous.

Patent multi-tubular pipes, of glazed earthenware, well-made; their use is to insulate and separate the wires of electric-telegraphs when placed under ground. Probably these would be perfectly insulated with gutta-percha wires, but, if broken, there would be some difficulty in replacing them. The desiderata are, great durability and great accessibility.

Wrought-iron pipes, with ball and socket joints. The length of each pipe is 2 feet, and allows an inclination of about 10 degrees, forming a subaqueous chain for protecting electric telegraph wires when under water. This arrangement seems to be good.

This completes the British portion of the exhibition of electric telegraphs, and from it a very good picture of the English systems of telegraph is presented. One out of the only two specimens which have been sent from abroad is that of Siemens and Halske, Prussian system, and which we proceed to describe:—

SIEMENS and HALSKE (Prussia, No. 310A, p. 1067). The telegraph exhibited by these inventors is extremely ingenious, and the construction and details are very good. It differs essentially from all others that have fallen under our notice, in that signals are made by arresting, instead of by causing, the passage of electric force. It consists of three parts,—an alarum, an indicating dial, and a printing arrangement. The force is derived from voltaic batteries. Daniell's constant battery is employed, twenty-five pairs of which, at each station (for the batteries at both communicating stations act in concert), are said to act through about 250 miles of wire. The force, in all cases, is made available by means of electro-magnets. And first, in respect to the arrangement, when no communications are passing, but the stations are each in a condition to receive notice that they are required to attend.

The bells alone are left in the circuit. When a current passes along the wire, the keepers of the electro-magnets, which are on one arm of a lever, are attracted, which causes a small hammer on the other arm of the lever to strike a bell. The clerk who desires to call attention turns his own bell out of circuit, by moving a lever, and, at the same time, turns his battery and his telegraph instrument into the circuit, and then leaves them. This allows the electric force to have free course, and the distant bell to ring; but the electro-magnet of the alarum is so adjusted that the circuit becomes broken the moment the armature leaves its normal position, which it does by the attraction of the magnetism: the magnetism, therefore, ceases with the cessation of the current, and the armature returns again to complete the circuit; and so on, alternately, producing a succession of blows upon the bell. During this time, the telegraph instrument of the first station, although in the circuit, is perfectly inactive; being so arranged that its electro-magnet is much less sensitive than that of the alarum, its armature requiring more electric force, or more time to acquire motion, so that the circuit is broken by the action of the alarum before the telegraph has been able to move. When the sounding of the bell has gained attention at the distant station, the officer in charge there turns his alarum out of circuit, and introduces his telegraph instrument and his battery. There are now in circuit a battery, and an instrument at each station, which are so arranged that the two batteries combine to produce a current in one constant direction, and, hence, both act simultaneously on both instruments.

The instrument presents a circular dial, around which are engraved the letters of the alphabet, or other conventional signals, and is furnished with an index, which, under the conditions above named, continues traversing the circle at the rate of about thirty times per minute. The two (or more, as the case may be) instruments act precisely in concert, which is thus accomplished:—

The armature of the electro-magnet carries a lever, at the end of which is a claw; that advances one tooth of a ratchet-wheel (mounted on the same axis with the index) at every attraction. But this armature breaks the circuit at each attraction; and the magnetism ceasing, it is returned to its normal position by the action of a slight spring, again to complete the circuit, and to draw on one more tooth of the wheel, and cause the index to advance, and so on. All things being in order, the alternate making and breaking of the circuit are simultaneous on each instrument, and the indices of each point to similar letters at the same time. In order to turn this arrangement to account, the dial is surrounded by a circle of studs corresponding to their respective letters. On pressing any one of these down, it impedes the progress of the ratchet-wheel just at the time when the circuit has become discontinuous, and no current is passing. The index, therefore, of each instrument rests at the letter in question, and continues its course only when the stud is allowed to return, and the wheel is liberated.

With the following additions this instrument becomes a *printing telegraph*. The ratchet-wheel is furnished with radii, consisting of springs, each having a type-letter at the end, directed upwards. In the revolution of the wheel, these types pass between a hammer below and a blackened cylinder above, and between the type and the cylinder passes a band of paper. The hammer is on one arm of a lever, the other arm of which carries the armature of a supplementary electro-magnet, which magnet is in the same circuit with the magnet of the indicating instrument. A current passes through the two simultaneously, but is so instantaneously cut off that the magnetism has not had time fully to develop itself and to attract the armature; but the act of depressing the stud, which causes the index to rest for a moment at a given letter, is contrived to keep the circuit of the printing magnet complete during the same interval, and so to allow the full development of its magnetism, and to cause the attraction of its armature. The type-letter in question is at this moment between the hammer and the paper band. The armature, being powerfully attracted, causes the hammer to strike a smart blow upward, and then to press the paper against the blackened cylinder, which prints the form of the letter. Letter after letter is thus printed, and a blank is touched at the end of each word. When the blanks are struck, the hammer, meeting with no resistance, moves a little further, and enables a lever attached to it to reach a bell, which was beyond its former limit, and thus the sound of a bell is heard at the end of every word. At the same time that the hammer strikes a letter it breaks the circuit of the printing magnet, and thus liberates itself, and returns to its normal position the moment its work is done.

The lever that carries the hammer is likewise provided with arrangements for advancing the paper the width of one letter as it returns to its position of rest, so that the letters follow in due succession; it also advances the blackened cylinder in the direction of its axis, so that it shall not become exhausted by always printing from the same surface.

There are other arrangements provided for facilitating the transmission of electric force to long distances, and for overcoming some of the difficulties that occur in practice.*

A Council Medal was awarded for this beautiful system of telegraph.

The remaining foreign Exhibitor—

Stöhrer (Saxony, No. 15, p. 1105), exhibits a magneto-electric telegraph. It is applicable to the ordinary use of telegraphs. In practice the hand always turns the same way. Attached is an alarm bell, which is readily put in and out of connexion.

A Prize Medal was awarded to Mr. Stöhrer.

Domestic Telegraphs.

Burdett (No. 425, p. 455) has exhibited a domestic telegraph, designed to supersede the use of bells in mansions, club-houses, hotels, and large public buildings. The machine itself presents a smooth surface or dial, with various numbers indicated upon it. Every room in the establishment with which it is in connexion, being numbered, is furnished with a wire attached to the corresponding number of the machine, which has a bell attached to itself. On any one of the wires being pulled, the fact is indicated by the striking of the bell, the indicators pointing at the same time to the corresponding number of the room which requires attendance; before doing which, the attendant should replace it, by pressing down the lever at the foot of the dial; but, should several indicators on the face of the dial denote that several wires have been pulled at the same time, the machine is so contrived that he may replace them successively as they are attended to. It is intended to obviate the confusion attendant upon the ringing of a number of bells at the same time, a source of great perplexity to the servants; as the bells having ceased ringing, they are deprived of the means of knowing in what part of the house their attendance is required. The machine is by no means unsightly, and is far less expensive than the ordinary fitting up with bells.

Reid (No. 427, pp. 456, 457) has exhibited a pair of electric telegraphs, adapted for the use of hotels, taverns, public gardens, &c.

Also, another pair, for railway boards, public companies, manufactories, &c.

A pair of electric telegraphs for domestic purposes, adapted to gentlemen's dressing-rooms, libraries, or ladies' boudoirs, &c.

Also an electrical apparatus for ringing bells in large mansions, hotels, &c. To be brought into immediate action by pulling a cord or lever, as with common bells. This instrument is designed to act at great distances with ease and rapidity.

Whishaw (No. 419, pp. 454, 455) has exhibited a domestic telegraph. The dial, which has an index hand affixed to it, has also engraven upon its face a number of short sentences or written orders for requisites, such as are likely to be called for at the establishment to which the telegraph belongs. The index points to any one of these sentences as required, the communication being established by means of wires and cranks in connexion with a clock movement.

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* For a full description of Siemens and Halske's telegraph, with plates, see Schellen, Der electromagnetische Telegraph, Braunschweig, 1850.

BROOKS (United States, No. 222, p. 1450) exhibits a bell telegraph for the use of hotels, &c., consisting of one bell, with a series of springs; it seems well adapted for its work.

HOWLAND (United States, No. 486, p. 1465) has exhibited a bell telegraph for the use of hotels, dwelling-houses, steam-ships, &c., and is designed to avoid the complication of bells necessarily employed in large establishments. Each signal on the dial of the instrument is distinct, and remains fixed until relieved by an attendant. It may readily be attached to the usual arrangement for bells. It is ornamental and requires but little space.

Chemical Apparatus.

A very small number of manufacturers have contributed to the Exhibition, and, with the exception of **QUENNESSEN** (France, No. 1683, p. 1257), and **STAFFEL** (Russia, No. 148, p. 1371), no great preference can be given to one or the other of the principal Exhibitors. It may, however, be mentioned, that, more or less, the chemical glass and china apparatus, made by German manufacturers, have been exhibited by the majority, which indicates its adaptation to practical use, as might be expected from its greater lightness and durability.

No new invention, except that of Mr. Staffel, nor any new application of known construction of apparatus, is mentioned.

KNIGHT and SONS (No. 453, pp. 462, 463) exhibit a chemical cabinet, containing apparati for laboratories, graduated cylinders, jars, blow-pipes, an improved bellows, pneumatic troughs, chemical tests; lamps, retorts, and other glass articles; apparati from iron and earthenware, arranging furnaces, mortars, &c., being a complete set of articles in daily use by the practical chemist.

This cabinet is intended to combine usefulness with economy: it is proposed that such cabinets should be fitted up with apparati and tests for the agriculturist, the analyst, the commercial man, and the student, with the prices attached to each article, so that the amount of the first outlay being under control, the ultimate expense may be known with certainty, and the difficulty of selecting appropriate and useful apparatus avoided; as well as the necessity of devoting an entire room to the purpose. This cabinet promises to be highly useful.

A Prize Medal was awarded to Knight and Sons for their chemical cabinet.

Knight and Sons also exhibit a chemical furnace on the same principle as that of Dr. Black, which is constructed of stout sheet-iron lined with fire-bricks, and is applicable to nearly every purpose for which a furnace is required; one sand-bath, stoppers, crucibles, muffles, rings, &c.

Knight and Sons also exhibit a galvanic battery, according to the arrangement of Daniell, consisting of a series of six cells, each holding a copper cylindrical vessel, to be filled with a solution of sulphate of copper, in the centre of which is a porous tube, filled with diluted sulphuric acid, and containing an amalgamated zinc rod; also a battery on Grove's arrangement, consisting of a series of six cells, each comprising a glass vessel, containing an amalgamated zinc plate, to be filled with diluted sulphuric acid, having in the centre a flat porous cell, with a platina plate, and filled with nitric acid; also another battery on Green's arrangement, consisting of a series of six cells, each comprising a glass vessel, containing diluted sulphuric acid; to each cell is a series of three plates, the centre one being of platinised silver plate, and the others amalgamated zinc. These plates are connected to one rod and can be easily raised out of or lowered into the liquor.

A galvanic battery, on the Maynooth arrangement, consisting of a series of ten cells, each being a cast-iron trough, filled with diluted nitric acid. In each cell is placed a porous cell, charged with diluted sulphuric acid, containing an amalgamated zinc plate.

A galvanic battery, consisting of cells formed of gutta-percha filled with sand, saturated with diluted sulphuric acid, each cell containing a copper plate, and one of amalgamated zinc.

GRIFFIN (No. 457, p. 463) exhibits graduated glass instruments, applicable to the examination of carbonate of soda and carbonate of potash, of all degrees of impurity, ammonia, sulphuric acid, muriatic acid, acetic acid, and vinegar of all strengths, bleaching powder, and bleaching liquors generally; the graduation of these instruments is executed on the principle of assigning a fixed volume to the atomic weights of each chemical compound when in solution, and so producing a series of equivalent test liquors. The standard is made on the consideration that 100 grains of oxygen, in a deci-gallon of solution (being in the proportion of 1,000 grains in a gallon), at the temperature of 62° Fahr., produce a solution of 100°, which represents a quantity of any chemical substance equivalent to 100 grains of oxygen, or its atomic weight expressed in grains, contained in a deci-gallon of the solution.

Thus—

503·38 grains of hydrate of soda,
667·34 grains of anhydrous carbonate of soda,
1792·13 grains of crystalline carbonate of soda,

dissolved respectively in water, so as to make a deci-gallon of solution at 62° Fahr., are of the same chemical strength.

In like manner

643·19 grains of anhydrous acetic acid,
455·13 grains of anhydrous muriatic acid,
501·165 grains of anhydrous sulphuric acid,
2028·64 grains of nitrate of silver,

brought into aqueous solutions of the above bulk at 62° Fahr., are all solutions of 100° of chemical strength. The extreme convenience of this system carried out in a laboratory in respect to the saving of time, thought, and calculation, and its power of securing uniformity of manipulation, must be obvious to every chemist.

The graduation of all the glass measures applicable to these investigations, as well as all others exhibited by Mr. Griffin, is exceedingly accurate and good, the divisions from 10° to 10°, being performed by Ackland's graduating machine, which gives correct aliquant parts. The unit of measure, to which the small measure, called pipettes and alcalimeters, is referred, is termed by Mr. Griffin the *septem*, by which is meant the bulk of seven grains of water, at the temperature and under the barometric pressure at which the imperial measures are regulated: 1,000 septems make a deci-gallon, corresponding to 1 lb. avoirdupois of distilled water, and the tenth part of an imperial gallon of water. The septem, therefore, is identical with the milli-gallon.

Mr. Griffin exhibits a set of decimal weights and measures founded on the imperial gallon and the 1 lb. of 7,000 grains.

This Exhibitor, in addition, has given a rich collection of objects, for the most part similar to those exhibited by No. 453, consisting chiefly of apparati for making assays with the blow-pipe, mineralogical boxes, a large collection of graduated glass apparati, applicable to various purposes, boxes fitted with chemical tests, alcalimeters, saccharometers, areometers. In the arrangements made by Mr. Griffin for special purposes, everything necessary has been included, to the exclusion of all else, with especial reference to economy and convenience.

A Prize Medal was awarded to Mr. Griffin.

EDWARDS (No. 438, p. 461) has exhibited retorts, phials, and capsules, covered with an electrotyped precipitate of copper, to protect them against cracking by heat; all these articles are good. The covering of glass vessels with copper is not, however, new; but its use would appear to be very little known in England.

The Jury considered Mr. Edwards deserving of Honourable Mention.

IBBETSON (No. 459, p. 463). Blowing apparatus, constructed with two circular bellows, for the purpose of a continuous blast.

STATHAM (No. 456, p. 463). Boxes fitted with chemical tests, in various sizes, pneumatical troughs, &c.

BAKER (No. 396, pp. 451, 452) exhibits a saccharometer and lactometer; but it is to be remarked, with respect to the former instrument, that the optical analysis of sugar surpasses all other modes.

COFFEY (No. 454, p. 463) exhibits chemical apparatus. In a few square feet are comprised the means of performing some of the most important and troublesome operations of the laboratory. It contains *a still* (or steam-boiler), with sets of moveable pans for decoctions, extracts, evaporations, steam-baths for retorts, stills, &c., drying-closet, a condenser for steam, and worms for other stills, the chamber containing them acting also as a stove and condensing tube. The temperature can be regulated with great exactness, by means of steam-cocks and valves. An improved feeder, a steam-gauge and thermometer, a safety-valve and alarum, are attached to the boiler.

JOHNSON and MATTHEY (Class I., No. 477, p. 161) have exhibited palladium crucibles and capsules. The use of palladium for this purpose has many advantages. Its infusibility, though not so great as that of platina, is such as to enable it to resist the greatest heats applied in all ordinary chemical operations, while it is not subject, as platina is to a considerable extent, and gold, in some degree, to be attacked and corroded by the caustic alkalis at high temperatures. It is much less fusible than gold or silver, and, like the former, resists the action of all acids. For this valuable accession to the list of chemical utensils a Prize Medal was voted.

[It may not be irrelevant to the subject of this report, to suggest as worthy the attention of chemists, the practicability of coating, by galvano-plastic processes, the interior of clay or plumbago crucibles with films of platina, palladium, gold, or even silver (as the use to which they are to be applied may require), of sufficient thickness and cohesion to withstand a moderate amount of mechanical abrasions, and to intercept the action of saline matter in fusion on the crucibles. Much of the original cost, both of material and fabrication, would thus be saved, and the material might be recovered by acids from the worn-out or broken utensils.—J. F. W. H.]

HORNE, THORNTHWAITE, and WOOD (No. 220, pp. 434, 435) exhibit a galvanic machine for medical and other purposes, with a case of instruments for its application. The novelty of its construction, and that upon which its utility depends, is, that the current of electricity produced should be of considerable intensity, and flow in one direction only. It is composed of one coil of stout insulated copper wire. A Smee's voltaic battery, with an arrangement for lifting the plates out of the acid when not in use; and a balance galvanometer, for indicating the strength of galvanic currents by means of grain weights.

HEARDER (No. 439, p. 461) has exhibited a galvanic machine, with a graduated regulator employed to administer galvanic electricity. It is intended to regulate the intensity of the shock by means of two moveable indices; that on the left by advancing over a graduated arc produces equal increments of power, that on the right by moving over an arc which subdivides the increments of the first index into four parts, makes the advance from one extreme to the other gradual. The difference of construction consists in the proper adjustment of the length and thickness of the generating or primary coil to the electro-motive force of the battery, by which the battery surface is much reduced, and a higher degree of magnetism produced in the iron core. The instrument is compact, the bottle of dilute acid being contained in the box of requisites. The high magnetic power permits the use of strong springs which vibrate rapidly: the great range of power is also equally divided. It is the invention of Mr. Hearder, of Plymouth, and is intended for the use of private families. It may be mentioned that a difference of construction has been resorted to for the purpose of increasing the attractive power by means of a small iron rod in the centre of the core, which is employed to exert a more powerful attraction upon the iron armature of the spring, the shape of the armature itself being peculiar.

TAYLOR (No. 466, p. 464) exhibits a pneumatic battery for igniting gunpowder in blasting operations.

NUNN (No. 371, p. 450) exhibits a hydrometer, capable of ascertaining the specific gravities of all fluids, its range including 0·6 to 2·0. The point of most interest in this instrument consists in the being able to insert certain weights with the instrument below the centre of gravity, thereby rendering its uniform bulk of any specific weight that may be required. By this means considerable accuracy and efficiency are obtained.

LYONS (Class VI., No. 203, p. 291) exhibits several batteries, and claims improvement for his introduction of wood instead of porous cells, which by rendering the deposition of copper more regular in its action, and more constant in its deposition, constitutes an arrangement by which no copper is lost. In consequence of the action of the sulphate of copper being limited to the surface of porous cells, holes were made in the cells, so that the solution becoming acidulated, acted upon the copper: Mr. Lyons, to obviate this, introduced a gutta-percha tube, perforated with holes, and found the copper clear and equal throughout, also the solution of equal strength both at the top and bottom.

The principle here exhibited is that of economizing the battery power.

Mr. Lyons has also introduced methods by which he makes the usual waste available for battery power, by having two cells of gutta-percha, the one fitting within the other, charged with aquafortis; by the introduction of plates of iron on either side, with zinc in the centre, and suitable arrangements, he saves the oxide of copper by its being thrown down. Mr. Lyons has the merit of arrangements whose objects are constant and regular action, cheapness, and suitability to the performance of all that to which electro-magnetism is usually applied.

QUENNESSEN (France, No. 1683, p. 1257). This exhibitor stands first in the exhibition of chemical apparatus, having exhibited a platina alembic for sulphuric acid, containing 250 pints, *made in one piece, without seam or solder;* also long platina tubes, made without seam, besides crucibles, capsules, &c., all of which are executed with the greatest care, and appear to be of the most finished and exquisite workmanship. Among the articles in platina exhibited by M. Quennessen is an apparatus for the distillation of hydrofluoric acid, of a very complete and perfect kind. A Council Medal was awarded to M. Quennessen.

CHUARD (France, No. 123, p. 1177) exhibits a gazoscope, an apparatus so constructed as to indicate the presence of hydrogen gas, when in an atmosphere containing only $\frac{1}{180}$th part of this gas, that is to say, 1 part of gas to 179 of atmospheric air.

In the year 1843, several engineers were appointed to test the gazoscope, in the coal-mines of St. Etienne, and they reported favourably upon its efficacy in preventing explosions of all kinds during the time of trial, viz., during the months of October, November, and December, 1843. According to Sir Humphry Davy, the proportion necessary to an explosion is about $\frac{1}{14}$th; and, consequently, if the presence of so small a portion as $\frac{1}{180}$th can be shown, its presence would be made manifest long before an explosion could take place.

M. Chuard also exhibits a new safety-lamp, which has been made at the expense of the Board of Health at Paris, for the use of establishments containing spirits, essences, ether, or any kind of volatile and inflammable substance. It possesses the advantage of having no wire gauze and is filled by a tube. It extinguishes itself when the gas becomes explosive, and is inexpensive. The construction of this lamp is very ingenious, and the Jury regret (it not having been patented) their not being at liberty to describe it.

M. Chuard also exhibits a lamp for chemical purposes, &c.

The Jury awarded the Prize Medal to M. Chuard for his safety-lamp.

BONNET (France, No. 1096, p. 1230) has exhibited an assay furnace and a small assortment of crucibles of white clay. Also a small melting furnace, remarkable for the facility with which it can be taken to pieces and cleaned.

DEYEUX (France, No. 476, p. 1200), has exhibited a large and complete assortment of utensils of the same description.

LEMOLT (France, No. 303, p. 1191) has exhibited a galvanic battery, patented in France and England, in which zinc is combined with a preparation of carbon agglutinated.

KAPELLER and SON (Bavaria, No. 28, p. 1099) have exhibited black-lead crucibles, for melting gold, silver, iron, steel, &c. These crucibles have a high reputation for supporting with security the highest temperatures, such as are requisite for smelting iron, steel, &c., and which is due to the introduction of a fire-proof strengthening substance. They are also very cheap, a crucible to carry 100 marks' weight, being sold for four shillings free from Rotterdam. The Jury award Honourable Mention to these crucibles, &c. (Prize Medal awarded in Class XXVII).

SEEL, jun. (Prussia, No. 483, p. 1078), has exhibited a remarkably complete and beautiful steam apparatus, fitted for chemical and pharmaceutical purposes, with still, digesting, and evaporating vessels, and cases for drying and filtration, at *single* temperatures, in German silver, and which may be considered one of the most complete things of the kind in the Exhibition. A Prize Medal was awarded to Mr. Seel.

ARNOLDI (Prussia, No. 778, p. 1093) has exhibited a good assortment of chemical apparatus, crucibles, evaporating basins, funnels, &c., made of white clay from Thuringen Forest, much resembling, in appearance and quality, our Wedgewood ware for similar uses. In particular may be noticed the great size of some of the vessels, such as a cylindrical one 2 feet in depth and 18 inches in diameter; also a hemispherical basin, 20 inches in diameter.

GRESSLER (Prussia, No. 854, p. 1096) has exhibited a carbon battery, in which the zinc rods have for their section a rectangular cross to expose a greater surface, and the exterior cylinder is composed of carbon powdered and strongly agglutinated by sugar, it is understood, or other saccharine cement, so composed as to dissolve with extreme slowness.

Dr. REINSCH (Zweibrücken, Bavaria, No. 831) has exhibited a galvanic battery of his own invention, in which a zinc cylinder surrounds one of earthenware full of powdered coke. It is used to excite an electro-magnetic apparatus.

KINZELBACH (Wurtemburg, No. 26, p. 1115) has exhibited a silver hydrometer.

WOLFF (Wurtemburg, No. 13, p. 1115) exhibits various chemical apparatus and graduated vessels for measuring fluids. Honourable Mention was awarded by the Jury to Mr. Wolff for his pharmaceutical apparatus for distilling.

LUHME (Prussia, No. 83, p. 1053) has exhibited a rich collection of pharmaceutical apparatus: lamps of different kinds for cooking, calcining, distilling; gasometers constructed in glass, and japanned zinc areometers, mortars, machine for making pills, platina crucibles, an apparatus in platina for preparing hydrofluoric acid; simple apparatus for ascertaining the quantity of sugar in solution by polarized light; glass tubes and various kinds of apparati for use in laboratories made at the Zechlin glass works. For this valuable collection of chemical apparatus the Jury voted a Prize Medal.

BATKA (Austria, No. 135, p. 1014) exhibits boxes with chemical tests, lamps, retorts, supporters in wood, alkometers, various kinds of apparati made from Bohemian glass, and a test apparatus for beer, after the design of Professor Steinheil, of Vienna. A Prize Medal was voted to M. Batka.

BRANDEIS (Austria, No. 133, p. 1014) has an apparatus for the chemical analysis of beer, invented by Professor Balling, of Prague.

STAFFEL (Russia, No. 148, p. 1371) exhibits an apparatus for assaying precious metals.

This invention of Mr. Staffel is intended to supersede neither the solution by fire, nor the various chemical tests which have been brought to a state of great perfection; it is simply designed for practical purposes, when neither acids nor fire can be made available. The apparatus is constructed on the principle of *specific gravity*, which has been extended to *specific volume*. The great difficulties to be contended with were, 1st, the elasticity of the air; 2ndly, its temperature; 3rdly, capillarity; 4thly, the closing of the apparatus hermetically; and, 5thly, the furnishing a scale for various weights; but after four years of unwearied study and labour Mr. Staffel overcame these difficulties. The apparatus consists of a glass tube, fixed in a brass case, the bottom of which forms a cylinder, which receives its movement by means of a screw. An annular dial, furnished with a *hair*, for an indicator, shows the degrees from 0 to 99, and controls the motion of this screw. The degrees, from 100 and upwards, are indicated on a plate, fixed at the side, which plate stands in connexion with the dial.

The glass tube is closed hermetically at the top with a glass cover, to which is annexed a capsule, a perpendicular glass cylinder, and two brass bars, serving as a scale.

By the side of the apparatus is a bar, by means of which the dial is brought to zero, and at the same time the fluid in the cylinder is reduced by means of a handle to the normal point. The object to be tested is then weighed by means of weights adapted to the purpose; after which the object is placed in a grate suspended within the fluid, and the capsule carefully closed. The handle is then set in motion and turned, until the weight, previously ascertained, is indicated upon the dial, while the fluid in the perpendicular cylinder will rise to a degree corresponding with the figure on the dial. The figure thus obtained gives the alloy, the remainder the amount of pure metal. For example, if it be required to test an object weighing 24 grains, it will be necessary to stop the dial-hand at 24, and of the fluid in the cylinder, then 8, the result will be

$$24 - 8 = 16,$$

which will give the standard of the gold.

If the gold be alloyed with silver and copper, which will be indicated by the paleness of the colour, it will be necessary to refer to the brass bar for the purpose of showing the alloy. The differential weights of the alloy between gold and copper, and between gold, silver, and copper, are indicated by various scales.

If the object weigh 39 grains, and the cylinder show 11, then the result will be

$$\frac{39 - 11 \times 24}{39\cdot} = 17\cdot23 \text{ proof.}$$

The volume of fine silver or gold is marked . . F;
The volume of copper, or any other alloy is marked C;
The volume of specific difference is marked . . D;
The volume of weight is marked . . . 1, 2, 3, &c.

If a fusion of 28 F + 11 C is to be made, the figure must be F = C − D, of F + D = C, or 28 F + 11 C = 39 F + 11 D = $\frac{11}{39}$ copper or alloy.

The practical utility of the instrument will chiefly be—

1st. The determining the quantity of gold or silver used in manufacturers' wares from either of these metals, and thereby enabling the employer to ascertain whether the finished article contains the exact amount of metal furnished to the workmen.

2ndly. In ascertaining, if required, the value of a chain, though the gold used in the several links be of a different standard.

3rdly. In previously ascertaining the standard of a fusion, when various sorts of silver, of unequal size and weight, are to be melted together.

4thly. In ascertaining the value of coins with the greatest accuracy and despatch.

Fire Annihilators by Chemical Application.

PHILLIPS (Class V., No. 92, p. 222) has exhibited a fire annihilator. This is a portable machine for the immediate production of steam, and carbonic acid and other gases, which, being directed upon the burning matter, is designed to check the progress of the flames more speedily than the usual application of water. It is in form cylindrical, and slightly conical; it varies in size from 16 by 8 inches to 24 by 12 inches, and is comparatively inexpensive.

For use, it is charged with a composition of powdered charcoal, nitrate of potass, and gypsum, in the following proportions: powdered charcoal, 20; nitrate of potass, 60; and gypsum, 5. These materials are boiled together in water, and afterwards dried in a stove, at the temperature of 100°. The whole is moulded into the form of a brick, down the axis of which penetrates a hollow cavity, for the reception of a bottle, which contains a mixture of chlorate of potassa and sugar, surmounted by a globule of sulphuric acid. The charge so prepared is placed in a cylindrical vessel, perforated in many places, which is itself within another cylindrical vessel, also perforated for the passage of the gases; both these are contained within a double cylindrical receiver, the lower part of which contains a quantity of water. The apparatus is closed by two covers; in the outer of which is an opening for the escape of the vapour. In the centre of the cover is placed a spike, for the purpose of breaking the glass bottle deposited in the cavity of the charge. The spike being forced down breaks this bottle, and the sulphuric acid, falling on the mixture of chlorate of potassa and sugar, causes instantaneous combustion, and spreading over the charge, causes a second ignition at once to take place. The gases thus formed pass through the perforations, and by heating the air in the water chamber, and causing it to expand, forces the water up a tubular passage into the spaces between and around the cylindrical vessels placed each within each; and being thus converted into vapour, mixes with the gases, and escapes by the discharge tube. The discharge forms a dense cloud, which continues until the charge is consumed and the water quite exhausted.

On Thursday, September 26, several gentlemen of the Jury assembled at Battersea Fields to witness Mr. Phillips' fire annihilator in operation. There were present—Sir John Herschel, Mr. Glaisher, Mr. Bowerbank, and Professor Collodon. A rough wooden house, two stories high, filled with planks of wood, shavings, &c., was set on fire, and the doors and windows fast closed, previously to which, a quantity of spirits of turpentine had been poured over the combustibles in the interior, from which in the course of a few minutes the flames were seen issuing from the windows, and on the door being burst open presented an unbroken sheet of flame. The fire annihilator was then brought forward, and the vapour directed into the doorway. The effect was almost instantaneous. The great mass of flame was at once extinguished, and at the same moment dense volumes of smoke were seen issuing from the same place. In the course of a few minutes the fire was entirely extinguished, leaving the walls of the house standing, though considerably charred. Ten minutes after (a few lingering traces of fire to the windward being extinguished with wet mops), the Jury entered without inconvenience; the air within being cool and moist. The experiment, which must be considered as a severe test to the powers of the machine, was considered satisfactory in the extreme. Shortly after, a tank, containing a mixture of tar, shavings, and other combustible matters, was ignited, and afterwards extinguished by one of these machines with equal success; the machine being placed to windward, and the gas thus swept over the burning surface, in a state of most violent combustion, instantly annihilating the flame.

The idea which Mr. Phillips has successfully applied to his fire annihilator was suggested to him by witnessing, some years ago, in the Mediterranean Sea, an eruption from an island, thrown up from a depth of 80 fathoms; he observed that, where the vapour formed by the boiling water, and precipitated upon the lava, came in contact with the flame, the latter was instantaneously extinguished.

The fire annihilator, in its action, may be said to resemble that of a pump drawing water, or the condenser of a steam-engine. The vapour which issues from it enters the building in a highly-expansive state, and extinguishes the flame chiefly by the presence of gases adverse to combustion, but partly also, no doubt, by reducing it to a temperature lower than that at which flame can exist. By degrees, the room being full of vapour, the temperature decreases, and the vapour condensing into water, fresh air enters to supply its place, and renders it possible for men to enter, and complete the work of extinction of the embers. The machine is unattended with any practical difficulties in its use; the mixture of steam and gases may be produced within a few seconds after striking the top for the purpose of breaking the little bottle. The vapour itself possesses the advantage of being less destructive to the unconsumed articles with which it comes in contact, and being also a more penetrative medium than water, is better calculated to act simultaneously upon the innumerable particles of gas which combine to produce flame. It is stated to be perfectly innoxious to human life, which, of course, must be understood to mean during that short time, and in that state of admixture with air in which men have occasion to inhale it.

When we take into consideration the large number of fires which, both by day and night, endanger the life and destroy the property of individuals situated in or near the metropolis, the production of a machine such as that which Mr. Phillips has exhibited, promises to be of very considerable utility. By being provided with one of these, each householder is possessed of an instantaneous means of checking a fire at its commencement, long before any great destruction of life or property could be apprehended. Its advantages on ship-board can scarcely be over-estimated, and are most obvious. The Jury, considering it well adapted in its application to the purpose intended, and being perfectly satisfied with its performance in this instance, have awarded Mr. Phillips a Prize Medal.

WEARE (No. 386, p. 451) has exhibited a fire annihilator, designed, by means of a discharge of gas, to extinguish fire, and prevent the ignition and self-combustion of inflammable matter. As the Jury have had no opportunity of examining the machine, or becoming acquainted with its construction, they are not qualified to decide upon its merits.

Meteorological Instruments.

Considering the greatly increased attention which has been paid within the last few years to meteorological researches upon a systematic plan, a part of which is the using instruments well adapted to the work, it is both surprising and very lamentable to perceive, among the numerous exhibitors of barometers and thermometers, instruments of so ordinary and inefficient a construction, the greater part of them being ill adapted and totally unfit for meteorological observations. In the barometers exhibited, the majority of the makers, in their anxiety to render them elegant and decorative articles of furniture, have paid but little attention to its essentials as a philosophical instrument. Their forms, as exhibited, are various, it is true, not as might be expected with a view to discover that construction likely to give the soundest results, but more, it would appear, to suit the requirements of those who can see in a barometer nothing more useful or important than a piece of household furniture, destined to take its place among the usual appurtenances of a well-furnished hall. This is much to be regretted, the barometer offering—as it does—so wide a field for the exertions of the instrument-maker to fit it for the increasing requirements of the present advancing state of meteorological observation. How disappointing it is to find all their exertions directed to the enshrouding it in a case which, with few exceptions, renders it not only cumbersome and inelegant, but, as typifying the apathy of a large class of instrument-makers to the fundamental principles of its construction, to us most offensive: on the score of inelegance of construction, we may, however, except those exhibited by ELLIOTT and SONS, (No. 320), which are fairly models of chaste design and excellent wood-carving. It would be well for the purchasers of these decorative and ill-constructed barometers to remember that by their adoption and use of such instruments they forfeit all claim to scientific notice, and they should also remember that to the well informed no instrument can be so pleasing in appearance as that which, from its construction, is well adapted to its work, and likely to lead to good and important results.

Of thermometers we cannot speak more favourably, the greater part of them being furnished with scales of ivory, a material most unsuited to a graduation of any kind; so much so, that the mercurial tube attached to an ivory scale cannot rightly be called a thermometer. The bulbs of those exhibited are nearly all too large, a defect which necessarily entails a very slow change of temperature. In self-registering thermometers there is nothing new, and no attempt has been made to improve the working of the instrument, either by the introduction into the maximum thermometer of a piece of enamel, as a substitute for the steel index, or by any other means. Very few of the tubes of the thermometers exhibited are sunk in the scale, so that the column of mercury may be in the same plane as the divisions, or the back part of the tube cut away to attain the same object; and, what is still more to be regretted, very few thermometers in the English portion are graduated on their stems, a method superior to any for insuring delicacy of graduation and correct readings. These remarks do not apply to the foreign portion of the Exhibition; the exhibitors it includes, however, are few in number, but the instruments generally are pretty good.

No branch of physical science has suffered more than meteorology by the use of bad instruments. Many journals, after years of patient daily labour, have necessarily been laid on one side as useless, owing to the imperfections of the instruments used. To judge from those exhibited, it would appear that as little attention is paid now to the construction of meteorological instruments in London, except by a few makers, as a few years ago, before the commencement of the systematic researches in meteorology at present being carried on by very many gentlemen throughout the country.

It is to be hoped that one of the good results of the Exhibition will be the calling into existence a better class of instruments generally, when not only shall be improved those necessary to physical research, but those also which are in general use by the public. That thermometer is the best whose bulb is small, whose divisions are cut on the stem itself, or engraved on well-seasoned box-wood or on metal. That barometer is the best which is made of brass throughout, and the mercury of which has been boiled in its tube; there should be no plunger, no need of capacity correction; and the most simple means should be adopted for measuring accurately the distances between the surface of the mercury in the cistern and that in the tube, a measurement best attained by means of an ivory point, terminating a brass scale.

The best exhibitor of thermometers in the Exhibition is **Fastré** (France, No. 511). All the instruments exhibited by him are distinguished by delicacy, and are possessed of the essentials of first-rate instruments. The best exhibitors of thermometers in the British portion of the Exhibition are **Negretti** and **Zambra** (No. 160), whose instruments seem to have been made with great care, the divisions being good, and mostly cut on the stems of the thermometers themselves. In appearance there is but little difference between those exhibited by Negretti and Zambra and those by Fastré. The accuracy of division was not examined in either case.*

We now proceed to speak in detail of the instruments exhibited.

Self-registering Meteorological Apparatus.

Dollond (No. 145, p. 426, and see Illustration) has exhibited a self-registering meteorological instrument, which he has called an Atmospheric Recorder.

This instrument registers simultaneously, for any period of time, according to the length of the paper used, the varying pressure of the atmosphere, the changes of temperature and evaporation, the variations in the electrical state of the atmosphere, the fall of rain, the amount of water evaporated from a surface of water, and the force and direction of the wind.

The apparatus is composed of a frame 2 feet by 3 feet 6 inches, and is firmly supported upon four pillars, the sides being strongly braced together. At the distance of 10 inches from either end of the frame, a roller 1 foot in circumference is placed. That near the south end is moved by clock-work, whilst the other acts as a reservoir for the paper; a third, of the same dimensions, is placed near the clock or driving roller, and so arranged as to press upon it equally throughout its length for the purpose of keeping the paper in contact with the driving-roller.

A strong bar is placed near the north end of the frame, upon which the fulcrums of several indicators, about a foot in length, are placed. Those for registering the variations of the barometer, thermometer, and hygrometer, have spring points at their ends; and those for the registration of the electrical changes, the fall of rain, evaporation, and the force and direction of the wind, have pointed pencils. The former are connected with a falling lever, and strike the paper once in every half hour, whilst the latter continuously mark the paper. Near the place of registration each element has its own scale. The indicators are continued somewhat beyond the fulcrums, and are thus connected with the various changes of the atmosphere to be recorded. Between each element on the paper a set of lines is drawn, which form zeros or base lines for the estimate of each. They also give a means of correcting any error caused by the hygrometric or other changes of the paper; on either side of the frame is a marker, which registers the time simultaneously at every half hour.

The barometer used is on the syphon principle, in the shorter leg of which is placed a float, so adjusted as to leave sufficient weight to follow the mercury. The registered scale trebles the actual changes. The apparatus for the temperature consists of ten bent mercurial thermometers, suspended upon a delicate balance. The hygrometer consists of a slip of mahogany cut across the grain, which was divided as follows: being suspended from its upper end, in a cylinder filled with water, a weight of 2 lbs. was attached to its lower extremity, until it was found, by repeated examination, to be completely saturated, and no longer to increase in length. Its whole length was then referred to an accurate scale. The slip of mahogany was then placed beside the pipe of a stove, suspended and weighted as before, until its shortest length was obtained. The difference of the two results being carefully taken, the scale was formed accordingly. In its use it is suspended and weighted as before, in a tube placed outside the observatory, protected from the sun and rain, and has free power to act upon the indicator.

The electrometer is constructed as follows: a well-insulated conductor is placed upon the highest convenient place, from which a wire is brought down to an insulator on the top of the observatory, and from thence to a standard, passing through another insulator to a metal disc, between which and a spring a moveable disc is attached to a glass or insulating arm, in connection with the registering pencil.

The electricity, in the first instance, is collected by means of points. There is a wire, connected with the earth, by which means any excess of electricity is discharged.

The rain-guage is placed on the top of the observatory, its receiving surface being 1 foot square. The rain is conducted by a pipe into a receiver inside the observatory, and situated under the registering apparatus. An air-float is placed inside the receiver, and connected with a set of inclined planes, each of which is equal to a fall of rain 1 inch in depth. These inclined planes, as they pass upwards, being in connection with the indicating pencil, register the fall of rain.

The evaporating dish is an open cube of 1 foot square, covered with a plate of glass at such an angle as to prevent rain falling into it, yet allowing the air to act freely upon the surface of the water.

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* To examine a thermometer carefully, and determine its index errors at every part of the scale, is very troublesome, and occupies a great many hours; yet every thermometer used for meteorological purposes should be thus examined.

The direction of the wind is shown by an indicating pencil in connection with a vane. The force of the wind is shown by a surface of 1 foot square, being kept in opposition to the direction of the wind by a vane, whose motion is nearly free from friction, every part being counterpoised. On the action of the wind upon the pressure plate, a combination of suspended weights is raised by a chain passing over a pulley in a line with the direction of the wind, and well protected from the weather. The suspended weights are in connection with an inclined lever and indicating pencil. The scale has been determined by experiment. A Council Medal was awarded to Mr. Dollond.

Brooke (No. 144, pp. 422-426) exhibits photographic apparatus for the self-registration of the dry and wet bulb thermometers.* It consists of two mercurial thermometers, with very long bulbs; one of them is covered with muslin, which is kept moistened by the capillary action of floss silk, or lamp wick, connected with three cisterns of water.† On either side of the thermometers, and placed near them, is a lamp, the light of which, condensed by a cylindrical lens, whose axis is vertical, falls upon the thermometer stems, and passing through that portion which is above the mercury, affects the paper. As the cylinder revolves, a broad sheet of photographic trace is left, whose breadth varies with the varying height of the mercury in the tube. The boundary of light and darkness thus indicates the height of the mercury in the stem of the thermometer. To know the temperature corresponding to this boundary, fine wires are placed across the thermometer-tube, to prevent the photogenic action of light, and thus transfer sufficient indications of the actual reading of the thermometer. Mr. Brooke also exhibits similar apparatus for the variations of the reading of the barometer. (See Illustrated Catalogue.)

Newman (No. 674, p. 468*) exhibits a self-registering anemometer and rain-gauge. It consists of a vertical cylinder, actuated by clock-work, and furnished with paper for the consumption of a month.

Barometers.

Griffith (No. 331, p. 446) exhibits a barometer of a new construction, giving the observer the power at all times of securing a vacuum above the mercury. The instrument consists of a tube for the column of mercury, with a crook on the top, and bent at the lower part, a joint with a trap placed near the middle of the tube, a stop-cock and a stretcher to close the open part of the glass tube when necessary; a brass bar, carrying two cylinders at the distance of 29·772 inches, and moved up and down by means of a steel screw, with 25 threads to an inch, moveable in a matrix by means of a milled head. The bar carries a pointer for reading to hundredths of inches, and there is suitable apparatus to read to one-thousandth of an inch.

The purpose of the crook on the top is to trap all the air which may be above the column, and thus to insure a good vacuum.

Mr. Griffith says that no boiling of the mercury is necessary. The instrument, though not tried, and not of very careful workmanship, was considered by the Jury good in principle, and an attempt out of the beaten track to improve the instrument. A Council Medal was awarded.

Newman (No. 674, p. 468*) exhibits his well-known standard barometer, which is made so as to require as few corrections as possible. The graduated scale which measures the height of the mercury is made of brass, and to it is affixed a brass rod, passing down the inside of one of the upright supports, and terminating in a conical point of ivory; this point in observation is made just to touch the surface of the mercury in the cistern, and the contact is easily seen by the reflected and actual point appearing to meet each other. The rod and scale are made to slide up and down by means of an endless screw and wheel. The scale is divided to 0·05 inch, and the vernier, which only moves by a slow motion screw, subdivides the scale to 0·002 inch.

At the bottom of the instrument are three screws, turning in the fixed part of the support, and acting on the piece in which the lower pivot of the barometer frame turns for adjustment to verticality. The bore of the tube is between 0·5 to 0·6 of an inch in diameter.

Mr. Newman observes that he has always found tubes boiled under atmospheric pressure to be foul, and that many barometers made with large tubes not boiled look well for a time, but that ultimately air-bubbles are seen to rise to the top and depress the column. These difficulties were to be overcome before filling the tube successfully, the bore of which measured from 0·5 to 0·6 of an inch in diameter. Mr. Newman has adopted the method of filling tubes in vacuo, and boiling them under diminished pressure, at a temperature which obviates all oxidation of the mercury.

Orchard (No. 161, p. 429) has exhibited a standard barometer very similar in construction and workmanship to that of Newman; it has, however, in addition a thermometer, placed in front of it, with a bulb of the same diameter as the tube, and there can be no doubt that the temperature of the two equal bulks of mercury will be the same.

Vidi (No. 326, p. 446) exhibits an aneroid barometer of the usual construction. This beautiful instrument, so recently invented by M. Vidi, was rewarded by a Council Medal.

Negretti and **Zambra** (No. 160a, p. 429) exhibit a barometer arranged to register the highest and lowest readings. It is a syphon barometer, to the longer leg of which, at the distance of 8 inches from the top, is joined a bent glass tube, carried up for 6 inches parallel to the principal tube, and joining it at two inches from the top. The mercury flows freely in and out of this tube, and maintains the same level as that in the larger tube. In this bent tube is placed a small piece of steel, which is kept in position by fine glass springs: as the mercury rises this piece of steel is pushed up, and remains stationary. The lowest readings are indicated by a similar steel index in the shorter leg.

Messrs. Negretti and Zambra also exhibit a barometer with an air-trap glass cistern, to be read off by means of a sliding scale, adjustable to the surface of the mercury by a fine ivory point. The tube and cistern are blown together, and at intermediate junctures are three points, and three small tubes or traps, communicating with each other to prevent the admission of air. This instrument is constructed entirely of glass. A folding barometer is also exhibited, consisting of a tube with a steel stop-cock in the centre, which, when folded up, carries with it the two valves of the tube with which it is connected.

Yeates (No. 332, p. 446) exhibits a barometer, furnished with a brass scale, terminating in an ivory point, and moveable by a screw. The cistern is composed of plate-glass and iron.

Mr. Yeates exhibits also a barometer, furnished with a registering apparatus, which consists of a revolving cylinder four inches in length, around which is paper ruled into thirty-one vertical portions, horizontally into tenths of inches, and numbered from 27 inches to 31 inches. To the receiver a pencil is attached for marking the paper. The ivory point is adjusted to the surface of the mercury by means of a plunger. Mr. Yeates also exhibits a third barometer, furnished with an ivory point, adjusted by a screw acting upon a leather plug attached to the bottom of the cistern. In these three barometers a ready means is furnished of cleansing the surface of the mercury in the cistern, by the withdrawal of a screw plug placed in the cistern near the surface of the mercury.

Somalvico (No. 681a, p. 469*) exhibits a mountain barometer, two upright barometers, three ornamental wheel barometers, &c.

Hall (No. 60, pp. 415, 416) exhibits a meteorological clock, to which is attached a barometer and thermometer kept vibrating by the clock connection, the number of vibrations in a certain time differing according to the variation of temperature in the one case, and of pressure of the air in the other; the number of vibrations is registered, and from them both the readings of the barometer and thermometer are known.

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* The principle is the same as that described in magnetical instruments, page 280.

† One large cistern will be found to act better.

Tremlett (No. 163, p. 429) has exhibited a marine barometer in a metal frame, with thermometer, enamelled scales and springs to check oscillation.

Elliott and Sons (No. 320, pp. 443, 444) exhibit barometers carved in walnut-wood, the design representing the four seasons; circular carved wood barometers similarly ornamented; Gothic carved barometers, and two mounted in ebony and gold. It is stated that the mercury in the tubes of all these instruments has been boiled.

Bursill (No. 673a, p. 468*) has exhibited a compensatory cistern barometer, in which, by a self-acting contrivance, the mercury is always preserved upon the same level within the cistern, uninfluenced by alteration of temperature or any change in the column of mercury itself.

Brown (No. 676a, p. 468*) exhibits a barometer in appearance similar to a water-barometer; it contains two immiscible liquids of nearly equal specific gravities; and their point of meeting, which may be placed at any part of the scale, is indicated by one liquid being coloured. The scale of the instrument, which is arbitrary, is 7½ feet to an inch of mercury.

Mr. Brown also exhibits two barometers at an exceedingly low price. The readings of a similar barometer were taken for two months commencing from July 15, simultaneously with those of a standard barometer, and was found to act admirably. Before reading it was always found necessary to incline the instrument until the mercury filled the upper portion of the tube: it afterwards descended to its proper level, though the rise at all times took place less freely on account of the smallness of the tube. These barometers are the cheapest in the Exhibition, and are better than any of the ordinary barometers exhibited.

Bennett (No. 1, p. 406) exhibits barometers of an ordinary construction.

Dixey (No. 271, p. 438) has exhibited a carved oak barometer, and an ordinary barometer.

Baker (No. 616, p. 452) has exhibited two barometers, one of which is that invented by Mr. Brown.

Watkins and Hill (No. 659, p. 466*) have exhibited barometers of various ordinary kinds, and Professor Potter's aerometric balance.

Grey and Keen (No. 138, p. 422) have exhibited wheel barometers mounted according to various designs.

Abraham (No. 140, p. 422) has exhibited a barometer, designed to show, without adjustment, the reading of the barometer. The scale is suspended over a pulley, by means of a counterpoise, the lower end of the scale being connected to a float in the shorter leg of the syphon.

A. H. Ross (No. 157, p. 429) has exhibited a self-compensating barometer.

Pizzala (No. 162, p. 429) has exhibited a wheel barometer, constructed with a rack-work motion. The case is elaborately carved in walnut-wood.

Grimoldi (No. 159, p. 429) has exhibited a pediment barometer, fitted up in a carved gilt frame.

Bourdon (France, No. 1108, p. 1231) has exhibited several barometers of an original construction. They consist of an elastic flattened tube of metal, exhausted completely of air, and bent very nearly in the form of a circle; they are in this state possessed of the property of expanding, a further separation of the ends being effected when the atmospheric pressure is diminished, a contrary or contracting effect taking place when the pressure increases. A lever is attached to the end of the tube by suitable mechanism, and connected to an index or hand, which traverses a divided dial-plate.

The dial-plate is graduated by placing the instrument with a standard barometer within the receiver of an air-pump, and the points of coincidence determined by varying the pressure. These instruments are applicable for measuring the pressure of the atmosphere, gas, &c., to a range exceeding 500 lbs. on the square inch. They are well adapted for application to steam engines, &c. A Council Medal was awarded to M. Bourdon.

Galy Cazalat (France, No. 1239, pp. 1236, 1237) has exhibited a manometer. The tension of steam is measured by the number of atmospheres to which its pressure is equivalent, consequently, by the number of inches of mercury which it will support in a tube by pressure on the surface of a reservoir into which the tube is plunged. The utility of a mercurial gauge is limited in practice by the length of tube capable of being applied, which, if of glass, cannot be safely extended, and if of iron, is very inconvenient, to say nothing of the difficulty of reading. The invention of M. Galy Cazalet is in effect equivalent to increasing in any given ratio the specific gravity of the mercurial column, supported so as to enable a column of any convenient length to counterbalance a pressure, however great. The steam acts only on the sectional area of the rod of a piston, the plunger of which, of much greater sectional area, presses on and so sustains, in the other leg of the inverted syphon, into which it plunges, a mercurial column of sectional area equal to its own. A Prize Medal was awarded to M. Galy Cazalet.

Ericsson (United States, No. 146, p. 1442) has exhibited an alarm barometer. This instrument is intended chiefly for use on ship-board, and is to be placed in the vicinity of the helmsman, being so constructed that, when the mercury sinks below a certain reading, a hammer is made to strike a gong. The helmsman by this means receives notice of the probable approach of rough weather, and time is afforded for the necessary precautions of taking in sails, &c.

The tube is similar to that of the common barometer, and is much enlarged at the upper end; the lower extremity terminates in a cup, which contains mercury, and is attached to a lever, weighted at one end. By means of the enlargement of the tube, a slight decrease in the reading of the barometer causes a considerable discharge of mercury into the cup, the balance of which is disturbed. This disengages a hammer, which, impelled by a spring, strikes a gong with considerable force. The weight which balances the cup is adjustable upon the lever, and may be so set that notice shall be given of any required reading of the barometer. The lever is marked with divisions corresponding to those on the scale, for the purpose of adjustment.

Thermometers.

Simms (No. 741, p. 475*) exhibits two standard thermometers, constructed by the Rev. R. Sheepshanks, who, during the last two or three years, has been more or less engaged in improving these instruments. The divisions are engraved on the stems. The zeros of these instruments, as determined by Mr. Sheepshanks, will be used by Mr. Glaisher in all future observations, and he believes the two instruments, exhibited by Mr. Simms, to be the most correct in the country.

Negretti and Zambra (No. 160a, p. 429) exhibit a standard thermometer, which seems to be good; several very delicate thermometers, with pea bulbs; a delicate dry and wet bulb thermometer; a Daniell's hygrometer; two Regnault's hygrometers, one furnished with black glass cups, instead of silver, designed to avoid oxidation; some thermometers beautifully made, and graduated on their own stems; a dry and wet bulb, with two identical stems close to each other, and united; this form of instrument is useless for practical purposes, but is a masterpiece of tube-blowing; several self-registering thermometers, both of Rutherford's and Sixe's form, &c.

These are the only Exhibitors in the British portion who have sent thermometers with their stems graduated, the only safe instruments for delicate experiments.

A Prize Medal was awarded for the beautiful work shown by these artists.

Newman (No. 674, p. 468*) exhibits a standard thermometer, the bore of which is stated to be a perfect cylinder, having been examined by the late Captain Kater and Professor Daniell, as well as by Colonel Sabine. Its scale is divided into half degrees; that part of the glass tube which is near the scale is ground flat, and polished, so that the column of mercury is very nearly in the same plane as the scale, by which means the error of reading, so far as parallax is concerned, is avoided. Also, a maximum register thermometer, with a small piece of enamel inserted between the index and the mercury; a minimum and maximum register thermometer, with black bulbs; a Daniell's hygrometer; dry and wet bulb thermometers; a Lind's wind-gauge; and rain-gauges of different kinds.

Philips (No. 411, p. 454) exhibits a maximum thermometer, with a bubble of air, which, by separating a portion of the mercury, causes it to act as the index; an air barometer for coal-pits; and a new electrophorus and cover, to work without making contact by the hand.

Watkins and **Hill** (No. 659, p. 466*) exhibit a dry and wet bulb thermometer, and other thermometers of an ordinary kind.

Harris and **Son** (No. 149, pp. 428, 429) have exhibited a self-registering thermometer.

Elliott and **Sons** (No. 320, pp. 443, 444) exhibit various ornamented thermometers, and some intended for the pocket.

Bennett (No. 1, p. 406) has exhibited many thermometers; they are for the most part furnished with ivory scales; the bulbs of those furnished with box-wood scales are too large.

Dixey (No. 271, p. 438) has exhibited several self-registering thermometers.

Baker (No 396, p. 452) has exhibited a thermometer for agricultural purposes.

Fastré (France, No. 501) exhibits probably the best series of delicate and accurate thermometers in the Exhibition; they are distinguished by being nearly all engraved on thin glass stems, and include exceedingly delicate dry and wet bulb thermometers, Regnault's hygrometer, &c. M. Fastré deserves high praise for the production of these beautiful instruments, which the Jury consider worthy of a Prize Medal.

Luhme (Prussia, No. 83, p. 1053). Good thermometers; divisions on glass, and some on paper.

Jerack (Austria, No. 134, p. 1014) has exhibited thermometers graduated on glass, for immersion in acids.

Jürgensens and **Sons** (Denmark, No. 17, p. 1356) exhibit two metallic thermometers, of a circular form, so arranged as to show the temperature at the time of observation, as well as the maximum and minimum temperatures since the previous inspection. A Prize Medal was awarded to Messrs. Jürgensens and Sons.

Anemometers.

Philips (No. 411, p. 454) exhibits an anemometer, designed for coal-pits and hospitals, consisting of a semicircle of card-board, graduated on its edge, and mounted on an axis passing through the diameter of the circle of which the card is the half.

De Hennault (Belgium, No. 183, p. 1157) exhibits a small travelling anemometer, extremely well made, of a simple construction, and furnished with a series of fans, which, by a simple and effective contrivance, may be stopped or set in action almost momentarily. It is intended chiefly to determine the horizontal velocity of the air in a given time. To this exhibitor Honourable Mention was awarded.

Rain-Gauges.

Philips (No. 411, p. 454) exhibits a rain-gauge, open at the top and four sides, prepared to show not only the fall of rain received on a horizontal surface, but also, by a simple calculation, to ascertain the inclination of the path of the drops and the direction of the rain. The Jury have awarded Honourable Mention to Mr. Philips.

Watkins and **Hill** (No. 659, p. 466) exhibit Crossley's self-registering rain-gauge.

Baker (No. 396, pp. 451, 452) has exhibited a rain-gauge.

Pyrometers.

Ericsson (United States, No. 146, p. 1443) has exhibited a pyrometer, an instrument for measuring temperatures from the freezing point of water to the melting point of iron, as indicated by the tension of a permanent volume of air or azote, which is measured by the reading of a column of mercury under a vacuum. The instrument is designed to meet the requirements of the artizan in all works which involve the application of great heat, and are dependent for success upon an evenly regulated temperature. In the formation of the scale, 32° and 212° have been respectively taken for the points of freezing and boiling water.

The instrument is composed of the following parts:—

A chamber containing mercury, with a flexible bottom, composed of a steel spring, or India-rubber held between steel plates, which may be raised or lowered by means of a screw. Into this chamber a glass tube filled with mercury is plunged to within one-sixteenth of an inch of the base.

Into the mercurial cistern a short glass tube is inserted, connected with a platina bulb by a small passage, the base of which is nearly filled by a silver wire, and a stop-cock. A coupling joint is affixed to the bulb, so that it may be removed at pleasure. The top and sides of the mercurial chamber are surrounded by a cistern for the reception of pounded ice, the whole being encircled by double plates of iron, to be filled with clay or some other non-conducting substance, for the purpose of shielding and supporting the instrument. The screen itself is supported upon a base plate. Two scales form an important feature in the arrangement of this pyrometer, graduated for reading off the height of the mercury in the tube, which reading is determined by the temperature of the medium in the platina bulb.

The graduation of the smaller of these scales reaches only to 700°, but that of the larger is extended to include the melting point of iron. A spirit level for placing the instrument in a vertical position completes the adjustments.

It is to be remembered, that the graduation of the scale is independent of any imperfection in the bore of the tube, and is not affected by the expansion of the bore from heat, the volume for measuring which being permanent and not expanding, affords greater accuracy in the readings at high temperatures.

The pyrometer comes into action where the thermometer ceases to be effective, the air or azote in the bulb of the former enabling it to remain unchanged under extreme variations of temperature, whilst the latter explodes on being thrust into an ordinary flue or vessel of over-heated lead.

Wurm (Austria, No. 137, p. 1014) has exhibited a pyrometer. The instrument is composed of a strong and massive frame of iron with a handle, across which is stretched a moderately strong platina wire, connected with an index in the handle, so arranged that the wire (being always kept in a state of tension by a spring or otherwise), when relaxed by expansion, shifts and marks the amount of extension.

The whole frame being introduced into a furnace or oven, the wire acquires instantly the temperature; the massive frame much more slowly. Relative expansion of the wire therefore takes place, and when this has attained its maximum the index is read off.

The instrument exhibited is adapted to ovens, &c., and is of considerable dimensions.

Tide-Gauges.

Hewitson (No. 152, p. 429) exhibits a self-acting and self-registering tide-gauge, every part of which displays good workmanship, and an endeavour to reduce friction or grip to a very small quantity. The teeth of the wheels are carefully made, so that should the rise or fall of the tide amount to the fraction of an inch only, a simultaneous movement of the whole machine follows to that extent. It is furnished with a brass cylinder, the axes of which are of bell-metal, revolving in Y's. The traversing bar carrying the registering pencil, moves on steel friction rollers, concealed in the capitals of the brass supporting pillars. In connexion with it is an astronomical clock, which vibrates seconds, and needs winding once in 16 days only, so that somewhat more than a chart of tidal curves, extending from new moon to full moon, or *vice versâ*, can be registered without any attention being required.

The instrument is also furnished with a system of wheels, by means of which the depth of water is shown on a circular dial; that placed at the mouth of the Tyne is illuminated at night, and can be seen at a great distance at all times.

The instrument is elegant in appearance, and seems to be perfect in its action, and is the only one which shows time and tide by separate dials. A Prize Medal was awarded to Mr. Hewitson.

NEWMAN (No. 674, p. 468*) has exhibited a self-registering tide-guage. This instrument consists of a metal cylinder 30 inches in length and 8 inches in diameter, moved by a clock, and performing one revolution in 24 hours. A pencil moved by a float is suspended by an endless chain, and maintains always the same buoyancy. The pencil attached to the chain is carried over two cylinders, one of which contains a spiral spring, and is so contrived, that the marking of the change of tide is immediate. On the face of the clock is shown the height of the tide at the time of observation. It also registers the highest and lowest for the day. The papers require replacing every fortnight, and the pencils used are metallic.

The chain consists of a given number of links, the ends of which are not soldered together, which in its progress loops over the spikes in the barrel; this method will do well for a time; but as the links cannot keep all of the same length, it is probable that some will not catch, but slip past, and cause error in the register

Acoustics.

HEEPS (No. 615, p. 476) exhibits a pulpit, to the reading-desk of which is attached a receptacle for collecting sound, to which a gutta-percha tubing is connected, intended to be carried under the floor, or otherwise, to the pew of the deaf person; the terminal of the tube, which is intended to be applied to the ear, is of ivory.

REIN (No. 629, p. 477) has exhibited several instruments for acoustic purposes; one of these may be worn without being seen, is adapted to the shape of the ear, and requires no spring. The power is great in proportion to its small size, the entire length of tube being 8 inches.

Another acoustic contrivance, which may be worn as a lady's head-dress, without being seen.

Also a new promoter of hearing. The great fault in instruments of this class has hitherto been the concentration of the sound in one ear only; so that, whilst the sound was much increased in loudness, it remained, if possible, still more confused and indistinct. To obviate this inconvenience, Mr. Rein designed this contrivance, which is to be worn on the head, and is adapted to both ears: by means of it the faulty ear is called into equal action with the healthy one. When worn by ladies, it may be quite concealed by the hair.

An acoustic chair. This is so constructed that its power by reflection is doubled to either ear, and may be used at pleasure for one or both ears. In the latter case the power is fourfold. The chair is rendered acoustic by the arms being made hollow, and terminated by a design suitable to the free admission of sound, which is conducted to the ears of its occupant, by two small tubes, projecting from the inner side of the back of the chair.

An acoustic vase, designed by its construction to collect the sound from all parts of the room. The vase being placed on a small table, the attachment of the tube is skilfully concealed beneath the table through which it is inserted; contrary to other contrivances for the same purpose, it is not trumpet-shaped, and in its appearance does not resemble an acoustic instrument.

All acoustic instruments hitherto made, partake more or less of the trumpet form; and all agree in one respect, viz., that the mouth or orifice for the reception of sound, is bounded by a line, generally circular, every point of which is in one plane; and, therefore, it is necessary that the voice of the speaker should be directed as nearly as possible at right angles to this plane. Some instruments have been made consisting of a large metallic receptacle for the sound, with a long flexible tube attached to them; but they are very unsightly objects. The vase above described differs from these in the following particulars:—

1st. That the orifice for the collection of sounds is arranged on a circular plan, so that when the instrument is placed on a table in the centre of a room, the deaf person can hear speakers in any direction with distinctness proportionate to his degree of deafness, or the tone of voice used by the speaker.

2nd. That it has not the appearance of being an acoustic instrument.

3rd. That it may be used as a flower vase. It is of course furnished with a flexible tube for the purpose of conveying the sound from the vase to the ear.

Mr. Rein has exhibited more than one design of the acoustic vase, several acoustic bells, also an acoustic walking-stick, which may be applied to either ear, without being recognized as an acoustic instrument.

Several portable telescopes, adapted to various degrees of deafness.

An acoustic instrument, or "Social Companion," to enable any number of persons to converse with one who is deaf, and requiring no change of place.

A conical and flexible whispering tube, so constructed that extremely deaf persons can distinctly hear and hold conversation even when spoken to in a low tone of voice.

A whispering tube, and ear-caps or reflectors, which last may be worn without a spring.

WATKINS and HILL (No. 659, p. 466*) exhibit a syrene; an instrument used in acoustics for demonstrating the production of a musical sound by a succession of musical impulses. The invention of M. Cagniart De La Tour.

Planimeters.

SANG (No. 333, p. 448) has exhibited a planimeter. The peculiarity of the construction consists in the product of the ordinating lines being given by the motion of a disc over the surface of a cone, instead of over a plane, by which means, the motions representing both the ordinates may be taken directly from the motion of the tracing point. In the Tuscan instrument the motion which represents one of the ordinates is conveyed through a rack and pinion, and in those of Swiss and German construction, through a hand and pulley. The arrangement of Mr. Sang is designed to obviate the shake necessarily caused by the teeth of the rack, and by the elasticity of the band of the pulley.

The parallelism of the instrument is trusted entirely to the simple rolling of two heavy wheels over the paper. This is rendered more certain in the foreign instruments by the rollers working in guides as on a railway. All, however, appear free from any tendency to divergence in this respect.

Mr. Sang's instrument possesses a practical advantage in the readiness with which it may be placed at once on a drawing of any size.

The error contained in the results given by instruments of this class generally arises from the shaking or elasticity of the parts which connect the index with the tracer. This error in practice may be easily corrected by measuring the figure twice; at one time placing it so that the shortest breadth is represented by one of the motions, and at another, so that the longest breadth is represented by the same motion. The average of the two results will be very nearly the truth. The Jury considered Mr. Sang as well deserving Honourable Mention.

GONELLA (Tuscany, No. 70, p. 1298) has exhibited a planimeter. All, or very nearly all, the planimeters, of which the Exhibition contains several, turn upon the mechanical integration of the differential expression for the area of a curve traced on a plane surface, and are most readily conceived on that old and now almost forgotten view of the differential calculus, which regarded the differential of a magnitude as a measure of the velocity of its increase at any instant. Suppose a straight line to be carried with a uniform motion along the base line (or abscissa as it is termed), of any curvilinear area, remaining always parallel to itself and perpendicular to the base line; and that, during this motion, a moveable point in the line so carried is kept always on the circumference or boundary line of the area. Then it is clear that the *velocity of increase of the area* will be proportional to and therefore measured by the length of the ordinate, or point of the moveable line included between the base line and describing point.

Suppose, again, that a circular disc or wheel can be made to revolve with an angular velocity, always proportionate to the same ordinate. Then will the total angle of revolution described by it from zero increase by similar increments with the curvilinear area, and consequently be always proportionate to and a measure of that area. The area, therefore, may be in effect *read off* upon its circumference by any method which shall keep account of the number of revolutions and parts of a revolution made by this wheel, which may be called the *integrating wheel, disc, or roller*.

If a circular disc be made to roll (whether by rack-work or friction) upon a line parallel to that on which its centre moves uniformly, its angular motion will be uniform. Supposing then a racket bar, parallel to the abscissa, and incapable of motion in the direction of its length, to work into a toothed wheel on the axis of such a disc, that disc will (however carried) revolve uniformly when the motion of its centre parallel to its abscissa is uniform. To convert this uniform angular motion into one proportional to the varying ordinate is, therefore, the problem of planimeters so conceived.

If the circumference of two circles, whether in the same or in different planes, be so connected, either by teeth, as in ordinary wheel-work, or by mutual friction and adhesion, their angular velocities are inversely as their radii; so that if the radius of one of them be constant, its angular velocity will be directly as the radius of the other. Any disposition of the parts of a mechanism then, which shall secure the condition, that a roller or rolling disc shall be carried round on its centre by contact with a uniformly revolving circle of a radius, always equal to the length of the variable ordinate, contains the solution of the problem. The uniformly revolving disc may be horizontal (that is parallel to the surface of the area to be measured), and the integrating roller at right angles to its plane, having its axis horizontal and parallel to the ordinate as directed to the centre of the disc. This is the construction adopted by Gonella and Gaspar Wettli, or it may be perpendicular to the horizon, being no other than the transverse section of a cone whose vertex lies in the abscissa of the curve, and the radius of which section is therefore proportional to the distance from the vertex, or to the ordinate. This is the construction adopted by Sang (No. 338); but it is only justice to Mr. Gonella to state that this construction is expressly indicated and figured in his original Memoir on the Planimeter, which carries the date 11th June, 1827, in which there will be found a full account of Mr. Gonella's instrument, and a very elaborate (though unnecessarily complicated) exposition of its theory, and to which we therefore refer for the particulars.*

A very great saving in the expenses of computation in the reduction of local surveys, to give the areas of districts, parishes, estates, and fields, as laid down in maps, has been found to result from the use of these instruments, where indications are sufficient for all practical uses.† A Council Medal was awarded to Mr. Gonella.

Laur (France, No. 567) has exhibited a planimeter, in which the area of a plane, supposed to consist of triangles, is first reduced, by geographical construction, to any right-angled triangle. On a rectangle of either gelatine paper or transparent horn are engraved a series of hyperbolas, such that the product of the ordinate and abscissa contained for each, shall change from hyperbola to hyperbola by a constant increment. The extremity of one side of the triangle then being made to coincide with the common centre of all the hyperbolas, and that side with the asymptote, the opposite angle will of necessity fall on one or between two adjacent ones of the hyperbolas, and its area (or its double) will be therefore expressed by the ordinal number of the hyperbola, or the number of the lowest *plus* or proportional part for the distance between that and the angle, as compared with the interval between the two consecutive curves.

This instrument, termed an "olarithme," is intended for the use of persons engaged in geodetical operations, and it offers a simple and ready means of measuring the surface of any portion of a plane. The Jury awarded Honourable Mention.

Wettli (Switzerland, No. 84, p. 1072,) exhibits a (Goldschmidt's) planimeter, for measuring the area of any plane figure, by the simple operation of drawing a tracing point round its periphery, the area being indicated by the divisions of a circle, which is fixed.

The disc is of glass, covered with paper, and receives the movement of rotation by suitable and simple mechanism. The results obtained by this instrument have been found to be correct within 1-1000th part of the area. The Jury awarded a Prize Medal.

Ausfeld (Gotha, Prussia, No. 704, p. 1089) exhibits a planimeter, consisting chiefly of a small roller, moving upon a horizontal disc. The instrument is well conceived, and tolerably well carried out. The Jury awarded Honourable Mention.

Dynamometers.

Taurines (France, No. 386, p. 1196,) has exhibited a dynamometer, adapted for the measurement of very great powers. The driving power, instead of acting at right angles to the spring to be bent, acts lengthways, or rather in the direction of the extreme tangent of a circular arc of nearly 120°, into which the spring is formed, one end being pressed on by the driving power, the other inserted at right angles into a strong radial bar emanating from the axle to be driven. Two such springs nearly complete the circle, and by compression are rendered more convex, and their opposite points made to recede. These opposite points are connected two and two by two other oblique-acting springs, which magnify the motion communicated to their extremities, and through the medium of a third pair, connecting their opposite points, ultimately push along the axis. A cylinder of brass serves as an index, and reads off a scale indicative intrinsically of the distance to which the cylinder is carried out from its zero point, but of which the graduation is so executed as to indicate the power necessary to drive it to that distance: this graduation is executed by trial. The instrument is useful only for heavy engine work. A Council Medal was awarded to Mr. Taurines.

Clair (France, No. 1151, p. 1233) has exhibited a dynamometer in which the driving-wheel of any axle, when thrown into gear with the moving power, is brought not at once to lock into connexion with the axle, but to press at once on a strong straight steel spring standing at right angles to the axis. The degree of flexure of this spring is read off by an index, to the measure of the force required to overcome the resistance, and drive the axle round. It is therefore applicable only to moderate powers, such as may be measured by a spring of reasonable strength, bent by direct action. It can be used either horizontally or vertically. By the application of a train of wheel-work, the movement is made self-registering in every instance, and the work done with the variations from instant to instant of the driving power required to overcome the resistance, is registered.

M. Clair has also exhibited the model of a locomotive fire-engine; a vertical section is also exhibited upon a large scale.

De Burg (Austria, No. 130, p. 1014) has exhibited a dynamograph. This is an instrument not unlike Regnier's, with the addition of a piece of clock-work, regulated by a fan, which can be set in motion or stopped at pleasure; it carries a pencil along the index of the instrument, recording at any moment the position of the index on a piece of paper stretched beneath it. Honourable Mention is awarded to this exhibitor.

Cazaux (Netherlands, No. 89, p. 1147) exhibits a dynamostater, intended for use as a dynamometer for ploughs, but applicable to the measurement of other strains, and furnished with a chronometric controller. It consists of two levers fixed to an iron frame, which mutually act on each other by a joint; to one of these the plough is attached, and to the other a counterpoise which constitutes one of the factors for the measurement of power, as it changes its position with a change of strain, which changes are marked as the lever moves.

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* Opuscoli Matematici, &c. &c. &c. Di Tito Gonnella, Professore di Matematiche Nell' I. E. R. Academia Delle Belle Arti di Firenze. Firenze, 1841.

† Tracing with a pen dipped in dilute sulphuric acid on paper of a moderate and uniform thickness by the aid of transmitted light, and weighing the portion *cut out* by the corrosive action of the acid on exposure to heat, will enable any one to extemporise a planimeter, following the most intricate details of outline, and giving the total area with a very considerable approximation.—J. F. W. H.

The chronometric controller consists of two watches provided with seconds-hands, one of which is unaffected by the pull, and merely indicates ordinary time, whilst the other is acted upon by the varying position of the lever, in such a manner that its rate per minute varies with the varying strain, and is self-registered. By this means all varying resistance is recorded, such as is experienced in the towing of a ship, &c., cases in which the ordinary dynamometer acted upon by means of a spring, is found to fail.

Crystallography.

LEESON (Class I., No. 8, pp. 120, 121,) exhibits a very beautiful collection of crystals; the apparatus for illustrating the crystallographic speculations published by Dr. Leeson, in the third volume of the Memoirs of the Chemical Society; a double-refracting goniometer; and numerous models of crystals. A Prize Medal was awarded to Mr. Leeson.

It is difficult to understand why the remark "rectangular" is annexed to a model labelled antimony. For according to the independent observations of Marx, G. Rose, M. Zippe, and Haidinger, antimony crystallizes from fusion in a form, the faces of which make, with each other, angles differing nearly two and a half degrees from a right angle.

MITCHELL (Class I., No. 9, p. 121) exhibits a collection of crystals: some very beautiful card-board models of crystals, in which the faces of each have a distinctive colour, as in some of the plates of Tennant's Mineralogy, and are marked with symbols according to the notation adopted by different crystallographers.

Also some very ingeniously contrived skeleton models, showing the outline of all the simple forms of a crystalline species, referred to the same axis.

Other models, some to illustrate theoretical views, are exhibited by Mr. Mitchell, according to which, the simple forms of crystals of any system may be derived from those of a crystal of the cubic or octahedral system. A Prize Medal was awarded to Mr. Mitchell.

LUHME (Prussia, No. 83, p. 1053) exhibits an extremely good collection of models of crystals, selected by G. Rose.

SCHRÖDER (Grand Duchy of Hesse, No. 77, p. 1129,) exhibits models of crystals, described in Kopp's "Einleitung in die Krystallographie," on a large scale, which are probably the best-executed models that have yet been made: he also exhibits various models of geometric solids, which appear to be as well executed as the crystals. A Prize Medal was awarded by the Jury to Professor Schröder.

BATKA (Austria, No. 135, p. 1014) exhibits some very good models of crystals in glass.

BERTAUD (France, No. 1549, p. 1251,) exhibits models of crystals

Drawing Instruments.

VARLEY and **SON** (No. 257, p. 436) have exhibited a graphic telescope and table; also a small graphic stand, adapted for use on an ordinary table.

The telescope is furnished with a variety of powers, and affords every variation of size in the object to be traced, which may be sketched to the true perspective distance of the picture on which it is to be placed.

The field of view is large, but the picture may be extended by moving the telescope, and shifting the paper, there being a means of applying correction, if necessary.

The paper or drawing surface may be placed in any convenient direction, and inclined at any angle, the instrument affording facilities for delineating objects in all positions, whether overhead, on the floor, or right and left. The image can be adjusted with equal precision at what distance soever the eye may be removed from the paper, and may also be reversed, for lithographic purposes.

This instrument has assisted in the production of the great "Panorama of London, as seen from the top of St. Paul's," at the Colosseum, in the Regent's Park, and in that of Corfu, the coloured sketches for which, on a large scale, were made by the late Joseph Cartwright, Esq.

The graphic telescope is designed to afford assistance to artists, architects, and draftsmen, by presenting to the eye a correct image of the object to be traced, in any direction and of any size required.

In order to trace telescopic images, great steadiness and portability are required. Both these requisites appear to be combined in the graphic table exhibited by Mr. Varley. The framework is so constructed as to be extremely light and steady; the joinings are made with hinges, from which the pins may be removed, and the instrument packed into a small compass. The table itself is supported upon a braced tripod, and admits of adjustment upon any surface, however irregular; it can also be supported at any angle.

ELLIOTT and **SONS** (No. 320, pp. 443, 444) exhibit a fine magazine case of drawing instruments, inclusive of all the recent improvements; the two trays with which it is furnished, and the interior of the lid contain metal rulers, sectors, triangles, ivory sectors, parallel rules, pocket rules, a graduated joint for taking angles, &c. The metal sectors are well divided, as are also those made of ivory. In the drawers is a complete set of water colours. This set of instruments, the case of which is in itself a fine piece of workmanship, was rewarded with a Prize Medal.

The same exhibitors have another case of instruments, of good workmanship, and highly ornamented by engraving and chasing. They exhibit also various sets of ivory sectors, divided from 10 to 100 to the inch, and ivory parallel sectors, capable of being used on both sides, with divided edges both sides. They also exhibit a small instrument called an opisometer, intended for measuring the length of curve lines. It consists of a small roller, which, having been passed over the lines, is made to perform the same number of revolutions over a scale.

PILLISCHER (No. 269, p. 437) has exhibited an elliptograph. The principle upon which this elegant little instrument is made to describe an ellipse, is that of a point revolving in a circle about a centre, with an angular velocity the double of that with which the centre revolves about a fixed centre. The cogs on a moveable bar, and wheels of the instrument are so arranged that the short arm which holds the style performs 100 revolutions while the long arm performs one. By varying the relative lengths of the two arms an ellipse of any form may be drawn. The semi-major axis of the ellipse will be manifestly equal to the sum of the two radii or arms, and the minor axis equal to their difference. A Prize Medal was awarded to Mr. Pillischer.

SIMMS (No. 741, p. 475*) exhibits an isometrical elliptograph. Invented by G. B. Airy, Esq., the Astronomer Royal.

DOBSON (No. 323, p. 446) has exhibited many well-made sets of drawing instruments, so far as could be seen through the glass case, which was never opened for the examination of the Jury.

TREE and Co. (No. 324, p. 446) have exhibited some well-made drawing instruments, with many accurately divided scales for different purposes. The Jury awarded Honourable Mention.

PARKE and **SONS** (No. 337, p. 448) have exhibited well-made drawing instruments, and several well-divided scales.

DIXEY (No. 271, p. 438) has exhibited several mathematical instruments, amongst which is a divided ivory rolling parallel rule.

HAGGARD (No. 328, p. 446) exhibits a double protractor, intended for measuring angles, and determining heights and distances.

GRAHAM (No. 355, p. 449) exhibits an ivory rule, one foot in length, and an inch and a half in breadth, for the purpose of exhibiting by inspection the circumference of a circle when the diameter is given, and *vice versâ*, and for showing the side of the square equal in area to that of a circle, whose diameter or circumference is given.

One side of the rule contains three lines extending its whole length, the upper side of each being divided into 100 parts. The under side of one is divided into 315 parts, 314 of which are equal, the remaining part being equal to 0·16, and the relation existing between the divisions above and below, the lines being that of the diameter to the circumference of the circle.

The under side of the second line is divided into 89 parts, 88 of which are equal, the remaining one equal to 0·623. On the diameter of a circle being given, on the upper side, the side of the square whose area is equal to that of the circle of that diameter, is read at the same point on the under side.

The under side of the third line is divided into 283 parts, of which 282 are equal, and the other is equal to 0·095. The relation existing between these lines at the same point, is that of the circumference of a circle on the upper side, to the side of the square (to one place of decimals) equal in area to the area of the circle.

The reverse side of the scale is occupied by scales of equal parts.

It is understood that Mr. Graham has arranged other lines, showing the relation existing between the area of the circle when the diameter is given; and another giving the area when the circumference is given.

Matthias (No. 395, p. 451) exhibits an instrument for dividing a given line quickly into any number of equal parts, less than 100, by a method susceptible of more extended use. The principle of the instrument is that of an angle and parallel lines, the angle being formed by the two legs of the instrument, which may be opened to the distance of 20 inches, any space less than which can be divided; it is made of ivory.

Horne, Thornthwaite, and Wood (No. 220, pp. 434, 435,) exhibit Tebay's universal planing-rule, the novelty consisting in the arrangement of the division of the odd and even scales; by continuing the graduation to the edges, the necessity of making use of dividing compasses is obviated.

Gavard (France, No. 235, p. 1197) exhibits improved pentagraphs; the improvements, which consist principally in a better arrangement of the steadying weight of the pivot, and the larger size of the wheels, add greatly to the smooth working of the instrument, so much so that even persons unaccustomed to its use may produce smooth and unbroken lines. In the hands of Madame Gavard it performed several beautiful tracings of great delicacy and difficulty, among which we may specially mention a map of France, showing with great distinctness the departments, comprised within two inches square. The steadiness of the instrument when in use is very greatly increased by the improvements of M. Gavard.

Gavard also exhibits a beam compass of most finished workmanship, and an instrument for drawing from nature by mechanical means. A telescope with a cross wire in its focus is suspended in a jimbal frame, near the eye, and so as to keep the position of the eye nearly fixed. It is so balanced and so lightly hung as to allow the most perfect freedom of motion, and the cross of the wires being carried along every part of the outline of the object.

The object end of the telescope is suspended over a pulley on a vertical support, by a silk line, which is conducted to the base of one support, and thence along a horizontal bar, to a pencil-holder sliding on the bar. Thus any movement in the vertical direction is traced on paper. To trace the horizontal movements in like manner, the upright support and the horizontal bar are made moveable on rollers to the right and left. The instrument is of most delicate execution, and works with perfect smoothness. As specimens of its performance are exhibited a tracing of a ceiling of the Luxembourg, of singular complexity; and a series of outlines, in illustration of the interior of the Palace of Versailles, with its rich and elaborate decorations, which are executed with exquisite fidelity and delicacy.

By adapting a microscope instead of a telescope to the jimbal frame, the outlines of a microscopic object, as of an insect, wood section, &c., can, in like manner, be traced with perfect fidelity, and on any scale. Honourable Mention was awarded to M. Gavard.

Lüttig (Prussia, No. 81, p. 1053) exhibits several cases of well-made drawing instruments, some in German silver and some in brass. The Jury awarded Honourable Mention to M. Lüttig.

Reifler (Bavaria, No. 34, p. 1100) exhibits a case of drawing instruments; and Honourable Mention was awarded by the Jury for his new method of fixing the two parts of a compass together by means of plane surfaces with steadying pins and screws.

Hommel-Esser (Switzerland, No. 81, p. 1272) has exhibited drawing instruments, distinguished for the care with which the most minute details have been finished. A Prize Medal was awarded to this exhibitor.

Gysi (Switzerland, No. 85, p. 1272) has exhibited drawing instruments. The remarks applicable to the preceding exhibitor, apply equally to these, and it may be observed, that the steel used by both exhibitors is of the finest quality and extremely well tempered. A Prize Medal was awarded to this exhibitor.

Kern (Switzerland, Nos. 88 and 92, p. 1272) exhibits some well-made drawing instruments, which, in common with those of the Swiss exhibitors, are made in different parts, which can be readily separated and cleaned with ease. The Jury considered Mr. Kern as deserving Honourable Mention.

Imperial Ijorsk Works (Russia, No. 169, p. 1372) exhibit a full set of twenty-seven drawing instruments, comprising eleven different articles 5 inches in length; a set comprising ten pieces of 3 inches in length, and mounted in silver.

The following drawing instruments are exhibited mounted in brass: a full set of twenty-four pieces; a set of eleven pieces 5 inches in length; and a set of ten pieces 3 inches in length.

The following pocket instruments are exhibited:—Folding or silver-mounted compasses; brass compasses in silver sheath; and several other compasses mounted in brass, some furnished with pencil tubes, and mostly folding up. All these instruments are well made, and include the recent improvements; they deserve very Honourable Mention.

Viberg (Sweden, No. 14, p. 1350) exhibits two small cases of drawing instruments, containing each a protracting semi-circle, a pair of large steel pointed compasses, two smaller for steel pens on exchangeable pencil points, and a steel ruling pen. They are very neatly made.

Littman (Norway, No. 15, p. 1350) is stated in the Catalogue to have exhibited drawing instruments, but careful search being made for them, they were not found among the objects in this compartment of the Exhibition. (See Microscopes, levels).

Nietzchmann and Vaccani (Prussia, No. 706, p. 1089) exhibit many sets of drawing instruments, of an exceedingly low price. The Jury awards Honourable Mention for cheapness.

Rochetti (Austria, No. 136, p. 1014) exhibits a case of drawing instruments of sixteen pieces, compasses, &c., of brass and steel, of very elegant construction. There is no protracter, ruler, or scale.

Penrose (No. 318, p. 443) has exhibited registered screw and sliding helicographs for drawing volutes, scroll work, and spirals of various kinds. The outline may be drawn on paper by means of an impression obtained from the disc by transfer paper, either with ink or pencil by the sliding helicograph. For a description of these delicate and well-constructed instruments see the Illustrated Catalogue.

A Prize Medal was awarded to Mr. Penrose.

Orreries, Planetariums, and Astronomical Machines.

It is a matter of regret that the time and ingenuity which have been devoted to the several machines of this class in the Exhibition, have not been better directed. Those exhibited do not indicate any improvement over the many which have been constructed, one only, perhaps, excepted, viz., a vertical orrery of large dimensions, made by a working man, after his own design, and it is understood, without ever having seen an orrery of any kind.

The time, ingenuity, and expense, devoted to machines of this kind, are wasted; they are of no use to the student of astronomy, and the erroneous impressions which they give are always displeasing to the eye of the astronomer.

If they be of any use in the lecture-room to children and novices, certainly Facy's vertical orrery is the best adapted for this purpose.

Orreries.

Facy (No. 195, p. 431) has exhibited a vertical orrery, showing the relative periodic times of the planets. A comet's orbit is also introduced which extends from within that of Mercury to some distance beyond Neptune. The Jury voted a Prize Medal to Mr. Facy for the ingenuity displayed by him in the construction of this orrery.

Newton and Son (No. 212, p. 434). An orrery, showing the motions of the earth and moon, the planets and their satellites. The mechanism by which these several movements are performed is actuated by clock-work. They exhibit a smaller orrery, constructed on the same principle, but showing only the motion of the earth and moon.

Plant (No. 215, p. 434) has exhibited an orrery, the sun being represented by a luminous body; the seasons, phases of the moon, and other natural occurrences are clearly shown. It may be used to the greatest advantage in a darkened room, when the sun of the orrery will best show the various changes attendant upon the different motions of the several bodies.

Planetariums.

Newton and Son (No. 212, p. 434). A planetarium for educational purposes, intended to show the diurnal and annual motion of the earth and moon, also the respective position of their satellites. It is exhibited for cheapness.

Le Feuvre (Jersey and Guernsey, No. 10, p. 941) has exhibited an orrery; it is designed to show the motion of the moon around the earth, her daily variation and position at the time of new and full moon, also to exhibit the cause of eclipses, either partial or total. It is intended for the use of schools.

Massett (Switzerland, No. 95, pp. 1272, 1273) exhibits a planetarium of an extremely simple construction, in which the motions of the sun, the earth, and the moon are shown. It is remarkable for its cheapness, and Honourable Mention was voted by the Jury.

Mollison (No. 585, p. 475) has exhibited a pedestal planisphere. The places of the stars being perforated, when the instrument is held up against a light background, they appear as luminous points. It is 20 inches in diameter, and designed for educational purposes.

Brake (No. 354, p. 449) has exhibited the model of an instrument called a Periphan, designed for the simple elucidation of solar and lunar phenomena. It is furnished with a terrestrial globe in the centre, and is intended to describe the apparent diurnal motions of the sun and moon, also the daily increase and decrease of the sun's declination, and to determine the time of sunrise, at any place on the globe; the causes of the harvest moon, &c. The model is in diameter 6 inches, which is about a third of the proposed size. It consists of a fixed meridian circle graduated on both sides; on one similarly to the brass meridian of the common globe, and on the other to show altitudes; a horizontal circle, showing the zodiac signs, &c.; a terrestrial globe, placed in the centre of the sphere, which turns freely on an axis; two small pea globes, to represent the places of the sun and moon, and which slide on circular wires; these wires themselves turn freely in their bearings. This instrument shows readily the time of the sun rising and setting at any place exterior to the frigid zones, and various other phenomena of an analogous nature.

Matthews (No. 193, p. 431) has exhibited an Astrorama. This is a concave representation of the heavens upon a small umbrella, which opens and closes at pleasure. The material with which it is covered is perforated to show the places of the larger stars.

Malloch (No. 208, p. 443) has exhibited a mechanical indicator for teaching geography. This is a contrivance for rendering purely mechanical the acquirement of the first rudiments of geography. A map is mounted upon a light framework, a few inches in depth, to permit the studs to work freely. These studs themselves represent cities, towns, &c., on the map, beneath which is placed an index giving the name of each place thus represented. On the same line with the printed name is placed a moveable stud. By keeping down one of the studs on the surface of the map, a corresponding one in the index instantly rises, the printed name beside it giving the required information.

This is an invention of Mr. Malloch's. The model which he has exhibited is, he considers, capable of still further improvement. Mr. Malloch also has exhibited a mechanical indicator of eclipses.

Murdoch (No. 202, p. 431) has exhibited an eclipse indicator. This is a circular table embodying by the motion of a circle of months on a cyclo-circle, with intervals of 18 years 11 days, the actual results of a previous calculation of the moments of conjunction, both for lunar and solar eclipses from 1647 to 2001. The rules given for setting and reading off the circles being adhered to, the precise moment of the ecliptic conjunction and other particulars are obtained.

Ryles (No. 190, p. 431) has exhibited an apparatus for showing the ebb and flow of the tide.

Newton and Son (No. 212, p. 434). An armillary sphere, mounted on a brass meridian and attached to a brass stand.

Zibermayr (Austria, No. 132, p. 1014). A chronoglobium and planetarium, a flat board on which are framed the orbits of Mercury and Venus. The earth and moon are attached to a small rolling carriage, as described in M. Guénal's instrument, by which the rotation of the earth and the phases of the moon are represented. Mars is also made to revolve on his axis by a similar contrivance, viz., by establishing a rolling drag on the orbit.

Dink (Austria) exhibits a globe of the earth, about five inches in diameter, within a glass sphere, on which are placed the fixed stars. The positions of the sun and moon are marked at any given moment by a simple mechanism.

Richards (No. 188, p. 431) exhibits a "geographical instructor," a piece of mechanism in which the sun (represented by a gilt ball elevated on a wire) is presented vertically, to every point of the earth between the tropics, by a compound movement of rotation on a horizontal axis, the revolving ball being pulled and pushed along it, by a movement to and fro corresponding in extent to the time of the sun's declination at the moment. The law of this movement is given by a train of clock-work, of which one peculiarity is the prolongation of the axis of the globe into a very long pinion, so as to allow the teeth of the driving-wheel to act upon it, however far displaced from a mean position. Another, that of the communication of the rotary motion from the *primum mobile* by a hook-jointed axis; the to-and-fro motion of the pinion prolongation of the axis not allowing the clock-work to be centrically placed in some point in that direction.

Detouche and Houdin (France, No. 1589, p. 1253) exhibit a uranographic apparatus (erroneously described in the Catalogue as a monographic apparatus); it consists of a table about six feet in diameter, in the centre of which is a lamp representing the sun. The earth with the moon attached is carried round on an arm, by a piece of clock-work, the *primum mobile* of which is not a spring, or any internal power, but the roller on which the mechanism rests, and which revolves as the earth is carried round on the table. This, by a train of wheel-work, communicates to the earth its diurnal motion, preserves the parallelism of its axis, and gives to the moon all the movements imitative of real ones. This mechanism is the invention of M. Guénal.

Dialling.

Newton and Son (No. 212, p. 434) exhibit a spherical sun-dial. The hour is indicated by means of the shadow of the pole or axis of the sphere being made to fall within side of the zodiacal belt, on the outside of which the signs of the zodiac are depicted. This is well adapted for a lawn.

The articles exhibited by Mr. Newton are distinguished by cheapness and good finish generally.

Lawrence (No. 115, p. 418) exhibits a sun-dial applicable to all north latitudes.

Elliott and Sons (No. 320, pp. 443, 444) exhibit a spherical sun-dial.

Darnell (No. 383, p. 451) exhibits an universal sun-dial.

Cox (No. 347, p. 449) has exhibited a portable instrument for ascertaining correct time by equal altitudes of the sun.

Uhlman (Netherlands, No. 85, p. 1147) exhibits an equatorial sun-dial made of copper, furnished with a moveable hour, minute-hand, &c., which, by suitable mechanism and a lens, may be made to discharge a piece of ordnance at any time required.

Globes.

Johnston, A. K. (No. 198, p. 431), has exhibited a terrestrial globe, 30 inches in diameter; it shows the geological structure of the earth, indicates the currents of the air, trade winds, monsoons, &c.; also the currents of the ocean, trade routes, and isothermal lines, or lines of equal temperature. The stand, which was executed by N. Davidson, of Edinburgh, is carved in walnut, and is of elaborate and elegant design. A Prize Medal was awarded by the Jury for this globe.

Newton and Son (No. 212, p. 434) have exhibited a large manuscript celestial globe, 6 feet in diameter. The positions of the stars have been laid down from their positions as calculated for the year 1860.

Several pairs of globes, ranging in size from 12 inches to 25 in diameter, variously mounted in different materials.

A glass case, containing several small-sized globes, varying from 1 inch to 9 inches in diameter. These are all differently mounted.

A pair of 12-inch globes are exhibited for economy of construction and improvement in the manner of mounting; the pole or axis of each globe remains stationary, whilst the horizon is moveable.

Slate globes are exhibited of various sizes, having the meridians and parallels of latitude marked upon them. The material of which they are formed affords the student means of filling in the outline map with common slate pencil. This is advantageous as applied to educational purposes. The globes exhibited by Messrs. Newton are distinguished by good finish generally, and by cheapness. A Prize Medal was awarded to them by the Jury.

Fletcher (No. 200, p. 431) has exhibited a pair of terrestrial globes, and one case showing the various stages of globe-making. The contents of the case are as follows:—

1st. An iron mould: by the adoption of iron instead of wood, the material generally used, all danger of warping is avoided, and much time is consequently saved.

2nd. The axis of the globe.

3rd. The globe in its rough pasteboard form.

4th. A globe coated with composition, resting in an iron semicircle, the revolving in which gives its perfectly spherical form.

5th. The engraved copper plate.

6th. The impression from the copper plates.

7th. The globe pasted and partly coloured.

The globes are well made and finished, and the process of globe-making, as exhibited by Mr. Fletcher, is interesting.

Readhouse (No. 677, pp. 468*, 469*) has exhibited a model of the moon in high relief, the craters, mountains, &c., being modelled from actual observation with a 1-foot reflector, power about 55, and the occasional use of a refractor power, 90 (the use of the latter being procured only at the expense of a journey of 35 miles). It merits commendation, though the scale of height has been pitched too high; and the effect is injured rather than improved by silvering or gilding portions of the surface, the whole being composed of a dark material.

Adorno (No. 218, p. 434) has exhibited a globe 25 inches in diameter, with the celestial and terrestrial maps superimposed one upon the other; also a globe of papier-maché, divided into forty-eight pieces, to be taken to pieces and rebuilt at pleasure; and a skeleton globe, to show how to rebuild the globe in its frame. The power of taking the globe to pieces is convenient for package and removal, as well as for the convenient study of any part of it. They are well made.

Stoker (No. 204, p. 433) has exhibited an angular terrestrial globe, intended for the solution of geographical problems. It is adapted for use as a common terrestrial globe, by unscrewing the cog-wheel attached to the spindle at the south pole, and substituting the horizon and meridian, the former being screwed in the upright of the stand, the latter being placed upon the globe, the angular motion given to which is designed for the better explanation of the changes of the seasons.

Mr. Stoker also exhibits a spherical geographical clock, to show the difference of time between two given places whose longitudes are known, and is intended to be of more general use than those ordinarily constructed.

Bentley (No. 213, p. 434) has exhibited a plain globe. The northern and southern hemispheres are printed on circular pieces of card-board, each hemisphere moving under a brass meridian, which confines it to its place, and affords the same facility as an ordinary globe for working problems.

Paxon (No. 191, p. 431) has exhibited a lunarian, with a contrivance for showing the phases of the moon.

Marratt (No. 409, p. 454) exhibits a Russell's globe of the moon, mounted as originally sold, with movement in brass for exhibiting the librations, &c., in longitude and latitude.

Good (No. 146, p. 428) exhibits a new method of illustrating the effect of the earth's diurnal motion upon the plane of a pendulum's oscillation. It consists of one end of a radius arm, fixed in the centre of a globe; the other end being adjustable in a vertical plane, and therefore to any latitude, is made to revolve so that its time of revolution varies as the sine of latitude; the time of the revolution of the globe being its measure.

Edkins and Son (No. 207, p. 433) have exhibited a pair of 18-inch globes. They are well finished.

Gilbert (No. 234, p. 435) has exhibited a portable celestial and terrestrial globe, made of tissue paper and inflated with air. The celestial globe is adapted chiefly for the use of the lecture-room, and may be made of any convenient size. The terrestrial is 12 feet in circumference, and is inflated either by means of an air-pump or by simply raising it to and fro from the floor, by which means it may be effectually filled in a few moments. These globes may be folded into a very small compass.

Kummer (Prussia, No. 194, p. 1058) has exhibited a terrestrial globe in relief, 4 feet in diameter. The execution is excellent: not only have the elevations been attended to with great care, but also highlands of moderate elevation, and the courses of rivers, have received the same degree of attention. A Prize Medal was voted by the Jury to M. Kummer for this globe.

Goodyear (United States, No. 378, p. 1461) exhibits inflated globes two feet in diameter, of India-rubber or silk, varnished with the former material. Also India-rubber maps.

Grosselin (France, No. 249, p. 1188) exhibits georamas and uranoramas, to be used as lamp-shades; also some very good and distinct celestial globes, in which the figures and constellation boundaries are neatly and prettily laid down, so as not to confine the representation of the stars.

Ziebermayer (Austria, No. 132, p. 1014) exhibits a small terrestrial globe, enclosed in a glass sphere, on which the celestial sphere and stars, &c., are traced. By means of mechanism the places of the sun and moon among the stars are shown.

Riedl (Austria, No. 131, p. 1014) has exhibited a small globe of the moon, about 10 inches in diameter; the engraving is of a sepia colour, somewhat faintly tinted, and of a seleno-topographical rather than a pictorial character. Some of the principal names are inserted. It is mounted on a brass pillar, with a horizontal circle showing lunar longitudes, and a vertical one for latitudes; the lunar axis is vertical.

Relief or Model Mapping.

Denton (No. 317, p. 443) exhibits specimens of model or relief mapping in its various stages, with all the tools necessary for use.

The base of the model exhibited is of slate, a material which may be procured of sufficient thickness to bear any weight in a horizontal position, may be ground sufficiently thin for framing, and may also be worked to the smoothest possible surface; thus containing the qualities necessary for the work in question, the use and accuracy of which are dependent on the material upon which the superstructure is raised.

To erect the altitudes represented in the contour map, a simple mechanical process is adopted; slips or ribbons of thin copper, cut parallel, of different breadths and of any length, are prepared. Each breadth represents a contour, and is proportioned to a certain elevation: after careful measurement with the altitudes which they are intended to represent, they are each adjusted and secured in their true position.

The model so prepared is ready for covering with plaster of Paris, a substance well suited to give a finished appearance to the work. After the plaster is dry, the whole should be scratched down until the light edge of each copper ribbon peeps to the surface. The model is thus prepared for the reception of the oil-colours intended to trace upon it the geographical details of the country.

Mr. Denton observes that it is not desirable to adopt a scale of less than 198 feet to the inch, and that the vertical scale of height should be carefully proportioned to the horizontal scale of distance. In thus exhibiting as he has done the details of a cheap, simple, and generally applicable method of surface modelling, Mr. Denton cannot fail to call increased attention to the subject.

The Jury have awarded a Prize Medal to Mr. Denton.

Schoell (Switzerland, No. 252, p. 1282) exhibits a model in relief of Mount Sentis and the mountainous regions around Appenzell, including a surface of about 150 square miles. It is executed with great spirit and distinctness, and is accompanied by a chart on a smaller scale of the same region (scale 1 to 25,000), containing the data for its construction, consisting of a minutely elaborate series of contour or level lines, which covers the whole area, and is carried into every detail. The merit of the execution is enhanced by the plastic material of the model, as well as the apparatus used in its construction, being of the artist's own invention.

This work has been considered by the Jury to merit a Prize Medal.

Ibbetson (No. 459, p. 450) exhibits an exceedingly well-executed relief model of the Isle of Wight, on a scale of three feet to one mile, the elevation being on the same scale. The geographical and geological features of the country are carefully delineated.

A Prize Medal was awarded to Captain Ibbetson. (Medal awarded also in Class VII.)

Aerial Machines.

Gilbert (No. 234, p. 435) has exhibited the model of a char-volant or carriage drawn by kites. The vehicle is in appearance similar to an open and double-bodied phaeton, with this difference, that before the driver is placed an upright spindle, surmounted by a T handle, the lower part of which is square, and carried under the head of the carriage, and fitted into a small horizontal wheel, round which is placed a band, which communicates with a similar wheel, and is fastened to the pivot of the front axletree. Two kites are designed to act as the propelling power; the upper one is of the ordinary form, and is called the pilot kite; the lower one is so connected with the carriage, that the driver possesses the power of varying its inclination to the wind at pleasure, an oblique direction being communicated to it by two additional lines attached, the one to the right and the other to the left hand extremity of the shoulders of the kite. By these means the plane of the kite can be inclined to the direction of the wind, and the line of traction thus rendered oblique to the direction of the aerial current, so as to enable the charioteer to "haul on a wind," or steer on an angle considerably out of the line of the wind. It has been calculated that two kites, the one 15 and other 17 feet in length, have power sufficient to draw a carriage containing four or five persons when the air is in quick motion.

This model deserves great commendation, as regards the elegance of its form and the lightness of its construction.

It is not impossible that under some circumstances the application of the propelling power of the kite may be useful, and at times attended with satisfactory results; but it would appear that as applied to nautical purposes it would be far more efficient than as a means of locomotion on land, the inconvenience attendant upon which must necessarily be great (the present arrangements not appearing likely in all their applications to carry out the sanguine hopes of their projectors); but as regards its application to vessels, it may often prove serviceable in obtaining the advantage of an upper current of air moving quickly when all beneath a certain elevation is calm; it is also likely to be of use in signalling from vessel to vessel, and might possibly serve in time of shipwreck to establish a communication with the shore; but that, with its present mode of manipulation and arrangement, it can take its place among the regularly organized systems of conveyance is without doubt fallacious. Yet it ought to be mentioned that this ingenious and singular contrivance has been so far at least reduced to actual practice by the inventor as to have been exhibited, occasionally, for a great many years, running on the road between London and Bristol; the whole distance (113 miles) having been performed on one occasion in 1846 by a party of 16 persons, in three such carriages, without accident, and with a speed occasionally as high as eighteen or twenty miles an hour. A member of the Jury recollects receiving from a friend, five and twenty years ago, the account of an excursion performed in such a carriage or carriages (as one of a party of nine persons), from Bristol.

Luntley (No. 237, p. 435) has exhibited the model of a rotary balloon, designed to be its own propeller by means of its peculiar shape, viz., cylindrical in the centre, and both ends formed into tapering screws. The balloon floats horizontally, and is intended to rotate by means of a band passed over its centre and worked by machinery in the car. The screw at one end is intended to draw, that at the other, to propel. By shifting the points of suspension, and thus altering the direction of the car, it is designed to guide its course through the air. This construction is intended, if possible, to overcome the direct atmospheric resistance encountered by the balloon in its progress, and to cause a more equal distribution of atmospheric pressure.

Graham (No. 233, p. 435) has exhibited an aerial machine designed to take any direction required; an axle suspended over the car, and worked by a strap communication from the car, carries at either extremity a system of fan sails, with expanding joints, allowing them to assume a more or less conical arrangement. Sails of a similar kind, of the nature of oars, project from either side of the car.

Sadd (No. 301, p. 442) has exhibited the model of an aerial machine. It consists of two cylindrical balloons placed horizontally, with revolving wheels, for propelling two floats, by which to raise or depress the machine at pleasure; and a rudder for the purpose of giving the required direction.

Bell (No. 715, p. 474*) has exhibited the model of a locomotive balloon. The car, which is in the form of a boat, is constructed with a buoyant apparatus at each end, so that in the event of its descending upon the sea, the balloon and machinery may be stowed away within it. Mr. Bell has also exhibited an improved valve for a balloon. Also the model of a locomotive parachute, equipped for service.

Brown (No. 713, p. 474*) exhibits a balloon in which the gas expanding as the balloon rises is not suffered to escape, but is husbanded for use by being conveyed into the car, which is made large and hollow to receive it as a supplemental balloon. The car is also furnished at either extremity with two centrifugal bellows pointing obliquely outwards, by whose reaction, as the wind issues, it appears to be the inventor's design to impel and to guide the balloon.

MASON (No. 714, p. 474*) has exhibited the model of a navigable balloon, to be worked and directed by means of sails, helm, and mariner's compass. The model exhibited is upon a scale of a quarter of an inch to a foot. From what may be regarded as its after part, project laterally axles, giving a rotary motion to sails of the nature of screw-propellers.

PLUMMER (No. 716, p. 474*) has exhibited the working model of an aerial machine, furnished with wings or sails, put in motion by a clock-spring.

Calculating Machines.

There have been very many attempts to perform numerical calculations by mechanical means, or at least such parts of them as follow simple and rigid laws. Hitherto such instruments have failed to unite correctness in the results, combined with economy of time, and, for the most part, have been limited to the performance of the first two operations of arithmetic.

To make such instruments really useful, they must have the power of executing, by themselves, the successive operations for the solution of the problem imposed on them, when the simple data for this problem have been introduced, without trial, and without guess-work.

The best machine of this kind exhibited is that of Staffel (Russia, 148), which, on examination, seems to combine accuracy with economy of time, and works easily and directly. The mechanism is 18 inches in length, 9 inches in breadth, and 4 inches in height, and consists of three rows of vertical cylinders; the first contains 13, the second 7, and the third 7. Upon each of the cylinders in the first row are 10 notches, corresponding with the units 1 to 10. Within each of these cylinders is a small pulley, in connection with a lever, set in motion by a slider which, when the cylinder has been turned from either 9 to 0, or 0 to 9, sets in motion the lever, and communicates its action to wheels, which carry over the figures. The pulley connected with the cylinder, the furthest from the handle, is in connection with the hammer of a bell. The purpose of this bell is to give warning to the operator, on committing an error, and constitutes a most important addition to the machine, particularly in the operation of division.

Upon each of the cylinders in the second row 10 units are placed. These seven cylinders are so fixed upon their axes, that they can bodily be moved right and left, and fixed at any part, so that the cyphers in the two cylinders can be made to correspond. This cylinder is furnished with a spike, which lays hold of and works the third row of cylinders.

The internal communication of each of the parts is brought about by means of a connecting wheel, furnished with nine moveable pegs, which are set in motion by means of an eccentric incision in the dial.

The machine is capable of performing addition, subtraction, multiplication, division, and of extracting the square root.

The operation of addition is performed as follows:—

By simply placing one line of the numbers upon the second row of cylinders (the index pointing to addition), and turning the handle, till it stops, these numbers are transferred almost instantly to the first row of cylinders, and so on successively, till all the numbers to be added are transferred, and their sum is shown on the top row.

In performing subtraction, the first part of the operation is the same as in addition, but on placing the second line of figures on the second row of cylinders, the pointer being placed to subtraction, the handle is turned the opposite way, or against the motion of the sun, and the difference of the two numbers is shown on the upper line.

The operation of multiplication is performed by placing the multiplier and the multiplicand on the second and third rows of cylinders, and then, the index pointing to multiplication, the product will be found on the first cylinder.

The operation of division is very similar, excepting that the handle is turned as in subtraction.

These several operations were performed accurately, and with despatch.

In the performance of the square root, the following additional mechanism needs explanation. Between every division of the cylinder, in row 2, a small wheel is placed, and near it a projecting piece which acts upon a lever; when the projecting piece is near the word "rad" engraved on the cylinder, on turning the handle, the figures increase by 1. This, by other mechanism, is connected with the other two rows of cylinders. The operation of the square root is performed directly, without any guessing at numbers; but it is, comparatively, rather a long process.

Upon the whole it must be considered that Mr. Staffel has made an instrument possessed of considerable powers, and that great praise is due to him. The double motion of the handle as well as the warning bell are important improvements.

Mr. Staffel also exhibits a small mechanical machine for the performance of the addition and subtraction of fractions, whose denominators are 10, 12, and 15. By enlarging the machine, this number would be increased, and the power of the instrument extended. The operations were performed with quickness, and with accurate results. A Prize Medal was voted to Mr. Staffel.

THOMAS DE COLMAR (France, No. 390, p. 1196) exhibits the next best calculating machine in the Exhibition, and has combined the two essentials of economy of time and accuracy of results. It is adapted for the performance of the four first rules of arithmetic; and indirectly the square-root may be extracted by the knowledge of $a^2+2ab+b^2$, the results being inferred; but this is not the legitimate use of the instrument.*

The instrument is adapted for the multiplication of numbers whose product is expressed by less than 16 figures; and consists of two rows of cylinders, the one containing 16, and the second 8; the former are moveable, the operation at each step being changed tenfold.

The principle of the instrument is, that multiplication is in reality the continual addition of itself as many times as there are units in the multiplier, and division that of continued subtraction of the divisor.

On trying the machine, the number 1 was almost instantaneously taken from 10,000, giving the difference, 9,999, accurately; the performance of this operation is generally a severe test to these machines.

The number 5,321 was multiplied by 3,256 in less time than was required to perform the calculation, in the manner following:—The number 5,321 was placed on one series of cylinders, and the number 6 was placed on one of the cylinders of the second row, and on the handle being turned (in one direction always) the number 31,926 appeared; the upper row was moved through one division, the handle agained turned, and so on, till in a very short time, the number 17,325,176 appeared.

The several operations to which the instrument was subjected were performed quickly and accurately.

A Prize Medal was voted to M. Thomas De Colmar.

WERTHEIMER (No. 387, p. 451) exhibits several calculating machines, adapted for the performance of addition and subtraction of numbers and moneys, of this and of other countries.

Each machine consists of a box, with a metal plate divided into nine indexes, with semicircular notches, under which are placed a succession of holes. Round the indexes, numbers are engraved, and the semicircular notches are furnished with teeth, and a pointer to insert between the notches, for the purpose of bringing the notch opposite any particular figure, from right to left. This operation is dangerous, for the notch is liable to slip and not go home.

The instruments are ingenious, but they are much wanting in the essentials of such machines, viz., economy of time and unerring accuracy. The Jury, however, voted Honourable Mention to them.

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* For a description of this ingenious and useful machine, see the report of M. Benoit, "Au nom du Comité des Arts Mécaniques, Société d'Encouragement."

SCHILT (Switzerland, No. 59, p. 1270) exhibits a simple calculating machine, but which can perform the first operation of arithmetic only. Honourable Mention was voted to Mr. Schilt.

ROOKER (No. 340, p. 448) has exhibited a sliding scale of involution, the invention of Dr. Roget. The instrument consists of one fixed and one moveable scale, like a sliding rule. On the slide a line is logometrically divided, the divisions of one half being from 1 to 10, and repeated on the second half in the same order.

The fixed scale is graduated in such manner, that each of its own divisions is set against its respective logarithm on the slider, and, consequently, all the numbers on the slider will be situated immediately under those numbers in the fixed scale, of which they are the logarithms. Thus, 3 on the fixed scale will stand under 100 on the rule, and so on.

The instrument is adapted to perform the operations of involution and evolution. The principle of the instrument is contained in the equation—

$$\text{Log. log. } a^x - \text{log. log. } a = \text{log. } x.$$

rom the first member of which a disappears. Two differences of the second logarithms of the power and of the root being equal to the first logarithms of the index, it is evident, that if a scale of second logarithms be engraved on one line, and a first on a line sliding along it, the indexes being read off on the latter, the power will be so on the former.*

LALANNE (France, No. 1690) exhibits a calculating rule, constructed upon new principles, consisting of a graphic table formed entirely of right lines, with which all calculations, usually performed by the sliding rule, can be performed to within 1-200th of the true result. The Jury awarded Honourable Mention to this Exhibitor.

Instruments for the use of the Blind.

HUGHES (No. 401, p. 452) has exhibited a portable typograph or writing machine for the blind.

This is a beautiful mechanical contrivance (by no means difficult in use) by which a blind person is enabled to print legibly, with ease and rapidity. It is also applicable to printing uniform labels for Museums, &c. (for description see "Illustrated Catalogue"). The following is the manner of using it. The paper intended to be written upon is placed within a portfolio, one side of which is made of semi-carbonized paper, which, being durable and inexpensive, serves for ink. Having done this with the first finger of the right hand, any required letter, figure, or point of the index circle is brought to the right side of the lever, the thumb being inserted in the end of which, presses it downwards. This pressure will give the impression of a corresponding type letter acting upon the back of the transfer paper. The next operation is to lift the lever to its utmost height, which motion makes the space required for the next letter, and so on to the end of a word. A repetition of the movement will also make the space between the words.

Having finished a line of writing, the index circle is pushed back to the left side of its frame, and the thumbscrew turned for the desired distance between the lines; one whole turn of this screw giving four lines to the inch.

The typograph is about the size of a quarto book, and does not occupy a surface of more than 12 inches square. Its inventor has done good service, having the merit of exhibiting the best machine for the same purpose, it being the most simple in its operations of any in the Exhibition. The Prize Medal was awarded to Mr. Hughes.

TOLLPUTT (No. 382, p. 451) exhibits a machine for facilitating the writing of the blind.

FOUCAULT (France, No. 220A, p. 1187) has exhibited a printing-machine for the blind. It consists of a fan composed of 26 rods, terminated at the upper extremity with the letters of the alphabet arranged successively, together with other rods terminated with the various ciphers and symbols required in printing; the lower extremity of these rods is furnished with a corresponding letter, &c., to the one above, but in smaller type. On pressing the larger character at the upper extremity, the smaller letter beneath is proportionably depressed, which causes it to leave its printed impression on a paper previously prepared. By a little contrivance the paper is made to move onwards, in proportion to the successive pressures from above. The exhibitor of this machine, himself blind, has the merit of being its inventor, and he was awarded the Prize Medal.

THOMPSON (United States, No. 26, p. 1434) has exhibited an invention for teaching the blind to draw and write. This device is simple, and intended to afford a means to the blind of acquiring knowledge of various kinds.

The writing tablet is covered with white leather, a material well suited to the purpose intended, as it yields to the pressure of the style without retaining the impression.

The style may be made of any hard material capable of receiving and retaining a rounded smooth point. The paper should be of a strong and rather firm texture, but at no visit of the Jury was any explanation given, and they are unable to speak further of this invention.

GALL (No. 687A, p. 471*) has exhibited a triangular alphabet for the blind. This is an improvement on the Parisian, Austrian, and other circular alphabets, and it is probable that adult blind persons may by its means be easily taught to read. A volume containing the Epistle to the Ephesians, in the same characters, was exhibited, and Gall's apparatus for the writing of the blind, by means of which they can correspond with each other by post, as described in the "Illustrated Catalogue."

MARCHESI (Austria, No. 139, p. 1049,) exhibits a circular printing machine, by which the blind can print readily with three different kinds of type. On examination by the Jury it elicited much commendation, and a Prize Medal was awarded to M. Marchesi.

Miscellaneous.

DUNIN (No. 210, pp. 433, 434) has exhibited a piece of mechanism designed to illustrate the different proportions of the human figure. This beautiful piece of mechanism resembles in outward appearance a well-formed human figure, standing erect. It is capable of both considerable expansion and contraction in all its parts. The internal mechanism is completely concealed, the figure externally being composed of a number of thin slips of steel and copper, which overlap each other in proportion to the amount of expansion or contraction exercised. The motion these slips are made to possess is communicated to them by thin metal slides to which they are attached within the figure, the slides being furnished with projecting pins at their extremities. These pins are inserted into curved grooves, cut in circular steel plates, the curvature of the grooves being so arranged, that when the steel plates are put in revolution by a train of wheels and screws, the slides belonging to the several parts of the figure are expanded or contracted in correct proportion. The external slips of metal are disposed as much as possible in the direction of the fibres of the muscles in the living subject, in which direction the two motions of contraction and expansion are severally performed. Where in nature the fibres of the pectoral muscle converge towards the shoulder, in the figure there is much compound internal mechanism, and very ingenious external arrangement; the contraction of the chest, the back, the shoulder, and the fore-arm, are performed either simultaneously, with great accuracy and just proportion, or each part can be separately adjusted if required. These adjustments, the most compound and difficult to be overcome, Count Dunin, by a new and most ingenious combination of mechanism, has successfully achieved. The dimensions of the figure are subjected to their respective variations by the establishment of a connection between several parts of the internal mechanism and a winding key, by means of circular-headed projections, which being turned to the right or left, gently and gradually effect the contraction or expansion of the adjacent parts of the figure. The motions we have just described, are performed by the introduction of the winding key into several apertures left for its reception; one of them is situated immediately between the pectoral muscles on the chest; other apertures situated in the back, on the top of the shoulders, in the arms and legs, serve for the different adjustments required; about the knee of the figure, the movements of which are regulated by an aperture in the thigh, the workmanship and mechanical ability displayed are very great. The thin external metal slips, which overlap one another very considerably when the figure is quite collapsed or contracted, are each furnished with a long slit or cut-out groove, through which the pins from the plates beneath are seen to project; as these slips move easily over one another, it follows that when the figure is fully expanded, the slips can overlap one another scarcely at all; and thus the power of variation in the dimensions of the figure is dependent upon the individual length of these pieces of metal and their cut-out grooves.

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* See "Philosophical Transactions" for the year 1815.

The apparatus itself is not unlike in its general appearance to a fine suit of armour, displaying as it does the just proportions of the human form, deficient only in the extremities. The entire machinery is totally concealed, and works noiselessly, and though the entire mechanism is of the most compound nature, the whole is easily managed and adjusted. In addition to the general adjustments which we have described, we may observe that every part of the figure has an independent adjustment by which it can be put out of proportion, and made to represent the deformities or peculiarities of form of any individual.

We availed ourselves of an opportunity of carefully examining the interior of the mechanism of a similar figure in the work-room of Count Dunin, it being impossible to obtain any correct idea of its internal construction from an external view of the figure as exhibited. This examination enabled us to form a high estimate of the genius and mechanical knowledge Count Dunin has displayed in its construction. The mechanical combinations and parts employed are very numerous; they are as follows:—875 framing pieces, 48 grooved steel plates, 163 wheels, 202 slides, 476 metal washers, 4,828 spiral springs, 704 sliding plates, 32 sliding tubes (to assist in the elongation of some parts), 497 nuts, 3,500 fixing and adjusting screws, besides many other small pieces. The figure is maintained in its vertical position by means of a strong iron support at some distance from and affixed to its back.

The invention, which is stated could easily be made available in the artist's studio, is designed to facilitate the exact fitting of garments, especially where great numbers are to be provided for, as in the equipment of an army, or providing clothing for a distant colony, and will enable the personal attendance of individuals to be dispensed with, as from a new system of measurement the figure may be adjusted to the exact form and size of the person to be fitted.

A Council Medal was awarded to Count Dunin for this beautiful piece of mechanism.

LLOYD (No. 322, pp. 444-446,) has exhibited a typhodeictor, or storm pointer, an instrument designed to determine, by inspection, the bearing and relative position of a revolving storm, or hurricane.

The instrument is composed of a ring of metal, upon which the several points of the compass are engraved; attached to the centre of the circle, around which it easily revolves, is a larger pointer, with the words "set this to the wind" upon its face; in addition to the pointer, two hands of a transparent horn are likewise made to move round the central point, one being designed for use in the northern, the other in the southern hemisphere; but both are intended to mark the ship's place. Each arm is perforated with a succession of small holes, for the adaptation of the instrument to charts of different scales. In the centre is a revolving glass, which, resting on a moveable centre and pivot, is made to revolve to the *left* when in the northern hemisphere, and to the *right* in the southern; it is designed to illustrate the revolution of the winds around their centre, and to determine the relative position of a ship to the centre of a storm.

It having been ascertained by Colonel Reid that storms have a progressive and revolving motion, and that on opposite sides of the equator they revolve in opposite directions, the centre of the storm being nearly a calm, it follows that the ship can be but in one position with regard to its centre, and that, in the event of the ship approaching the storm, or the storm approaching the ship, the edge or outer boundary of it must be first encountered.

For the purpose of affording to seamen a practical illustration of the revolving winds, circles showing the gyrations of a storm, with directions for use upon them, have been made on paper which, for conveniency, has been rendered transparent; but these only prove useful in the case of a circular storm, and would fail entirely in a progressive whirlwind. Colonel Lloyd has the merit of supplying this want, and the Prize Medal was awarded to him by the Jury.

CHALLIS has exhibited an instrument for calculating the sum of the corrections of the three errors of a transit instrument, adapted for the latitude of Cambridge, and for any given N. P. D. The manner of determining these corrections is dependent upon certain geometrical considerations fully detailed in the "*Proceedings of the Royal Astronomical Society*," vol. x., No. 8. The instrument consists of a brass circular plate, moveable about a vertical axis, passing through its centre; on the plate are engraved lines for the purpose of taking account of both positive and negative corrections. At a short distance from the circular plate is a contrivance for guiding the motion of two bars, which carry two fine parallel threads of blackened unspun silk on the surface of the plate. The interval between the threads is made equal to the collimation error by means of a scale engraved on a brass plate, to which one of the bars is attached, and an index is fixed to the brass plate to which the other bar is attached; the two plates are clamped together by a screw; when the threads are set to the required interval, the screw-head serves for a handle by which to move them. The circle is graduated, for showing North Polar distances both above and below the pole. The method for performing the calculations and various details in the construction of the machine are fully described in the paper before referred to

With regard to the degree of accuracy of which the machine is susceptible, Professor Challis observes, that for calculating the reduction to meridian transit, it has been usual to form a table of the coefficients of the collimation level and azimuthal errors, arranged according to the North Polar distance, whence the coefficient for a proposed N. P. D. may be readily deduced; for the sake of saving time, the multiplication having been performed by a sliding scale. The usual method may be inaccurate to one hundredth, or even two hundredths of a second, whilst the machine by moderate care will give the nearest hundredth of a second. The indications of the instrument, however, become more uncertain in proportion as the North Polar distances are less, on account of the small inclination of the threads to the correction scale; to meet these cases an additional scale is engraved, near the contrivance which gives direction to the threads.

Should the instrument be required for use in a latitude different from that for which it was constructed, a slight addition is required, but one which the instrument is made to perform itself. Professor Challis observes, that the machine, which requires no little nicety of work, was executed for him by Mr. Simms in a very satisfactory manner.

A Prize Medal was awarded to Professor Challis.

BLUNT (No. 372, p. 450) exhibits a model of Erastothenes, as seen through a reflecting telescope of 9 inches aperture, 7 feet focal length, and magnifying power 380.

The model is beautifully executed, representing very accurately this part of the moon. The large crater-like cup, with the neighbouring mountains and smaller cup-like valleys in their neighbourhood, are well shown. A Prize Medal was awarded to Mr. Blunt.

SPRATT (United States, No. 5, p. 1433) has exhibited lightning rods. These rods, in their cross sections, are similar to the letter X, and are made either of copper or of iron. The points are formed of a compound of platinum, silver, silex, antimony, bismuth, and tin, mixed in certain proportions. The extreme top being of solid platinum is calculated to resist atmospheric decomposition. The base is furnished with three angular cast-steel magnets, plated with gold, one being also affixed to the brass connections at every point, for the purpose of facilitating the silent discharge. Zinc rings are placed between these joints to prevent oxidation.

The fastenings and glass insulators, also exhibited, are designed to afford greater convenience for the attachment of the lightning rods. Owing to this invention being in process of registration, the Jury were not able to examine it at the proper time.

Nasmyth (No. 688, pp. 471*, 472*) exhibits a well-delineated map of the moon on a large scale, which is drawn with great accuracy, the irregularities upon the surface being shown with great force and spirit; also separate and enlarged representations of certain portions of the moon as seen through a very powerful telescope; they are all good in detail, and very effective. A Prize Medal was awarded to Mr. Nasmyth.

Fisher (United States, No. 263, p. 1452) has exhibited a "dial of the seasons," intended to illustrate the sun's declination at all seasons, together with the coincident effects of light and heat upon animal and vegetable life in all climates.

The chart is divided into two portions by a line crossing the picture horizontally. The upper corner to the extreme left is made to serve as the apex of the triangles, formed by lines drawn from it to the boundary line; these, by their verticality over the tropics and gradually increasing obliquity towards the Polar regions, illustrate very clearly the different amount of sun-light distributed over equal degrees of latitude, and the difference of temperature consequent upon this unequal distribution. The chart gives also a comparative view of the equinoctial and solstitial angle of sun-light, and is designed to show the comparative rapidity of the sun's declination at the spring and autumnal periods of the year.

The effect of the unequal distribution of sun-light is shown by a series of coloured illustrations, placed immediately beneath the boundary line, which, forming the base successively of the various angles, becomes in a measure graduated. The several degrees of latitude between these graduations contain the principal productions, either animal or vegetable, which may be considered strictly indigenous: thus, towards the equator, are shown the palm-tree, the coffee-plant, the tiger, &c.; in the polar regions to the north, the white bear, pine-tree, Laplander, &c.; whilst the temperate latitudes are characterized by the various animal and vegetable productions with which we are most familiar. Immediately beneath these illustrations is another parallel series, representing on the ocean the corresponding ranges of temperature from the tropics to the poles; indicated by the typhoon in its progress, the storm of the temperate latitudes, aurora borealis, the volcano of Mount Hecla, &c. The chart, which is carefully executed, and well suited for educational purposes, is 2 feet 9 inches by 1 foot 4 inches. The book accompanying it is of considerable length, but too diffuse for educational purposes. It contains a detailed description of the diagram, and towards the conclusion an interesting table showing the influence of climate upon intellectual development, confining the existence of men of genius to within certain parallels of latitude: it is pleasingly and well written, and, were it within our prescribed limits, fairly entitled to a favourable review.

Leyser (Saxony, No. 16, p. 1105) exhibits Weber's electro-dynamometer for measuring the intensity of galvanic currents.

The instruments employed by Ampere in his electro-dynamical researches are not capable of affording very accurate results from the friction overcoming, either wholly or in part, the electro-dynamic force to be measured. Under the most favourable circumstances the utmost that these instruments can perform is to enable the feeble electro-dynamic forces to overcome the friction; but in every accurate measurement it should be assumed that the friction is an insignificant fraction of the force to be measured.

In order to exclude friction the electro-dynamometer was contrived by Professor Weber. It consists essentially of two coils of wire covered with silk; one of these has 650 feet of copper wire, making 1,200 turns round a slender ivory spindle, 0·79 inch in length, and 1·26 inch in diameter. The ivory spindle on which the coil is wound is attached to a slender stump of brass, which carries a circular plane mirror about 1·1 inch in diameter, and also an index about 1·1 inch in length, beneath which is a circle having a graduation of about the same diameter. The two ends of the wire forming the coil are attached to the lower ends of two fine silver wires 19·7 inches, and 1·27 inch distant from each other, by which the stirrup and coil are suspended, with the axis of the coil horizontal like the bifilar magnet, for measuring variations of the horizontal component of the earth's magnetism. The second coil has 980 feet of wire, making 900 coils round a thin hollow brass cylinder 1·73 inch in diameter, and 1·73 inch in length, placed with its axis horizontal, bisecting, and bisected by the axis of the suspended coil. The two coils are surrounded by a case having an opening, covered with plate-glass, through which the mirror attached to the suspended coil can be viewed. A vertical glass tube, 1·65 inch in diameter, and about 19·7 inches in length, ascending from the middle of the case, carries at its upper end insulated attachments for the upper end of the suspended wires, with adjustments in height and distance from each other, and a motion round the axis of the glass tube.

The case is fastened to a circular plate 5 inches in diameter, which has an azimuthal motion on a pedestal 6·7 inches in diameter, provided with 3 foot screws for horizontal adjustments. The upper end of one of the suspending wires is connected by a conducting wire with one end of that of the fixed coil; the upper end of the other suspending wire is connected respectively with the poles of a voltaic element or battery; the current will hence traverse the whole of both the fixed and suspended coils. At a proper distance is placed a horizontal paper scale of 19·7 inches, the image of which, by reflection, is seen in the mirror attached to the suspended coil, and viewed through a telescope placed immediately below the scale, so that the angular displacement of the suspended coil, produced by the mutual action of the currents traversing the two coils, can be measured with great precision.

By means of an instrument similar to that exhibited, Weber obtained a most accurate experimental proof of the mutual action of voltaic currents on each other.

The electro-dynamometer serves to measure the intensity of a voltaic current, as does a magnetometer under the influence of a coil through which the voltaic current is transmitted; but the electro-dynamometer differs from the magnetometer in some very important particulars, the one supplying many of the deficiencies of the other.

In the magnetometer the tangent of the deviation is proportional to the intensity of the current; in the electro-dynamometer it is proportional to the square of the intensity of the current.

A change in the direction of the current causes the magnet to move to the other side of its position of equilibrium; when not acted on by the currents it does not affect the position of the electro-dynamometer.

The electro-dynamometer has been employed by Mr. Weber to measure the intensity of the oscillations producing sound. By including a magnetometer and an electro-dynamometer in the same circuit, he was enabled to determine both the duration and intensity of momentary currents, such as those produced by the discharge of a Leyden jar. Results, highly valuable as determining the effects of momentary streams in animal physiology, may be obtained by similar observations.[*]

The instrument is exhibited by Leyser, to whom much praise is due, not only for the workmanship, but also for many details which he has introduced in its construction.

Engel (Berlin, Prussia, No. 274, p. 1065) exhibits a well-executed wood model of Fresnel's wave surface, in biaxal crystals, and an ellipsoid of three unequal axes marked with the lines of curvature. A Prize Medal was awarded.

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[*] See Weber's "Elektro-dynamische Maasbestimmungen, insbesondre wider stands messungen;" Leipzig, 1850; and also Poggendorff's "Annalen," B. 73, S. 193.

Ward (No. 664, pp. 466*, 467*) exhibits his botanical cases, which are fully described in the Illustrated Catalogue. A Prize Medal was awarded to him.

De la Rue (Class XVII., No. 76, p. 542) has exhibited various applications of iridescent films for the purposes of decoration, their vivid colours being produced simply by the agency of light upon a thin, transparent film of varnish. The process adopted to render the film and its reflected colours permanent, together with the method of its application, are as follows:—

The objects to be ornamented, whether insects, shells, birds, bronzes, paper-hangings, card-cases, &c., are immersed in a vessel of water. Upon the surface of the latter, when perfectly tranquil, is dropped a little oil or spirit varnish, which, spreading in all directions, becomes exceedingly attenuated, and reflects the most vivid colours of the spectrum. The varnish being fixed, the object, which is slowly raised in such manner that the film shall adhere to its surface, is then placed in a convenient situation, to permit the water draining off. When completely dry the film is found to be firmly attached, and perfectly iridescent, having lost nothing of its original brilliancy of colouring. This is a beautiful illustration of the production of colour on a thin transparent surface, by the slight agency of light, such as is transiently seen in an ordinary soap-bubble. The Jury awarded a Prize Medal to Mr. De la Rue.

Van Schendel (Belgium, No. 173, p. 1157) exhibits an exceedingly good illustration of the laws of perspective, consisting of a series of objects, of exaggerated forms and dimensions, painted upon a horizontal plane, and two vertical planes. At a certain height above the picture there is a circular hole, cut in a small wooden frame; on looking through which, the objects assume a natural appearance, in strict accordance with the rules of perspective, and appear in the most perfect relief. A Prize Medal was awarded to Mr. Van Schendel.

Fisher (United States, No. 263, p. 1452) has exhibited "mathematics simplified," consisting of some beautifully-drawn diagrams, intended to facilitate the study of mathematics. His idea is that of teaching a physical geometry, either preliminary to, or, when no better may be had, instead of the science. His method of using the diagrams is by teaching each step by a course of reasoning, and illustrating the laws by well-drawn figures.

Nobody can question the great disadvantage under which students lie who have to apply geometry graphically, if their previous figures have been drawn only by hand; or, what is worse, if badly drawn by ruler and compasses. It is doubtful which of the two is the greater evil—the giving a student ruler and compass as part of his course of geometry, or the making reasoning on badly-drawn figures the only preparation for a draughtsman or architect, &c. This has been often said, but seldom accompanied with any proof of the very satisfactory use which may be made of well-drawn diagrams. Mr. Fisher has the merit of offering this proof to the Exhibition, with some ingenious ideas as to the manner in which the details may be managed. The attention he has paid to one point, viz., the exhibition of areas of given simple ratios under the same and different forms is particularly beneficial. Some of his diagrams are, in this respect, excellent studies for an eye which is to be trained to correct estimation. His method is particularly applicable for adults possessed of a power of thought, which requires to be enlisted and exercised to make their study agreeable or even profitable.

Mr. Fisher's merit may be described as consisting in—1st, the application of the idea of teaching by physical perception, to a wider range of subject than merely making very exact drawings of the propositions to be demonstrated in Euclid; 2nd, in the ingenuity of his details; 3rd, the beauty of the drawings. The Jury considered Mr. Fisher deserving Honourable Mention.

Perigal (No. 693, p. 472*) has exhibited a demonstration, by the transposition of parts, of the theorem of the right-angled triangle. The square or base of a right-angled triangle being intersected by two straight lines, passing through its centre, parallel and perpendicular to the hypothenuse, is thereby divided into four parts equal and similar to each other: which, being symmetrically arranged around a square equal to that on the perpendicular, form therewith a square equal to that on the hypothenuse of the right-angled triangle conversely. The sides of the hypothenuse square being bisected, and the points of the bisecting lines being drawn (till they meet) parallel to the base and to the perpendicular, the hypothenuse square is thereby divided into four equal quadrilaterals, which are together equivalent to the square or the base, encompassing a square equal to that on the perpendicular. Thus proving that "in a right-angled triangle the square of each side is equivalent to the *sum*, or to the *difference*, of the squares of the other two sides."—*Euclid*, i. 47.

Mr. Perigal has also exhibited a quadratic trisection of the square. The square is divided into nine parts of three different shapes and sizes; so proportioned that, by combining together one of each of them, they will form three equal squares, each one-third the area of the square formed by the whole nine sections. The construction is scarcely susceptible of brief explanation without a diagram.

Mr. Perigal likewise exhibits diagrams of the *retrogressive* parabola, as derived from the circle, $y = R \cos \phi$; $x = R \cos 2 \phi = R\,(2 \cos^2 \phi - 1) \therefore 2 y^2 = R\,(R + x)$. The origin of co-ordinates at centre of circle, radius R. The kinematic curve, of which the retrogressive parabola is a limit, was discovered by Mr. Perigal, in 1835, and produced from continuous motion by him in 1840.

Mr. Perigal has also exhibited a lunarian, of novel construction, which he calls a "selenescope;" intended to elucidate the kinematic effects of the three hypotheses which have been advanced to account for the inhabitants of the earth never having seen more than one-half the surface of the moon, the same hemisphere of our satellite being always presented towards the earth. For this purpose, a terrestrial globe (about 3 inches diameter) is fixed on a brass stem supported by a brass pedestal. At the bottom of the stem is a fixed wheel of forty-eight teeth; and, between that and the pedestal, a T-shaped brass arm is centred, having at one end a receptacle for a mariner's compass. The other extremity of the arm is grooved to receive four arbors with each a wheel of forty-eight teeth like the fixed wheel first mentioned, into which one of them is made to gear. Another wheel in the middle of the cross part of the T gears into the second, and a fourth at the extremity into the third; while the fifth occupies a position at the opposite end of the cross groove, but does not gear with the other wheels. All these wheels have the same number of teeth. To the third, fourth, and fifth wheels are attached spindles, each carrying an ivory ball (about one inch diameter), representing the moon, at such elevation that their centres and that of the globe, representing the earth, may be all in the horizontal plane.

Carried by the arm round the fixed wheel, into which it gears, the second wheel is constrained to turn round its axis or arbor in the same direction, driving the third wheel in the contrary direction, by which the fourth wheel is driven in the same direction as that of the revolving arm; all with the same angular velocity: while the fifth wheel, not being in gear with the others, revolves with the arm without any additional rotation on its own arbor or axis. A coloured spot upon each of the ivory moons tends to render their relative motions more perceptible and distinct.

By this means one of the moons is caused to rotate on its axis in the same time, and in the same direction in which it revolves; another is caused to rotate on its axis in the same time in the contrary direction to which it revolves; while the third moon revolves about the earth, but does not rotate round its own axis.

Mr. Perigal also exhibited a gyroscope; an instrument designed to illustrate the effects of revolution and rotation. On a brass pedestal, an arm, supported at one end by an axis round which it freely revolves, carries at its other extremity a globe (about one inch diameter) representing the earth or the moon; which is flange-jointed in the middle, in order that the globe may be placed over the axis or centre of motion, and at various distances, as the experimenter requires.

Gerard (No. 109, p. 418) has exhibited a spherical trigonometer, for the mechanical solution of problems in spherical trigonometry and nautical astronomy. The instrument consists of three legs, jointed together nearly as in the common triangular compass, and in such manner as in every position to point to a common centre, and to represent three radii of a sphere; three graduated arcs form the sides of the spherical triangle. In use an angle is measured by clamping a brace upon the sides containing it, and sliding the other to 90° upon three sides. The instrument is coarsely constructed, but its principle is good, and if better made would be very useful; the Jury consider it well deserving Honourable Mention.

Demanet (Belgium, No. 178, p. 1157). Conversion of vibrating into rotatory motion. This is done by the inertia of a bob-weight on a horizontal arm attached to an axis which has a fixed bearing below, and can be pushed or pulled backwards and forwards from above. The bob once set going is its own crank and fly-wheel. A sudden push given to the axle crosses the bob in the same direction, and the axis being then held till the bob by its inertia has attained the other side, the axis is pulled, and then the bob gets a further motion: by means of alternating the action and non-action of the axis to coincide with favourable situations of the bob, it is made to obtain a rotation, which is easily maintained by a regular to-and-fro movement of the axis, whose upper end works in a gimbal, and is guided in its motions by a groove.

Yates (No. 378, p. 451) exhibits an instrument for squaring the circle. Its principle is, that the diameter of a circle multiplied by 1·25, equals the diagonal of the square required.

Roberts (No. 130, p. 422) has exhibited a synchronometer. It consists of a gutta-percha tube, connecting two expansions of the nature of bellows, of vulcanized Indian-rubber; on expanding one of these by a spring worked by an excentric wheel in connection with any movement, a partial vacuum is created, which being propagated along the tube, sucks in and closes down the other, whose movement puts in action a click acting on a ratchet-wheel. Thus every movement of the mechanism at one end of the tube may be synchronously (or very nearly so) communicated to a corresponding mechanism (as a clock) at the other.

Cooke (No. 664a, p. 467*) exhibits closed cases for plants.

Bateman (No. 187, p. 430) exhibits a machine intended to illustrate the effects of centrifugal force. It consists of a representation of the planet Saturn, attached to a piece of string by the edge of its ring, which, when in a state of repose, is in the same straight line with it, but on a rapid twisting motion being communicated to the string by clock-work, the object occupies a position at right angles to the string, or, in other words, spins round upon its shorter axis.*

Darnell (No. 383, p. 451) exhibits an apparatus for the detection of either fire or robbery; consisting of a lever, with a centre tumbler and balance weight, which is poised by a small line carried through any portion of a house, and fastened. On the least pressure the balance weight is raised; or if the line be cut or burnt, it will fall into a notch; in either of which cases, the alarum is put in motion. It is contained in a small portable box.

Saunders (No. 205, p. 433) exhibits a kaleidoscope which revolves on pressing the covering of the eye-piece downwards, and, therefore, is self-acting whilst the instrument is in use. This is the only kaleidoscope exhibited.

Knight and Sons (No. 453, pp. 462, 463) exhibit a machine for cleaning and polishing daguerreotype plates; portable mercury box; plate-holders; head-rests, with a series of bolt and socket joints; glass and porcelain dishes for preparing sensitive paper.

Thomson (No. 80, p. 417) exhibits an instrument called an autochronograph, intended for the registration of the times of occurrences; for example, to register the time of the arrival and departure of trains in railway stations, &c.,—to note the presence and individuality of guards, and other persons whose absence might incur inconvenience or danger; it is thus of use also in police and public offices, banking and mercantile houses, &c.

Dyer (No. 370, p. 451) exhibits a circular slate, divided into as many equal portions as there are days in the month. It is intended to make memoranda of engagements, &c., that occur on each day; and when properly adjusted at the end of each month, and turned day by day, each day's engagements are brought correctly under notice.

Roper (No. 197, p. 431) contributes Lawson's observing chair, to enable astronomers to observe with large telescopes.

Watkins and Hill (No. 659, p. 456*) exhibit Biot's apparatus for the polarization of liquids; a reflecting polariscope; an oxy-hydrogen polariscope; Attwood's machine; and a steam-engine indicator, for ascertaining the power of steam-engines.

Newberry (No. 460, p. 464) has exhibited a case of medals, the metal precipitated by electro-metallurgy, containing—a medal of Alfred the Great; Clement XII., from a very scarce original; Pius V., from the original in the possession of the exhibitor; and various others.

Rundell (No. 438a, p. 461) exhibits impressions of seals, the depth and execution of which are very good, as are the ciphers and arms, particularly when it is considered that they have been executed by machinery.

Willatts (No. 265, p. 437) has exhibited a registering thread counter, or linen prover, a small instrument designed for the purpose of ascertaining the number of threads in a certain sized piece of linen or silk, by means of an index and a self-registering apparatus. A magnifying lens is also attached, for examining the texture of the material to be tested.

Haward (No. 298, p. 442) has exhibited a gauge for measuring the thickness, and ascertaining the weight of metal and other plates, rods, and bars. Its principle is the progressive movement of a most accurately cut screw, to which is affixed a dial or circular index, so divided that each space indicates the advance of the screw to the thousandth part of an inch. The gauge exhibited is so divided that each of the smaller divisions represents one ounce per foot of superficial sheet iron, whose specific gravity is 7·68, with other divisions, till a weight of 20 lbs. to the square foot is shown. This gauge is convenient in use, and Mr. Haward has very wisely adopted the decimal notation in the subdivision.

Edge (No. 702, p. 473*) exhibits a photometer for the determination of the illuminating power of gas, as compared with that derived from any other source. The instrument was not tried by the Jury.

Chamberlain (No. 399, p. 452) exhibits a large model of a machine for recording votes, which is so constructed that the vote shall be recorded without the manner of its disposition being made known, the number of votes given being indicated by the sounding of a bell. The machine appears to be well adapted to the purpose intended, and combines ingenuity of construction with careful workmanship. Being an instrument intended for direct use, it does not fall within the province of this Jury, and was not subject to an award in Class X. This notice is given in consequence of its being placed among philosophical instruments.

Baker (No. 396, pp. 451, 452) has exhibited a vacuum gauge, furnished with a sliding scale, the glass tube being protected by a bronze covering. Also a vacuum gauge, fitted in a brass case, showing a scale of more than 22 inches, and is intended for sugar boiling, and for situations where space is an object. A steam-gauge upon the principle of compressed air, to show the temperature of steam at various pressures. Another steam-gauge, so constructed as to be less easily deranged by carriage from place to place.

Brown (No. 335, pp. 446, 447) has exhibited a patent power-engine, which acts as a water-meter. Its novelty consists in its economy of space; it is 3 feet in height, 2 in length, and 2 in width. He also exhibits a patent water-meter, which is 2 feet in length, 2 in width, and 1 foot 6 inches in length; stated to keep perfect adjustment under varying pressure. Also a patent water-meter, stated to work in compressed air, without cock or valve; and two other meters. (See the Illustrated Catalogue.)

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* See Dr. Parr's "Philosophy of Motion" for a distinct description of this machine.

LAWRENCE (No. 115, p. 418) exhibits a screw-wrench, capable of being adjusted by a spring, and of being varied in size in a moment. Also a pair of dividers; a hand-drill, intended to supersede the use of the bow-drill, and driven by a crank. A turner's centre-bearing, with friction-rollers to prevent small articles from moving in the lathe, and to enable the lathe to turn easier than in the ordinary way. These articles all seem to be useful, but scarcely belong to Class X.

PLANT (No. 215, p. 434) has exhibited a self-registering steam-boiler feeding apparatus, intended as a substitute for the common force-pump and regulating-float.

ROCHER (France, No. 991, p. 1226). A tank apparatus, for the distillation of water; adapted to the use of a ship of the line. The workmanship is excellent, but it can, in no respect, be considered a philosophical apparatus.

GREEN (No. 446, p. 462) has exhibited damp-detectors, fitted up in different kinds of boxes; also several angle-meters.

MERRYWEATHER (No. 151, p. 429) has exhibited a tempest-prognosticator. This consists of a number of bottles placed on an ornamental stand, in each of which it is proposed to place a leech, so as to render available the well-known sensitiveness of this animal to changes of the weather.

Before closing this Report, it may be well to dwell for a short time upon the probable good resulting from the exhibition of the subjects which it embraces. So vast is the field over which it is spread, and limited the time allowed for its preparation, that, in some instances, we have been able only to enumerate, without fully discussing, the merits of individual works. No opportunity, for the same reason, is afforded of instituting an inquiry into the comparative importance of the several classes of instruments—an inquiry which would be attended with great labour, from the necessity of gravely weighing and determining the comparative value of results which we have been enabled simply to record.

That the Exhibition will form an era in art and science is to be expected; and that both will benefit greatly from so large a collection of instruments and useful applications from all countries is also certain. That it is not calculated to engender national animosities will be seen by a review of our Report, which discovers the fact, no less pleasing than anticipated, that every country is characterized by peculiar excellence in some department; and we might venture to predict, that steady and constantly progressive as the advancement of science has been—from the broad basis now offered for the first time, as a groundwork for future improvements—it will receive a fresh impulse and many accessions from new and otherwise unexpected quarters. That the Exhibition has received contributions from individuals of various grades, is one of its most pleasing features; as is the fact that a vast field for increase of knowledge, and a means of self-education, has for the first time been opened to the artizan. This class of individuals greatly want a knowledge of that which has been done—a deficiency the Exhibition is well calculated to supply, and may thus divert much fruitless labour and ingenuity into newer and more useful channels. That there does exist in this class of the community a considerable amount of ability and power of application, is evidenced by the various patents which have been taken out for ideas and inventions, the purchase-money of which has too often been the sole remuneration of the inventors.

The Exhibition will make the improvements which have been made in different instruments by various countries known to all; and the means for the acquisition of knowledge, hitherto confined to the few, will, by it, be placed within the grasp of the many.

Glancing once more at the collection now before us, combining as it does a concentration of the labours of eminent men, who have toiled during successive generations for the advancement of science, and whose successful efforts have developed the important principles which have served for the groundwork of modern discoveries, and their beautiful applications to the wants of the present day, we are impressed more strongly than ever with the all-important fact, that much as man has done, both in the physical and scientific world, by a long train of brilliant discoveries, there is more yet left to achieve than has hitherto been accomplished.

As heat, light, electricity, magnetism, chemical affinity, &c., by the recent discoveries of Volta, Faraday, Oersted, Seebeck, Wheatstone, &c., have been found to be mutually related, so that heat may be said to produce electricity, and *vice versâ*, and so on for all the rest, we may expect that a still more intimate union than that already discovered may be found to exist. That things apparently distinct and remote prove to be linked together and inseparable, is instanced by the frequent discovery of intermediate missing links in the continuity of the chain connecting all living bodies, from the most minute, and almost inanimate, to man; and which have tended to prove that the powers with which they are severally endowed, and the principles of their formation, have been regulated upon one grand system of gradation, having unity alone for its summit. That the effect of a concentration of the sciences of the age must be infinitely greater than that exerted by a single one, is obvious; as also that this concentration and union, once effected, will be productive of vast and universal applications, such as we dare not even to predict.

The Exhibition, by collecting, within a comparatively small space, almost all the known applications of science throughout the civilized world, is eminently qualified for the attainment of this great end, by promoting the advance of science in its various branches, and by infusing a taste for the development of the highest faculties with which man is endowed.

JAMES GLAISHER, REPORTER.

Lewisham, Nov. 1851.

INDEX TO CLASS X.

Note.—This Report being so extensive, and embracing a large variety of subjects, it has been deemed by the Author expedient to prepare a special Index to accompany it.

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CLASS XA.

REPORT ON MUSICAL INSTRUMENTS, &c.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Sub-Jury A for Musical Instruments.

Sir H. R. BISHOP, *Chairman and Reporter*, 13 Cambridge Street, Hyde Park; Professor of Music at Oxford.
SIGISMUND THALBERG, *Deputy Chairman*, Austria; Professor of Music.
W. STERNDALE BENNETT, 15 Russell Place, Fitzroy Square; Professor at the Royal Academy of Music.
HECTOR BERLIOZ, France.
J. ROBERT BLACK, United States; Physician.
Chevalier NEUKOMM, Zollverein.
CIPRIANI POTTER, 9 Baker Street, Portman Square; Principal of Royal Academy of Music.
Dr. SCHAFHAUTL, Zollverein; Professor of Geology, Mining, and Metallurgy.
Sir GEORGE SMART, St. Anne's, Chertsey; Organist and Composer of the Chapel Royal.
HENRY WYLDE, 65 Westbourne Terrace; Doctor of Music and Professor at the Royal Academy of Music.

Associates.

Rev. W. CAZALET, Tenterden Street, Hanover Square; Superintendent of the Royal Academy of Music.
JAMES STEWART, 22 Brecknock Crescent, Camden Town; Pianoforte Manufacturer.
WILLIAM TELFORD, Dublin; Organ Builder.

THE Jury of Class XA, having concluded the examination of the various articles confided to their inspection, and having made their awards, have now, in accordance with the desire of the Royal Commission, to offer the result of their labours in an official form, which it is hoped may hereafter serve as a faithful and impartial register of the state of musical instruments, and their manufacture, in the year 1851.

When the very large number of articles (eighteen hundred and fifty-seven) in this Class, displayed in the Exhibition, is taken into consideration, the utter hopelessness of doing adequate justice to all exhibitors in such a Report as this is at once apparent. Nevertheless, the Jury are desirous to record the unfeigned satisfaction and pleasure which they have derived during their inspection, from becoming acquainted with some of the most beautiful specimens of musical instruments of all kinds ever manufactured; and it will be their consolation to know that the restriction which they are necessarily obliged to make in the length of their Report will be amply compensated by the increased intelligence of the musical public, who have not failed to visit those articles, and to reward them, in their own opinion, according to the merit displayed.

Organs.

In this department the Jury, after due deliberation, determined to award the Council Medal to the following makers:—

M. P. A. DUCROQUET, Paris, Messrs. HILL and SON, and Mr. H. WILLIS, London, for their introduction of a fundamental pneumatic principle into the art of organ-building, by which means the great exertion hitherto required on the part of the performer on a large organ is no longer necessary, the labour being transferred to the bellows-blower; and thus the largest organs may now be built without exacting from the performer more physical strength than he is obliged to use in playing one of the smallest size and compass.

The following are the explanations of the various improvements illustrated in the organs which have been exhibited by the three above-mentioned builders, Messrs. HILL, WILLIS, and DUCROQUET.

The organ by Messrs. HILL and SON has two manuals; compass C C to F (54 notes). Pedal organ C to E, 2½ octaves.

The great organ contains 10 stops.
The swell organ contains 5 stops.
The pedal organ contains 1 stop.

In this organ the following improvements have been introduced:—

1st. The "*Tuba Mirabilis,*" a stop of great power and fulness of tone, the invention of Messrs. HILL. It is voiced on a much heavier pressure of wind than ordinary, namely, 11 inches, the ordinary pressure for church organs being from 2½ to 3 inches. This stop has a separate bellows and wind-chest, and has never been made by any other builder.

2nd. The "wind-trunks," for conveying the wind from the bellows to the wind-chest, are abolished, and hollow posts and framework substituted, thus effecting a great saving of room, and simplifying the general construction of the mechanism.

3rd. The application of a new valve to the great organ, the invention of Messrs. HILL, who first adapted it to the large pedal pipes in the York and Birmingham organs; it being found that such large pipes could not be supplied with sufficient wind by means of valves of the old construction, without increasing the resisting surface to such an extent as to render it impossible to open them by the pressure of the fingers, or even the feet of the performer.

The above-mentioned valve reduces the pressure, or rather resistance, to one-fourth of that presented by one on the old plan, and admits at the same time double the quantity of wind. This valve has now for the first time been adapted to the manuals, to which it insures equality as well as lightness of touch.

4th. The stops and sliders are shifted by means of the pneumatic apparatus; so that in changing the stops a key has merely to be pressed down, instead of drawing them off and on by means of draw-rods.

These keys act upon a set of valves which admit compressed air into a series of small bellows acting directly upon the sliders.

There is a small bellows at each end of a slider, one for pushing the stop on, and the other for taking it off. Upon one of the keys being pressed down, the valve is opened, and the bellows becoming suddenly inflated by the admission of the compressed air, a motive power is obtained sufficient to move the slider into its required position.

5th. The composition pedals are exceedingly simple in their construction, the performer having merely to move the keys above mentioned, which being very light are moved with great ease. The usual heavy iron-work is entirely done away with, and the action much simplified and condensed.

Mr. H. Willis's organ consists of three rows of keys, from C C to G (56 notes), and two octaves and a fifth of pedals, namely, from C C C to G (32 notes).

The pneumatic lever, as improved by the builder, is applied to the great and swell organs; the choir touch is lightened by pneumatic contrivance, counteracting the resistance offered by the pressure of the air, and a remarkably effective valve is applied to the 32 and 16 feet wood stops in the pedal organ, called the patent cylindrical pedal valve, though used for other purposes in the same instrument. The bellows supplying the swell organ are placed in the box itself, and give two pressures of air. The whole of the draw-stop movement is centred in a peculiar way—also patent.

The various organs have applied to them a novel and convenient movement for arranging the stops, called "The Patent Combination Movement."

The swell-box is constructed of 3-inch pine plank, with double front, upon the Venetian principle; the shutters of which (40 in number) are made of 2-inch pine, with leathered joints, &c.

The instrument will stand in a height of 27 feet, as at present arranged, and is 25 feet wide, by 22 feet 6 inches in depth; but it is capable of extensive alterations at a trifling expense, should they be necessary.

The following is a synopsis of its contents:—

	Stops.
Great organ, C C to G - -	20
Swell organ, C C to G - -	22
Pedal organ, C C C to G - -	14
Choir organ, C C to G - -	14
Couplers - - - - - -	7

Observation 1.—The whole of the stops extend throughout the compass of the various claviers, except the orchestral oboe, which, from its close resemblance to that instrument, is only of the same compass.

Observation 2.—The plan of placing the bellows in the abstract swell overcomes all the evils resulting from confinement of air by closing the front, thus the pipes remain in tune. The other advantages are obvious.

The following is a description of M. Ducroquet's organ.

The instrument is composed of 20 stops; with two manuals and German pedals. Each manual comprises five octaves, from C C to C, and the pedals two octaves, from C C C to C. There are ten stops on the lower, or great organ manual.

Observation 1.—All the reed-stops on this manual are established on a separate wind-chest, and supplied with air at a greater pressure than that of the diapason stops.

Observation 2.—The reed-stops and the furniture can be withdrawn at pleasure by means of a pedal.

There are eight stops on the upper or swell manual.

Observation 1.—All the stops on this manual are inclosed in a swell.

Observation 2.—The upper manual can be coupled with the lower in three different ways, namely, in unison, octave above, and octave below. The couplers are brought into play by pedals, and in consequence of the application of the pneumatic lever, do not add in the slightest degree to the weight of the touch, whatever may be the number employed.

Pedal Stops.

	Pipes.
Pedal pipes, 16 feet - -	25
Ophicleide, 16 feet - -	25

Observation.—The pedals act at pleasure on the bass of the great organ by a coupler.

The instrument is contained in a handsome oak case in the Gothic style. It measures 30 feet high, 12 feet broad, and 6 feet deep.

All the mechanical parts of this organ are constructed of the best materials, and executed on the most approved principles. In addition to many late and important improvements, will be found peculiar dispositions, which have been adopted with a view of enabling it to compete, both in power and variety, with instruments constructed on a much larger scale.

Connoisseurs will, no doubt, be struck with the proportionably greater number of reed-stops introduced into M. Ducroquet's organ, compared with organs of the same dimensions built either in England or Germany. The object has been to obtain a fuller orchestral effect: many of these stops, such as the oboe, cor-Anglais, and bassoon, being particularly adapted for the execution of solos; while the trumpet, clarion, and double-trumpet stops give unusual energy to the fortissimo passages.

It may, however, be necessary to observe, that the diapasons, which can alone give to the organ its essential character, have been by no means neglected. Of these there are two of 16 feet, and eight of 8 feet, five of which commence on the CC. It may be added, that among these stops are two of remarkable power and brilliancy, the harmonic flute and bell diapason; the latter of recent invention, never having yet been introduced in any other organ.

This instrument, built expressly for the Great Exhibition, for the special purpose of representing the actual state of organ-building in France, is equally suitable either for a church or a large concert-room.

A fourth Council Medal was also awarded by the Jury to Messrs. Gray and Davison, London, who have invented a very ingenious and simple contrivance to combine the great organ with the swell organ, by means of a pedal, which acts with the utmost ease, and by which a very effective *sforzando* may be produced; thus enlarging the musical field of the performer, and adding variety to the otherwise monotonous character of the most powerful and magnificent of all musical instruments.

Messrs. Gray and Davison's organ contains their newly-invented stop, the *keraulophon*, first introduced by them in the organ at St. Paul's Church, Wilton Place. It has also three manuals, and an independent pedal organ. There are—

	Stops.
In the great organ - -	14
" swell " - -	9
" choir " - -	8
" pedal " - -	4
" couplers " - -	5

and six composition pedals.

Mr. J. C. Bishop, London, and Mr. J. W. Walker, London, have exhibited but few specimens of their organ-building. Such makers have not been passed over by the Jury without Honourable Mention, having ever been in the foremost rank of organ-builders.

A Prize Medal has been awarded by the Jury to Johan Franz Schulze, and Sons, Zollverein, for an organ, which possesses two manuals, and an independent pedal organ. There are—

	Stops.
In the great organ - -	8
" choir " - -	6
" pedal " - -	5

Messrs. Schulze's organ has blind prospect-pipes; the construction of the interior is therefore more simple. It requires no roller-boards, and is constructed with squares, which go in an oblique direction to the valves. In front, a vacant place for tuning is left, and the smaller stops may be placed in front, to the great advantage of the tone of the organ.

2ndly. It has a more powerful tone than others of larger dimensions; it has also several soft stops—the whole being constructed after the theory of Professor Töpfer.

3rdly. It takes up less room than any other with the same number of stops, it weighs less, and requires less labour than organs of the same proportions.

4thly. It has claims for its comparative cheapness, considering that it has more power and depth of tone than is usual in organs of the same size.

5thly. The trumpet 8′ is a free reed-stop, it is tuned by screws, the crutch is fixed, while the plate and the tongue are moveable. The tone of this stop is more like that of a clarionet or bassoon, which has been attained by a novel covering of the body of the pipes.

6thly. The posaune (trombone) 16′, is also a free reed-stop; it has a stronger tone, and speaks quicker than a common reed-stop.

7thly. Messrs. SCHULZE's organ has also a *reserve* bellows, which assists materially the rapid speaking of the pipes, and which is of a peculiar importance, inasmuch as it provides a sure remedy for the unskilfulness of an organ-blower.

A Prize Medal has also been awarded to—

Messrs. DUCCI, Florence, for a beautiful specimen of a chamber-organ, respecting which the following is an extract of the opinion of Signor Rossini:—

"Messrs. A. and M. DUCCI, of Florence, have built an organ of a diminutive size, possessing the same tone as one eight times larger. Its chief peculiarity is the position of the lower notes, which are placed within the bench on which the player is seated. These lower notes are placed in one single pipe, which gives the lowest C with 16 feet, and the successive tones of the chromatic scale by means of eleven holes." To obtain the tone of a large organ, the builders, Messrs. DUCCI, have altered the form and disposition of the pipes, and invented a new species of mechanism. The instrument can be easily removed as it is, or it may be taken to pieces, packed up, and carried anywhere, just like a piano.

"The builders deserve great praise for this new instrument, which not only does honour to their ingenuity, but must expand the boundaries of art, particularly in the power it gives of uniting all the lower notes in one single pipe, which may thus lead to new mechanical improvements, and open sources of acoustic phenomena."

Honourable Mention has been made of an enharmonic organ, invented by Lieut.-Colonel T. PERRONET THOMPSON, M.P., and built by T. J. F. ROBSON, London.

Mr. G. H. HOLDITCH has exhibited a small choir organ, the compass of which is from C C to F in alt. The stops are as follows: open diapason, as far as tenor C, 4 feet; stop diapason bass, cœlestina, principal, *diaocton*.

The *diaocton* stop has the effect of doubling every single stop throughout the instrument; the power, therefore, of the instrument is equivalent to one with twice the number of stops. This addition was invented by Mr. Holditch, who has applied it to church and chamber organs. The contrivance is very simple, and not liable to derangement. The organ possesses a pneumatic lever or valve, by which means the wind is made steady; also three composition pedals, with double actions to pull in and out the draw-stops. The pallets in the bellows are of peculiar structure, to prevent their casting or turning up from excess of heat or damp, which has been a great inconvenience in the formation of bellows hitherto.

Pianofortes.

The following remarks upon pianofortes have been contributed by Mr. Thalberg:—

"Having been invited to contribute towards a Report on the pianoforte, I proceed to comply, in as short a space as is consistent with the nature of the subject.

"It is necessary, in the first place, to notice the fact that music, though, perhaps, of all the fine arts, the first in the order of cultivation in every country, has been certainly the very slowest in its development. In all its sister arts we look for the finest productions to the past, and in some cases to very remote periods of European civilization, while the great productions in music belong, as it were, to the present time, and are nearly all included in the last seventy or eighty years, certainly in the last century. For ages, even amongst the most cultivated and polished people, music was confined almost wholly to melody; and its execution was bounded by the natural powers of the human voice, slightly and artistically cultivated; and to instruments, most of which were exceedingly imperfect. But the pleasure from music, even then, was derived from a complication of separate effects; from the quality of the tone, from intonation or variation in the degrees of gravity and acuteness, from modulation, or the departure from and return to the principal key, from rhythm, or divisions into equal groups, from the modes of expression—staccato and legato, forte and piano, &c., and from the various movements appropriate to different feelings, from the solemn adagio to the merry presto. This complication of the elements of pleasure was increased by the employment of instruments in accompaniment to song, at first in unison with the voice, which gradually led to counterpoint, which in its turn immensely increased and varied the effects of music, caused the science to be far more studied, induced numerous experiments in musical acoustics, and gave a new and more elevated character to musical compositions. New instruments were invented, and old ones improved, accompaniments began to be composed to vary and heighten the effect of the melody, by using different figures of intonation, and orchestral effects were produced by appropriating different instruments to particular purposes. Then harmony, properly so called, began to be cultivated, or the flow of different melodies in harmonic agreement. At length came the great masters, as Handel, Bach, Haydn, Mozart, Beethoven, &c., who gave an entirely new, intellectual, and real artistic character to music, by employing in their compositions subjects appropriate to the character intended in the particular piece, and treating the different elements of musical pleasure in a methodical and artistic manner.

"These great composers thus elevated music to a level with its sister arts, and made the pleasure to be derived from it, like that from painting, complicated and refined, requiring a certain education in the hearer, as in the observer, to be able to understand and appreciate its higher productions, so that we may now include music with the other fine arts, in so far that the uncultivated taste feels only this or that element of pleasure, while the cultivated taste appreciates all the elements employed, and reaps the full enjoyment of the most beautiful productions of art.

"In this progress of the art composers found all the aid they desired for the composition of melody in the truth and flexibility of the voice and the violin; but for their orchestral and concerted pieces they could not keep in their studios bands of musicians. To meet this exigency they employed spinettes, clavichords, and harpsichords, and afterwards pianofortes, which, though feeble instruments of no great compass, answered this purpose so well as to become universally adopted by composers. This use of this class of instruments led to the peculiar capabilities of the pianoforte being thoroughly studied and appreciated; and the composers repaid their obligation to the instrument by writing for it many of the very finest productions in music, and by practising the execution of these productions to such an extent as to be able to bring them before the public with the greatest *éclat*. The importance which the instrument had thus gained led from time to time to its improvement and enlargement, and this again to still finer compositions being produced for it, and to the adaptation for the pianoforte of all the best orchestral compositions; so that the advance of the art, and the improvement of the piano, have had a mutual effect upon each other, until it is now beyond all question the first of musical instruments, both to the profession and to the cultivated classes of society.

"More than three centuries back there were in use two kinds of small instruments with key-boards; the Clavitherium, of a square shape, having strings of catgut, which were vibrated by bits of hard leather about a quarter of an inch long projecting from the side, and at the upper end of the jack, which was operated on immediately by the inner end of the key; and the Clavecin, of nearly the same form as the present grand piano, having strings, which were vibrated by plectrums of quill or hard leather. These limited instruments, with others of kindred forms, such as virginals, spinettes, and harpsichords, continued in use, with very slight improvements, for two hundred years, until the beginning of the last century, when, in 1716, Marius presented to the Academy of Sciences, at Paris, a Clavecin, whose strings were vibrated with hammers instead of plectrums. This was a very great step, wholly changing the quality and character of the tone of the instrument, and making it in reality a new and different one; in fact, the embryo piano. Two years after, Christoforo, at Florence, introduced some further improvements in the instrument, and produced what has generally been considered the first piano. But the new inventions, although immeasurably superior to their predecessors, had great difficulties to contend with, and were a half century in fighting their way into any considerable degree of favour. However, in 1760, Zumpe in England, and Silberman in Germany, had established small manufactories of the piano, and it was successfully competing with its more established rivals, as is sufficiently shown by its having been adopted and used by Haydn, who left sixty sonatas composed expressly for it. Gluck also adopted the piano; and we have seen the instrument on which he composed his Armida and other works, made for him by Johannes Pohlman in 1772. It is but 4½ feet in length, and 2 feet in width, with a small square sounding-board at the end, the wire of the strings being little more than threads, and the hammers consisting of a few plies of leather over the end of a horizontal jack working on a hinge. The instrument, compared with a fine piano of the present day, is utterly insignificant and useless; and it is difficult to conceive how it could have been used for the purposes it certainly served, till we reflect upon the importance to the composer of having at instant command any description of orchestral effect.

"About this time Sebastian Erard made the first pianos in France: in the following year Stodart patented in London a combination of the harpsichord and grand piano; and, in 1783, Broadwood took out a patent in relation to the piano. From this period pianoforte-makers rapidly increased in every part of Europe, especially in Germany, England, and France, showing how broad-spread became the estimation of the instrument. Since 1786, up to the present moment, hardly a year has passed without the appearance in England alone of patents for real or imaginary improvements, countless experiments being made, most of them totally empirical and unimportant, but some, especially in the last thirty years, truly scientific, resulting in the enlargement and improvement which we now find.

"In 1786, Gieb took out a patent for what is called the grasshopper action, which is still in use for square pianos, in the dampers of which improvements were patented in 1794 and 1798 by Southwell. In 1809, Sebastian Erard, to whose genius the pianoforte is so much indebted, patented the upward bearing of the strings, which was a very great and scientific improvement, now almost universally adopted. In 1819, Thom and Allen patented compensation metallic tubes, which were adopted by Stodart in the grand piano. These tubes, firmly fixed at one end, were made moveable in a slide at the other, to allow them to contract and expand with changes of temperature. They had not the slightest compensating effect as intended,[*] but they were very effective for bracing, and certainly gave much greater strength to the frame. In 1821, Pierre Erard brought out his first repetition action, and in 1824 patented a complete system of metal-bracing for the grand piano, by bars firmly fixed at both ends to plates and abutments of metal, and employed a number of thicknesses of oak glued together in a mould to form the bent side, thus obtaining such increased strength of frame as to permit thicker wire to be used in stringing, from which he discarded brass altogether, and employed steel strings throughout the scale, which was followed, in 1827, by a new repetition action. Broadwood, Collard, Kirkman, Stewart, Wornum, and a few other makers, have likewise contributed, in various degrees, at different times, to the progress of the instrument.

"During the first years of this century two systems chiefly prevailed with regard to the grand piano, the older one followed by the London makers, known as the English system, and the newer one in Germany, called the Vienna system. The difference was principally in the action, that of the English being the common grand action, the origin of which is unfortunately unknown; and that of Vienna a new action, invented, it is said, at Augsburg, by an organ-builder. The old grand action gave a more powerful blow and produced a fuller and finer tone, while the lightness of touch of the Vienna action afforded far greater facilities of expression, and caused it, therefore, to be adopted by most of the eminent pianists of the time. This is not at all to be wondered at, when we consider the immense importance of the action of the piano, in bringing out the elements of expression which are peculiar to the instrument. Between the mind of the player that conceives, and the string that expresses by its sound the conception, there is a double mechanical action; one belonging to the player in his fingers and wrists, the other to the piano in the parts which put the strings in motion. No two piano players touch the instrument alike—that is, no two players have the same mechanical action in their fingers, or produce the same tones; and the difference in the style and degrees of excellence of pianists is more owing to this than to any other cause. It is, therefore, self-evident, that that part of the piano which continues the action of the fingers, and completes the connexion between the mind of the player and the strings of the instrument, should have a delicacy and a power answering as near as possible to those of the hand of the player. Every difference in the action of the piano will give a corresponding difference in tone and expression; and hence this part of the instrument has at all times been justly considered of paramount importance, not only by the great professional pianists but by the highly-cultivated amateur player. Now, however, we have an action, the invention of the late Sebastian Erard, which gives a more powerful blow than the old grand action, and a far more rapid and delicate effect than the old Vienna action—thus combining the advantages of both systems.

"To give an idea of the degree of perfection attained at the present day in the construction of the piano, we will describe one of the grand pianos in the Exhibition.[*] This instrument is 8½ feet in length, and 4½ feet in its greatest width; its frame is of enormous strength, compared with the instruments of former times, being heavily braced with wood below the strings, having a complete system of metallic bracing above the strings, firmly abutted, and consisting of longitudinal bars let into metal at each end, and having the curved side formed of a number of separate pieces glued together in a mould to insure durability and fixedness of form. Its sounding-board extends to the frame on all sides, except the space left for the action. The strings are made entirely of steel, and of wire so thick that the tension necessary to bring them to the proper pitch produces an aggregate strain equal to at least twelve tons weight, while they are passed through studs drilled into the metal-wrest plank, thus giving the strings an upbearing position, which prevents the slightest displacement of the point of contact by any force of the hammers; and the system of placing the strings on the instrument, determined by accurate acoustic experiments, causes them to be struck by the hammer at that precise nodical point which produces the freest and clearest tone. The compass is extended to seven octaves from A to A. The action of this piano is described by Dr. Lardner, in a work just published on mechanics, as 'a beautiful example of complex leverage in the mechanism which connects the key and hammer. In this instrument the object is to convey, from the point where the finger acts upon the key to that at which the hammer acts upon the string, all the delicacy of action of the finger; so that the piano may participate, to a certain extent, in that sensibility of touch which is observable in the harp, and which is the consequence of the finger acting immediately on the string in that instrument without the intervention of any other mechanism.' The power of this instrument depending on the quantity of matter brought into vibration, the resonance, or the perfection of that vibration, depending on the correct proportions of its parts, and the accuracy of intonation depending on the nature of the bridging, the proportions of the strings, and their arrangement with regard to the blow of the hammer, are all most admirable; while the action depending on the peculiar mechanism employed far surpasses everything else of the kind, for it enables the player to communicate to the strings all that the finest-formed and most skilful hand can express, and becomes, as it were, a part of himself, reflecting every shade of his feelings, from the most powerful to the softest and most delicate sounds. This action is, indeed, so perfect, particularly in its power of delicate repetition, that if any note is missed in execution upon it, it is the fault of the player and not of the instrument. Many persons have a very meagre notion of the power of expression possessed by the pianoforte. The fact is, however, that it really possesses almost all those elements of expression which belong to any other instrument, and several which are peculiar to itself, from the circumstance of the various parts of music adapted to the instrument being brought out by the same hand and same feeling. An immense difference of volume of tone and of effect is produced by the manner of touching the keys and by the use of the pedals, especially upon an instrument of great power, fine quality of tone, and delicate mechanism in the action.

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[*] And yet for that very purpose they continue to be used by many celebrated makers up to the present time.—*Reporter*.

[*] Mr. Erard's, in the British Department.

"The manufacture of the piano as a branch of trade is of very great importance, from the superior character of the principal workmen, and the vast numbers employed, directly and indirectly, in connexion with it. In all the cities of the civilized world there are numerous makers of this instrument, with immense numbers of workmen; and in most secondary towns throughout Europe there are small makers; while the increase of the number of pianos compared with the population is every year more rapid, a circumstance which is not observed in regard to other musical instruments. This is corroborated by the fact that some years ago pianoforte-music constituted only a very modest portion of a music-seller's stock; whereas now it fills more than three-quarters of his shelves, and makes his chief business. The number of teachers is something wonderful: many are reduced ladies, who find in this exercise of their acquirements the most available means of support. Every professional pianist has often had occasion to exercise his kindly and generous feelings in recommending and assisting accomplished women, whose helpless families would otherwise have been utterly destitute.

"The social importance of the piano is beyond all question far greater than that of any other instrument of music. One of the most marked changes in the habits of society, as civilization advances, is with respect to the character of its amusements. Formerly, nearly all such amusements were away from home and in public; now, with the more educated portion of society, the greater part is at home and within the family circle, music on the piano contributing the principal portion of it. In the more fashionable circles of cities, private concerts increase year by year, and in them the piano is the principal feature. Many a man, engaged in commercial and other active pursuits, finds the chief charm of his drawing-room in the intellectual enjoyment afforded by the piano.

"In many parts of Europe this instrument is the greatest solace of the studious and solitary. Even steam and sailing-vessels for passengers on long voyages are now obliged, by the fixed habits of society, to be furnished with pianofortes, thus transferring to the ocean itself something of the character of home enjoyments.

"By the use of the piano many who never visit the opera or concerts become thoroughly acquainted with the choicest dramatic and orchestral compositions: this influence of the piano is not confined to them, but extends to all classes; and while considerable towns have often no orchestras, families possess the best possible substitute, making them familiar with the finest compositions. The study of such compositions, and the application necessary for their proper execution, may be, and ought to be, made the means of greatly improving the general educational habits and tastes of piano students, and thus exerting an elevating influence, in addition to that refined and elegant pleasure which it directly dispenses."*

One hundred and seventy-eight instruments of this class have been exhibited, Great Britain contributing sixty-six of that number, according to the following Table:—

	Exhibitors.	Instruments.
Great Britain - - - - -	38	66
Canada (Colonial possessions)	1	1
Nova Scotia ditto -	1	1
France - - - - - - -	21	45
Zollverein - - - - - -	18	26
Belgium - - - - - -	6	16
United States - - - - -	6	10
Austria - - - - - -	5	6
Switzerland - - - - -	3	3
Denmark - - - - - -	1	2
Russia - - - - - - -	1	2

In the above department the three great European makers, Messrs. BROADWOOD, COLLARD, and ERARD, have exhibited specimens of the most perfect and beautiful manufacture. And upon the subject of this highly-important and valuable instrument it is necessary to dwell with more than an ordinary force; though any attempt to analyze the entire structure of a pianoforte, comparing its former build with the present, would be here superfluous. We would, however, draw attention to the perfection at which this instrument has arrived, so that the public may review its past history, and acknowledge the debt of gratitude due to those makers who have so unceasingly worked for its improvement. And here it will be proper to state, that the Jury, appreciating the strong claims of the three makers, Messrs. Broadwood, Collard, and Erard, to public testimony, awarded them alike the Council Medal.†

Messrs. Longman and Co., of London, predecessors of Clementi and Collard, first introduced what is called the "*hopper escapement*." The invention of the *damper*, for checking the vibration of the strings, was due to a native of Ireland, and it was for a long time called the "Irish" damper.

About the year 1776, Becker, a German, undertook to apply the pianoforte mechanism to the harpsichord. In this task he was assisted by John Broadwood and Robert Stodart, at that time workmen in the employ of Burkhardt Tschudi, of Great Pulteney Street, London. After many experiments, the grand pianoforte mechanism was contrived by these three. It is, in all essential particulars, the same still used by Messrs. Broadwood and Messrs. Stodart, and is remarkable for its simplicity, efficiency, and durability. It may be emphatically termed the *direct action*.

Messrs. Broadwood alone, from 1780 to 1851, have made with this mechanism (slightly modified from time to time) upwards of eighteen thousand full-sized grand pianofortes, besides fifteen hundred pianofortes of small dimensions.

The earliest notice of a pianoforte in their books occurs in 1771—of a *grand* pianoforte in 1781. Clementi was the first to bring the grand pianoforte into notice as an effective *concert* instrument. He played on one by Broadwood in the Pantheon, Oxford Street, in 1782.

The total number of pianofortes of all kinds made by Messrs. Broadwood from 1771 to 1851 is one hundred and three thousand seven hundred and fifty, and of these, sixty thousand three hundred and eighty-two have been made from 1824 to 1850—an average of about two thousand two hundred and thirty-six *per annum* for that period. The number of persons employed in their manufactory, at the taking of the census in 1851, was five hundred and seventy-three. Besides these there are numerous persons working at home for the same firm.

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* End of Mr. Thalberg's remarks upon pianofortes.

† This award was only confirmed by the Council of Chairmen in Mr. Erard's case.

It is clear that for many years the pianoforte was inferior to the harpsichord; for when, in 1765, Burkhardt Tschudi presented an instrument to the King of Prussia, it was a harpsichord with two rows of keys. This instrument is still at Potsdam. The strings of the harpsichord being very *thin*, the wooden framing of the case sufficed to bear the tension. As soon as the strings of the pianoforte were increased in thickness it became necessary to strengthen the cases, and *steel arches*, therefore, were introduced between the strings. So early as 1808, Messrs. Broadwood applied horizontal steel bars over the strings. The number of these bars varied from two to seven.

Messrs. Stodart, in 1820, patented a system of bracing by means of *hollow* metal tension bars applied over the strings, combined with a suspension bar over the wrest-plank.

In 1824, Mr. Erard patented a somewhat different system of horizontal metal bracing.

In 1827, Messrs. Broadwood patented a third system of metal bracing for the grand pianoforte. It was a combination of the metal bars already adopted by them, with the metal string-plate which had by them been first applied to the square pianoforte in 1822. The four pianofortes which have been exhibited by this firm, may be described, as to externals, as follows:—

1. A grand pianoforte in the *Nave*, ebony case richly carved and gilt; the top, ebony inlaid with satin-wood; above each of the three legs is a medallion, carved and gilt, having busts of Handel, Mozart, and Beethoven. The design by E. M. Barry, Esq. 2. A grand pianoforte in Amboyna-wood case, with carving. 3. A grand pianoforte in plain Amboyna-wood. 4. A grand pianoforte in Italian walnut-wood case.

Of these four seven-octaves, C to G, grand pianofortes, two have each three straight tension-bars parallel to and over the strings. Of the other two, one has *one* parallel bar and *one* long oblique bar: the other has *one* parallel bar and two oblique bars. The scale of this latter instrument may be considered as a triangle of unequal sides, divided by these three bars into *four* triangles. This instrument is the most sonorous of the four. In all the four pianofortes any bending of the wrest-planks is obviated by the application of a metal transverse suspension bar, placed over and nearly in a line with the studs. The peculiar application of this suspension-bar is considered as an essential improvement. The tension-bars are also new, and entirely peculiar to these instruments, being constructed with flanges on each side to prevent twisting. A section of these bars transversely would present the figure of a cross +. The strain of the strings on these instruments is immense, notwithstanding which they stand in tune far better than those constructed with the ordinary bracing. In the four pianofortes exhibited, the following improvements are illustrated, and are claimed by Messrs. Broadwood as being entirely their own:—

1st. A newly-revised harmonic scale of strings.

2nd. A peculiar method of fixing the sounding-board.

3rd. The transverse metal suspension-bar. (It supports the wrest-plank, enabling the maker to dispense with several direct tension-bars, which are just so many impediments to free vibration.)

4th. The construction of the tension-bars. These are constructed in such a manner as to combine the maximum of *strength* with the minimum of *weight*.

5th. The fixing these tension-bars in the string-plate by means of wedges, thus insuring equal tension.

6th. The diagonal tension-bars. These abut against the strongest angle of the wrest-plank and *bass* side. They meet effectually what is commonly termed the "side-swag" of the string-plate, and they enable the maker to do with a single direct tension-bar.

The whole of the above-named six novelties of invention are dated by Messrs. Broadwood in the year 1847.

It is by the combination of most of the improvements just mentioned that this firm has attained, in their pianofortes, not only more sonorous tones, but a greater perfection of the quality of tone. Again, there can be no doubt but that simplification of bracing, in the construction of pianofortes, will *eventually* enable the public to obtain first-rate instruments at a comparatively moderate price. And it is proper to record that, up to this time, the aim of most makers has been to introduce as much iron or other metal bracing as safety to the quality of tone would bear, and that Messrs. Broadwood are now the first to retrace such steps, learning from experience that tension-bars are but make-shifts, and that it is probable that the best mode of constructing a pianoforte would be to strengthen the case by other means, superseding the tension-bars altogether.

It should also be noticed that the action used by Messrs. Broadwood in their pianofortes is of the most simple and effective kind, and that its very simplicity is a guarantee for its durability.

Mr. P. Erard has exhibited a variety of pianofortes in the British and French Departments. In these pianofortes considerable improvements have been made with regard to the mechanical part of the action, which has become one of the most perfect existing,—answering the purposes of the most intricate manual dexterity of the performers of modern times. This maker combines with his improved mechanical action a peculiar structure of the body of the pianoforte, by which a highly-successful result is attained.

Various patented improvements in the mechanism, &c., of pianofortes, are displayed in the instruments exhibited by Mr. Erard, of which the following is a description:—

British Department.—1. Extra grand pianoforte, in walnut-wood, with carvings gilt; seven octaves, A to A; with Erard's patent repetition action (1821); patent upbearing (1809); complete system of metallic bracing (1825); and other improvements (1850). See description in remarks.—2. Extra grand piano (1850), with pedal keys.—3. Extra grand piano, with new patent metal wrest-plank (1850).—4. A short grand, six and three-quarters octaves, new scale, C to A; in a rose-wood case, with nullings.—5. Extra grand walnut, oblique, with carvings in the Elizabethan style; seven octaves, A to A; braced with four metallic bars (1850). Action patented (1840).—6. The same, in ebony, inlaid with silver (repetition action); also braced with four metallic bars (1850).—7. Satin-wood; six and three-quarters; oblique. Patent of 1840.—8. A new patent frame, with new screws, tuning apparatus for upright pianofortes; the same having been specified in the patent for horizontal pianofortes.

French Department.—1. Extra grand pianoforte, in tulip-wood case, inlaid with silver bands, tortoiseshell, and brass, elaborately engraved, supported by six caryatides, in the most rich and elegant style; seven octaves, A to A. Patents of 1809, 1821, 1825, and 1850.—2. Extra grand pianoforte in rosewood, with or-molu ornaments; seven octaves, A to A.—3. Short, or semi-grand, with repetition action (1809); six and three-quarters octaves, C to A.—4. Grand square pianoforte, of a new form, with repetition action (1821), metal bracing (1825), upward bearing (1809), on the principle of Erard's grand; six and three-quarters octaves, C to A.—5. Grand oblique of seven octaves, braced with four metallic bars. Patents of 1840 and 1850.—6. Oblique rosewood, with or-molu mouldings; six and three-quarters octaves, C to A. Patent of 1840.

Messrs. Collard and Collard have exhibited several pianofortes, of which the following is a description:—

1. A grand pianoforte, in a case of British mottled oak, with carved and gilt ornaments, in the style of Louis XV.; seven octaves, A to A.—2. A grand pianoforte in rosewood case, with carved cabriole truss supporters; seven octaves, A to A.—3. A square semi-grand pianoforte, in walnut-wood; six and three-quarters octaves.—4. A grand cabinet pianoforte, in a case of British oak, of novel design; six and three-quarters octaves.—5. Two microchordons, or semi-cottage pianofortes, in pine and rosewood cases; six and three-quarters octaves. Exhibited as specimens of superior instruments of their class, at very low prices.

In the above-named instruments the following patented improvements are illustrated:—

1. In the mode of stringing pianofortes, by passing the wire round a single pin, in all classes of pianofortes, thus superseding the use of the noose or eye, before in general use. Patent of 1827. This mode of stringing has become almost universal since the expiration of the patent.
2. Applying a check to the under-hammer, to prevent the rebound of the hammer against the string. Patent of 1829.
3. A new construction of the action in horizontal grand and square pianofortes, the escapement being placed upon the key, and coming into contact with a lever or crank, and thus regulating the rise and fall of the hammer. Patent of 1835.
4. The introduction of a new class of square pianoforte, entitled "the square semi-grand pianoforte;" in which a closer approximation to the peculiarities of the horizontal grand pianoforte was attained. Patent of 1838.
5. The introduction of the traversing escapement fixed upon the hammer-rail, thereby admitting of a firmer blow and greater resistance, as also the introduction of a repetition movement. Patent of 1841.
6. The application of the repetition movement to square and to vertical, or upright pianofortes. Patent of 1843.
7. A new design for the shape of a square pianoforte, entitled "the Symmetrical Grand Square," by which greater beauty of form was secured, the key-board being placed in the centre of the instrument. Registered in 1847.

Several other makers of the pianoforte have contributed to the success of the musical department of the Exhibition, to whom the Jury have awarded the Prize Medal: their names will appear in the Award List.

Harps.

Mr. P. ERARD has exhibited eleven harps in the British Department, and two in the French Department.

In the manufacture of harps several highly-successful and important improvements have been made by this house, particularly in the invention of the *double-action* harp; and there cannot be a doubt that, from the perfection of their mechanism and the excellent quality of their tone, their harps are unsurpassed by any other maker.

In awarding the Council Medal to Mr. P. Erard, with reference to his pianofortes, the Jury took into consideration the great merits of his harps, and have, therefore, included them in that award.

In this class of instruments Honourable Mention has been made of Messrs. B. JONES, for an improved triple-strung Welsh harp, United Kingdom; and DOMÉNY (France).

A beautiful and very ingenious specimen of the *harp guitar* (called a "guittarra harpa") has also been exhibited, and for which the Jury have awarded a Prize Medal to the inventor, J. GALLEGOS (Spain).

Bow Instruments.

In this department the Jury have awarded the Council Medal to Mons. J. B. VUILLAUME, of Paris, for the excellence of his violins and other bow instruments, and for his invention of the Octo-Basse.

M. Vuillaume is entitled to pre-eminent rank among those modern manufacturers who have more or less contributed to restore that peculiar art, which, at the commencement of the last century, had been brought to such perfection by the far-famed *Italian* makers of violins and instruments of that class, but which for a long time appeared to have been entirely lost. His instruments, and, it must not be forgotten, those of other modern makers, will bear comparison with some of the best productions of the great Italian masters, whether as to perfection of form or quality of tone; while, from their moderate cost, compared with the enormous prices, to which, from time to time, those of the ancient makers have risen, a very essential service has been rendered to the musical art.

Some highly-meritorious specimens of violins, violas, violoncellos, and double basses, have also been exhibited, particularly those by the following makers, to whom the Jury have awarded Prize Medals:—

United Kingdom.—Messrs. A. BETTS, S. A. FORSTER, PURDY, and FENDT.

United States.—G. GEMUNDER.

France.—BERNARDEL, sen.

Honourable mention has likewise been made of Messrs. J. K. HEAPS, United Kingdom; P. HIGGINS, Canada; J. TONNA, Malta; G. and A. KLEMMS, Zollverein.

Brass Instruments.

The following remarks have been contributed by a Juror:—

"Among the musical instruments exhibited in the Exhibition, the number of brass instruments, 'instruments de cuivre,' is considerable.

"England, France, and the German States are the countries which have contributed largely and nearly exclusively; whilst America, Hamburgh, Canada, Denmark, and even Russia, swelling the list of instruments with fixed tones, such as pianofortes and organs—or instruments of wood, such as flutes and clarionets, &c.,—do not appear as manufacturers of brass instruments.

"As in all other instruments of music (machines producing isochronous vibrations of not fewer than 16, or more than 8,192, vibrations in a second), so in wind instruments three things are distinguishable, viz., the 'striking body,' the 'regulating medium,' and the 'sounding-mass.' In the pianoforte the 'hammer' is the sounding-body, the string the 'regulating medium,' and the 'sounding-board,' the 'resonant-mass.' In wind instruments, the 'air-blast' from the mouth, taking the place of the hammer on the string, is the sounding body, which acts on the air in the tube of the instrument; the latter is the regulating medium, controlling the number of vibrations, and the pitch of the sound, and this air acting by friction on the body of the instrument, the 'resonant-mass,' brings the whole into resonance, and a musical sound is produced.

"That instruments of this class might, in the early ages of the world, have been more perfect than others seems likely; for our forefathers well understood, for acoustical purposes, the use and power of the lungs to act on the 'sounding-body' of wind instruments. Great mechanical ingenuity was not required in the construction of the latter, nature having endowed them with a power which no human mechanical contrivance has ever equalled, or is ever likely to equal; for though in machines composed of wind instruments or pipes, such as organs, 'the bellows' (which are artificial lungs) are employed and preferred; from the great bulk of agitated air required, it is at the expense of nearly all force, sharpness, and power of modulation of tone, rendering the organ and its imitations, in spite of the encomiums of the unlearned in musical sounds, one of the least perfect of all musical instruments.

"That the organ is the king of instruments, or best collection of wind-instruments, in itself more perfect than any other, and capable of producing most effect on the mind of the hearer, is an illusion which may be referred to the circumstance that it is generally placed in a building such as a cathedral, whose reverberations and 'resonant mass' produce most of the effect attributed to the organ itself; an illusion which would be destroyed, were the organ removed to a different kind of edifice, for instance, to the Crystal Palace, and if a number of wind-instruments acted upon by the 'human lungs,' whose voluminous expansion of sound were equal to that of the organ, to take its place in the cathedral.

"The injury to the effect of the organ, by change of situation, may be appreciated by hearing those already in the Crystal Palace; and yet two of them are very fine specimens, one by Messrs. GRAY and DAVISON, the other by WILLIS.

"Listen to their tones; where is the grandeur attributed to the organ in the cathedral?—it is not discovered in the 'Palace of Glass.' To counterbalance this loss, where is its power of expression and power of modulation of tone combined with sonorousness?—it has neither. These qualities are not possessed by instruments making use of 'artificial lungs,' to act on the sounding mass. So, then, deprived of a building, to whose column of air it acts as the sounding body to bring it into resonance, as a small pipe is used to bring the large diapason into resonance, it is eclipsed by an insignificant-looking 'Sax or euphonic horn,' blown by the 'human lungs,' and capable of giving expression to music; and to induce even the multitude to listen to the organ (who, perhaps, respect it from its early association with our religious services, and the effect produced by it on their minds in the cathedral), it has been found necessary to get one of these small wind-instruments to mingle its more expressive and exciting sounds. I allude to the combined performance of the euphonic horn and organ, which has been so often heard in the Crystal Palace.*

"The modern makers of wind-instruments having the 'air-blast' as a sounding body, and the mechanism for acting upon it perfect, have turned their attention to the improvement of the wind-course as the 'regulating medium,' particularly in valved instruments: they have endeavoured to avoid the angles caused in the tube by the action of the piston. The improvement of the form and quality of the 'sounding mass' has also occupied their attention.

"As the examples are few of sound produced by undulation of air without resonance (perhaps one is thunder, which may be called a purely aerial sound, but which sets in motion a greater bulk of air than all the machines for producing sound in the world put together), and acknowledging that the resonant mass is a distinguishable feature in musical instruments; so, taking the well-known instrument, the pianoforte, as an example, and regarding the use of the sounding-board as 'resonant mass' in that instrument, we shall be able to judge, by analogy, how justly the attention of wind-instrument makers has been turned to the resonant mass, case, or sounding-board, of their instruments. The effect of a string set into vibration by the sounding body in the 'framework' of a pianoforte is not appreciable, although its vibrations are within the prescribed limits; but when set vibrating in connection with the sounding-board, or 'resonant mass,' it brings the whole into resonance, completely controlled by the 'regulating medium,' (the string), and the result is a voluminous expansion of the tone. The greater the resonant power of the sounding-board, the greater is the expansion of the tone. So with wind instruments, the greater the resonant power of the material of which the instrument is made, the more powerful is its volume of tone; but no indistinctness is produced on these instruments, by carrying this expansion of sound to its greatest attainable point, from the character of the regulating medium, and the comparative slowness with which notes are required to be produced. But, in the pianoforte, if this expansion of sound is carried too far, much indistinctness is the result.

"The use of metal as the 'resonant mass' of all wind instruments, besides those usually known as brass metal instruments, is becoming very general; thus we have the flute, *par excellence*, of Mr. Boehm: the clarionet, *par excellence*, of Mr. Pask; and the bassoon, *par excellence*, of Mr. Sax, made of metal.†

"Brass is the material which is most generally preferred for wind instruments, though to the fancy of an American exhibitor we are indebted for a flute made of 'galvanized India-rubber.'

"On hearing and examining this class of musical instruments, and comparing those made on the old principle of construction with those possessing the improvements effected of late years, both in their acoustical proportions and in their mechanism, the superiority of tone and facility of performing on these (many of them unwieldy) instruments is very striking. This facility is acquired by the application of valves to all kinds of brass wind instruments, enabling the performer of moderate ability to produce on his instrument every note of the 'gamut' or 'scale' with the greatest rapidity; if not as pure in tone and vibratory as the harmonic notes, yet with such justness of intonation and freedom as can rarely be produced on the harmonic instrument (or instrument without valves) even in the hands of a superior performer. The inventor of these valves is unknown, but their introduction is due to the munificence of the Emperor of Russia, who about 24 years ago presented a complete set of brass instruments with valves, to the band of the Second Life Guards.

"Mons. Perrinet, a native of France, seems to deserve the credit, amongst the instrument-makers, of having, about twelve years ago, first materially improved the construction of valved instruments; and the English and French exhibitors have been very successful in carrying these improvements still further: thus the equitrilateral valves invented by Mr. Oates, a surgeon of Lichfield, shows the improvement which he has effected in the wind-course of brass instruments, avoiding many of the numerous angles caused in the wind-course by the action of the piston.

"The instruments exhibited by Mr. **Koehler**, of Henrietta Street, Covent Garden, made on the plan invented by Mr. Shaw, of Nottingham, called the 'patent lever action,' are of a decidedly superior character: and the ingenious contrivance for obtaining a free wind-course in valved instruments is highly successful.

"The instruments of Mr. **Pask**, 141 Strand, are all of the first order; they have great sonorousness, power, and facility of execution.

"Those by the French exhibitors, viz., by Messrs. **Ant. Courtois**, **Besson**, **Aug. Courtois**, and **Gautrot**, and those by **Mahillon**, of Belgium, possess in every respect the qualities which in these instruments are required, some having greater fulness of tone than others, but all are constructed on the best-known acoustical principles, of very superior manufacture and finished mechanism.

"The instruments exhibited by M. **Sax**, of Paris, show great advancement; for not only do many of them, such as French-horns, trumpets, and trombones possess additional power, sharpness, and impressiveness, obtained in a great measure from their remodelled proportions (proving that it is not the quality of the metal brought into vibration by the air-blast which influences to any great extent the quality of the tone produced, and that successful results have ensued from an improved modification of form), but many of them, viz., the so-called 'Sax-horns,' possess a quality and richness of tone unheard until the introduction of these instruments by M. Sax.

"The instruments exhibited by the German manufacturers, though not so perfect as those of the French and English manufacturers, have some excellent qualities; and the euphonic horn, invented by Herr Sommer, is an instrument of great power, as well as sweetness of tone.

"Two ingenious contrivances for changing the keys of brass instruments without the use of crooks, are exhibited by M. **Gautrot**, of Paris, and Mr. **J. Callcott**, of London, the former making use of a screw, the other a 'radius-tube,' for lengthening or shortening the wind-course of the instrument.

"Judging from the number of makers, it may be supposed that the demand for this class of instruments is considerable. There are upwards of thirty exhibitors of brass instruments, and the number of instruments contributed by M. Sax, amounts to nearly fifty. It is well known that the demand has of late years increased amazingly, which may be attributed to the ease with which command is now obtained over these instruments by the use of valves, the less force required for the air-blast consequent on the better form of the instrument, and their present comparative cheapness. But it is in this point, viz., cheapness, that our English makers are eclipsed. That their brass instruments are equal to the French and superior to the German cannot be disputed, but they must be bought at a price often fifty per cent. dearer than those of the French or German makers."

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* That the Crystal Palace was very unfavourable to the effect of even the largest organs exhibited, does not admit of a doubt; but I cannot agree with the contributor's remarks on organs in general, nor do I believe that it was "found necessary" to employ either a "Sax or euphonic horn" to "induce the multitude to listen" to any one of the organs in the Exhibition.—*Reporter.*

† The invention of the bassoon exhibited by Mr. Sax is claimed by Mr. Cornelius Ward, of London, to whom a patent for it has been granted in France.—*Reporter.*

WIND INSTRUMENTS.—WOOD AND METAL.

For Orchestras and Military Bands.

In this department the Jury awarded the Council Medal to—

M. ADOLPHE SAX (Paris), for his invention of several new classes of wind-instruments, in wood and metal; and to T. BOEHM (Munich), for his important scientific improvements of the *flute*, and the successful application of his principles to other wind instruments.

The following remarks have been contributed by a Juror:—

"Among the inventors of musical instruments, the highest distinction is due to the merits of M. ADOLPHE SAX, whether considered with regard to the variety, excellence, or the utility of his inventions. His creation of the entire class of Sax-horns, and Sax-trumpets, has produced the most satisfactory results, in the total revolution of military music. Both in the theatre and the concert-room, the two extremities of this vast instrumental scale can be introduced with important advantages. His *Sax-horns* (double-bass in E flat, and B flat) have left ophicleides very far in arrear; and his small treble Sax-horn, in B flat, is the only brass instrument known that can reach with certainty and just intonation the notes of the upper octave of the flute. His cornets-à-pistons are the best we are acquainted with.

"M. Sax has also created the class of Saxophones, brass instruments with a simple reed, similar to the clarionet. The effect of these new instruments possesses a charm equal to the originality of their tone, and they carry to the highest degree of perfection '*la voix expressive de l'orchestre.*'

"It must be conceded, that his bass and double-bass clarionets, in wood and metal, are inventions of inestimable value. Besides these, he has added a semitone to the lower register of the ordinary clarionets, and by a new *key*, has rendered it possible for the performer to take the upper notes at once with the greatest ease.

"M. Sax has also contrived to fill up the gap which existed between the lower E and the lowest B flat of the tenor trombone, by very simple means; and his brass *bassoon*, with a new system of holes and keys, is very perfect.* He has likewise invented a contrivance for brass instruments with mechanical cylinders, as simple as it is ingenious, by means of which the sound is *continued* upon those instruments, as upon the violin, sliding-trombone, and with the voice, in passing from one note to another through all the *enharmonic intervals*.

"Lastly, M. Sax has adapted to the bugle-horns of infantry bands a set of portable tubes, which, on being adjusted to simple bugles, transforms them into cylinder bugles of various keys; thereby changing the monotonous character of the simple bugle, by giving it the means of producing all the intervals of the musical scale.

"M. BOEHM's inventions may be described as follows:—Firstly, he has brought the acoustical proportions of tubes and the finger holes of wind instruments into correct numbers and measurement, by which means flutes, oboes, clarionets, bassoons, &c., can be theoretically constructed. Secondly, he has invented a mechanism for the keys which gives facility and precision to the execution, and by which the former difficulty of reaching or stopping the holes at great distances, or of large sizes, is now surmounted. As by these means the holes can be made correct in size and position, M. Boehm has acquired not only a perfection in tone and tuning never before attained, but also a great facility in playing in those keys which were hitherto difficult and defective in sonorousness or intonation."

It is proper to notice, that among the brass instruments exhibited by Mr. Köhler, was an improved Chromatic Trumpet, invented by Mr. T. HARPER, sen., and which has been acknowledged by competent judges to be the best instrument of its kind.

It should also be mentioned, that several improvements are illustrated in Mr. J. CLINTON'S Flute, exhibited by Mr. H. POTTER, in which the facilities of other modern flutes, and the ordinary system of fingering are combined, and their defective parts avoided. In this instrument the tone and tune are rendered equal by the same means that M. Boehm has adopted, namely, an equality of size and distance in the holes. It has likewise claims to consideration for comparative cheapness, the mechanism being so simple, that its price does not exceed that of the old eight-keyed flute.

The Jury have awarded the Prize Medal to various makers of wind instruments whose names will appear in the Award List.

Harmoniums, &c.

In the class of musical instruments, including Melodiums, Seraphines, Panorgues, Æolians, &c., Messrs. WHEATSTONE and Co., of London, have exhibited a very ingenious and effective one, called the Portable Harmonium, of which the following is a description.

It has a compass of five octaves, commencing from the lowest C on the violoncello, the key-board being on the same extent and scale as the larger harmoniums. It can be instantaneously folded up, so as to occupy less than half its height, and half its length.

This instrument is quite original in nearly all its mechanical parts. It is peculiarly constructed for producing expression, and may either be used by itself for the performance of music written for the organ or harmonium, or for taking violin, flute, or violoncello solos or parts—its capabilities of expression giving it great advantages in imitating these instruments. It may be used in front of the key-board of a pianoforte; thus enabling the performer to give a hand to each instrument, and by this means to produce a variety of effects.

The Jury have awarded the Prize Medal to Messrs. WHEATSTONE and Co., also to M. JAULIN, of France, for instruments of this class.

Honourable Mention has been made of MM. ALEXANDRE and SON, France, for two "*Harmoniums à Percussion;*" A. MÜLLER, France, for two portable Melodiums; and J. DEUTSCHMANN, Austria, for a Seraphine.

In this class may also be placed a novel kind of musical instrument, called the *Harmonine*, exhibited by the inventor, M. DE VILLEROI. This little instrument is about eight inches in length, and its scale, commencing on the lowest C of the violin, comprises three octaves, including all the semitones. Considering the very small dimensions of the harmonine, its tone possesses a remarkable power, but at the same time is of an agreeable quality, somewhat resembling that of the oboe and flute. Its capabilities of imitating the distant sounds of an organ, and of producing every species of accentuation, also merit notice, as displaying considerable ingenuity on the part of the inventor.

Instruments of Percussion.

In this department, comprising Drums, Cymbals, &c., the Jury have noticed a variety of improvements of considerable importance, in the mechanism for tuning drums, for orchestras and military bands. For these improvements Prize Medals have been granted to Messrs. C. WARD (included in the award to him for a bassoon), United Kingdom; A. KNOCKE, Zollverein. And Honourable Mention has been made of C. REXER, Zollverein; also of four very large and fine Gongs, exhibited by THE HONOURABLE EAST INDIA COMPANY.

Automatic Instruments.

In this class, comprising Mechanical Organs, &c., Mr. BRYCESON, of London, has exhibited a Barrel-Organ, for which the Jury have awarded a Prize Medal.

Other ingenious instruments of a similar description have been exhibited; and Honourable Mention has been made of Mr. C. DAWSON (for a barrel-organ, called an *Antophon*, the tunes of which are produced by means of perforated sheets of mill-board), Messrs. GRAY and DAVISON (for a barrel-organ), Messrs. WEHRLE and

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* It has been already stated that the invention of the bassoon exhibited by M. Sax, is claimed by Mr. Cornelius Ward, of London.—*Reporter.*

STEUERT, London (for a self-acting organ, manufactured by F. WEHRLE, Black Forest, Baden), United Kingdom.

Miscellaneous Articles in connection with Musical Instruments.

In this class are included tuning-forks, tuning-hammers, pitch-pipes, wire-strings, violin, viola, and violoncello bows, rosin for bows, musical diagrams for various purposes, miniature models, metronomes, specimens of wood and felt for musical instruments, &c. The Jury have made Honourable Mention of Messrs. J. DODD (for violin, viola, and violoncello bows, and for covered strings for violins, violoncellos, and harps), E. DODD (for violin, violoncello, double-bass, and harp-strings), E. GREAVES (for a chromatic tuning-fork), United Kingdom; Messrs. SIMON and HENRY (for violin and violoncello bows), France; A. INDRI (for violin, violoncello, double-bass, harp, and guitar strings), Venice.

AWARDS IN CLASS XA.

COUNCIL MEDAL.

NATION.	Number and Page in Catalogue.		NAME OF EXHIBITOR.	OBJECTS REWARDED.
	No.	Page.		
Munich	23	1099	Boehm, T.	Important scientific improvements of the flute, and the successful application of his principles to other wind instruments.
France and Algiers	173	1181	Ducroquet, P. A.	Application of the pneumatic lever to a church organ.
United Kingdom and France	496 497	467 1281	Erard, P.	Peculiar mechanical actions applied to pianofortes and harps.
United Kingdom	555	471	Gray and Davison	Invention in organ building, of a new method of connecting the great organ with the swell organ, by means of a pedal and of a new stop called the keraulophon.
——	556	471	Hill and Co.	Invention of a stop of great power, and for their mode of shifting the stops by means of keys.
France	1725	1259	Sax, A.	Invention of several classes of wind instruments in wood and metal.
——	735	1215	Vuillaume, J. B.	New modes of making violins, in such a manner that they are matured and perfected immediately on the completion of the manufacture, thus avoiding the necessity of keeping them for considerable periods to develop their excellencies.
United Kingdom	209	433	Willis, H.	Application to organs of an improved exhausting valve to the pneumatic lever, the application of pneumatic levers in a compound form, and the invention of a movement in connection therewith for facilitating the drawing of stops either singly or in connection.

PRIZE MEDAL.

United Kingdom	497	467	Addison, R.	"Royal Albert" transposing pianoforte.
France	421	1198	Bernardel, sen.	Violins.
——	424	1199	Besson, G.	Various metal musical instruments.
United Kingdom	519	468	Betts, A.	Two violins.
Saxony	25	1106	Breitkopf and Härtel	Grand pianoforte.
United Kingdom	518	468	Broadwood, John & Sons	Successful improvements in pianoforte-making.
——	735	475*	Bryceson, H.	Church barrel-organ.
France	442	1199	Buffet, A.	Oboes, clarionets, flutes, and a "corno-Inglese."
United Kingdom	547	471	Callcott, J.	Invention of a French horn, without loose crooks.
United States	458	1464	Chickering, J.	Square pianoforte, and the Jury think highly of his grand pianoforte.
United Kingdom	168	430	Collard and Collard	Pianos, and for their successful application of several improvements in pianoforte-making.
France	1172	1233	Debain, A.	Mechanical pianoforte.
Tuscany	71	1295	Ducci, A. and M.	Organ with a "Baristata" stop.
United States	481	1465	Eisenbrant, C. H.	Clarionets and flutes.
United Kingdom	509	468	Forster, S. A.	Violoncello, violin, and viola.
France	1234	1236	Franche, C.	New repetition action in a pianoforte.
Spain	272	1346	Gallegos, J.	"Guittarra Harpa."
Prussia	848	1096	Gebauhr, C. J.	Pianoforte.
United States	442	1463	Gemunder, G.	"Joseph Guarnerius" violin (chiefly), and for three other violins, and a viola.
France	454	1200	Godfroy, C. sen.	Flutes.
Nassau	8	1132	Heckel, J. A.	Bassoon of a new and improved construction.
United Kingdom	615	476	Heeps, J. H.	Hearing apparatus, made of gutta percha.
Wurtemberg	24	1115	Helwert, J.	Bassoon with 19 keys, of an improved construction.
United Kingdom	500	467	Hopkinson, J. and J.	Horizontal grand pianoforte, with new patent action.
——	486	466	Hund, F., and Son	Cottage pianoforte, in the form of a lyre, termed the "Lyra" pianoforte.

PRIZE MEDAL—*continued.*

NATION.	Number and Page in Catalogue.		NAME OF EXHIBITOR.	OBJECTS REWARDED.
	No.	Page.		
Belgium	176	1157	Jastrzebski, F.	Upright pianoforte.
France	1274	1238	Jaulin, J.	Panorgue, and for his improvements in free reeds.
United Kingdom	484	466	Jenkins, W., and Sons	Expanding piano for yachts, &c.
——	467	464	Kirkman and Son	Semi-grand piano, and an oblique piccolo piano.
Bavaria	100	1103	Knocke, A.	Mechanical improvements in kettle drums.
United Kingdom	540	470	Köhler, J.	Slide trombone, and for the application of his patent valves to other metal wind instruments.
——	100	–	Lambert and Co.	Cottage pianoforte.
——	673	468	Macfarlane, G.	Improved cornet-à-piston.
Belgium	175	1157	Mahillon, C.	Clarionets, and a trombone and ophicleide.
United States	59	1437	Meyer, C.	Two pianofortes.
France	1665	1256	Montal, C.	Four cottage pianofortes.
United States	374	1460	Nunns, R., and Clark	7-octave square pianoforte, and a new tuning of Æolian reeds.
United Kingdom	520	468	Oates, J. P.	Improvements as applied to cornets.
France	943	1225	Pape, J. H.	Certain improvements in pianofortes.
United Kingdom	504	468	Pask, John	Clarionets and brass instruments.
——	537	470	Purdy and Fendt	Double bass (chiefly), and for four violins, and two violoncellos.
France	1687	1257	Roller and Blanchet	Three pianofortes.
United Kingdom	536	470	Rudall, Rose, and Co.	Cartes' Boehm patent flute.
Wurtemberg	23	1115	Schiedmayer and Sons	Square pianoforte, in mahogany.
Prussia	707	1089	Schulze, J. F. and Sons	Organ.
United Kingdom	469	464	Southwell, W.	Grand pianoforte.
——	470	464	Stodart, W. and Sons	Square pianoforte.
France	1510	1248	Triebert, F.	Oboes and a "corno-Inglese."
United Kingdom	527	469	Ward, C.	Newly-constructed bassoon, and a pair of kettle drums.
——	526	469	Wheatstone and Co.	Novel invention of a portable harmonium.
——	499	467	Wornum, R.	Improved piccolo pianoforte.

HONOURABLE MENTION.

France	1719	1258	Alexandre and Son	Two melodiums.
——	404	1197	Aucher and Son	Two upright pianofortes.
Belgium	174	1157	Berden, F. and Co.	Three cabinet pianofortes.
United Kingdom	553	471	Bishop, J. C.	Cabinet organ, containing composition pedals, &c.
France	1555	1251	Bréton, —	Clarionet on Boehm's principle.
United Kingdom	546	470	Card, W.	Flutes.
New South Wales	5	989	Clinch, J.	Set of bagpipes, made by George Sherrer, Sydney, New South Wales.
France	1163	1233	Courtois, Antoine	Bombardon and cornets.
United Kingdom	554	471	Dawson, C.	Organ, called an "Autophon;" the tunes being produced by means of perforated sheets of mill-board.
France	475	1200	Detyr, N., and Co.	Two upright pianofortes.
Austria	141D	1015	Deutschmann, J.	Seraphine.
Wurtemberg	20	1115	Dieudonné and Bladël	Grand pianoforte, with double action.
United Kingdom	505	468	Dodd, E.	Violin, violoncello, double bass, and harp strings.
——	543	470	Dodd, J.	Violin, viola, and violoncello bows; and for silver strings for the violin, violoncello, and harp.
Wurtemberg	21	1115	Doerner, F.	Square pianoforte.
France	477	1200	Domény, —	Harps.
United Kingdom	–	913	East India Company, The Hon.	Four gongs.
France	844	1220	Gautrot and Co.	Bombardons.
United States	435	1463	Gilbert and Co.	Pianoforte with Æolian attachment.
United Kingdom	503	467	Greaves, E.	Chromatic tuning-fork.
——	468	464	Greiner, G. F.	Tuning apparatus (in addition to 50*l.* in money).
——	510	468	Heaps, J. K.	Violoncello.
France	1268	1237	Herz, H.	Four pianofortes.
United States	438	1463	Hews, G.	Square pianoforte.
Canada	185	968	Higgins, P.	The quality and cheapness of a violin.
Denmark	30	1357	Hornung, C. C.	Square pianoforte.
Switzerland	87	1272	Hüni and Hübert	Grand pianoforte.
Austria	151	1015	Indri, A.	Violin, violoncello, double bass, harp, and guitar strings.
United Kingdom	533	470	Jones, B.	Improved grand triple-string Welsh harp.
France	1633	1235	Kleinjasper, —	Cottage pianoforte.
Saxony	18	1105	Klemm, G. and A.	Violin ornamented with mother-o'-pearl.
France	556	1205	Labbaye, —	Bombardon.
Russia	172	–	Lichtenthal, M.	Semi-grand pianoforte.
France	1711	1258	Martin, —	Reverberating organ.
——	633	1208	Mercier, S.	Two cottage pianofortes.
——	1365	1231	Muller, A.	Two portable melodiums.
Bavaria	35	1100	Pfaff, M.	Bombardon ophicleide.
United States	90	1438	Pirson, J.	Patent square pianoforte.
Wurtemberg	25	1115	Rexer, C.	Pair of orchestra kettle-drums, tuned on a new plan.
Austria	153	1015	Riedl, J. F. (Widow of)	Chromatic horn.

HONOURABLE MENTION—*continued.*

NATION.	Number and Page in Catalogue.		NAME OF EXHIBITOR.	OBJECTS REWARDED.
	No.	Page.		
United Kingdom	559	472	Robson, T. J. F.	Enharmonic organ, invented by T. Perronet Thompson, Esq., M.P.
Hamburgh	14	1137	Rühms, H.	Upright pianoforte.
——	13	1137	Schröder, C. H.	Grand pianoforte.
France	1489	1248	Simon, Henry, and Co.	Violin and violoncello bows.
Prussia	893	1097	Sommer, F.	Sommerophone.
France	1699	1257	Soufleto, —	Three cottage pianofortes.
Austria	154	1015	Stehle, J.	Double bassoon.
United Kingdom	494	467	Towns and Packer	Semi-grand transposing pianoforte.
Malta	1	944	Tonna, J.	Double bass, made of bird's-eye-maple.
France	398	1197	Tulou, —	Flutes.
Austria	155	1015	Uhlmann, J.	F, E, and A clarionets, oboe, and corno-bassetto.
Belgium	181	1157	Vogelsangs, J. F.	Grand piano.
United Kingdom	561	473	Walker, J. W.	Organ, adapted for a hall or music-room.
Prussia	879A	1097	Wehrle and Steuert	Self-acting organ, manufactured by F. Wehrle, Black Forest, Baden.
——	80	–	Westermann and Co.	Grand pianoforte, made of rosewood.
United States	533	1467	Wood, J. S.	Invention of a "piano violin," in addition to 50*l.* in money.

MONEY AWARDS.

NATION.	No.	Page.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	468	464	Greiner, G. F.	New and useful method of bringing into unison the strings of each choir of the pianoforte, also for his invention of a new and mechanical contrivance for pianos, combining the advantages of Erard's machine, with greater simplicity of construction and durability, 50*l.*
United States	533	1467	Wood, J. S.	The expenses incurred in constructing his piano violin, 50*l.*

H. R. BISHOP, REPORTER.

London, November 1851.

CLASS X B.

REPORT ON HOROLOGICAL INSTRUMENTS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

E. B. Denison, M.A., *Chairman and Reporter*, 42 Queen Anne Street. (Juror Class X.)
Baron Armand Seguier, *Deputy Chairman*. France. (Juror Class X.)
Professor Daniel Colladon. Switzerland. (Juror Class X.)
E. J. Lawrence, M.A., 44 Chancery Lane.

The marine chronometer may be considered the most important of all machines for measuring time; and it is also the one in which an invariable rate of going is of the most consequence, inasmuch as longitude at sea is determined by means of chronometers, and they have frequently to go for a longer time without the means of being corrected by astronomical observations, than astronomical clocks, which are generally accompanied by fixed transit instruments.

It will probably appear strange that we have not awarded any Council Medal for chronometers, of which there are a considerable number in the Exhibition, especially in the English part, some of them by makers of the highest reputation. It is, however, this very circumstance which has rendered it impossible to make any such award; not only because we are directed by the Royal Commisioners to avoid the attempt to distinguish one article from others of the same kind, merely on account of superiority of execution, but because, among several of the best makers, there really is no one who could properly be so distinguished above all the rest.

The principles of the construction of chronometers have now been settled for some years without any material variation, except in one point, which will be mentioned presently, and there is hardly any visible difference between one good chronometer and another; it was hence obviously out of our power to make such actual trial of them as can only be conducted in an observatory, and must be continued for a considerable time in order to ascertain their relative merits.

We therefore came to the conclusion that the only satisfactory plan on which we can distinguish any among the large number of chronometers in the Exhibition (at least in the English part of it), is to adopt the results of the trials at the Royal Observatory, during the last few years, of chronometers by the same makers as have now sent any to the Exhibition. But it must be understood that the same reports of the Greenwich trials which justify us in awarding prizes to several chronometer-makers who are exhibitors, show that others who are not exhibitors would have been equally entitled to Medals if they had sent any chronometers here. The exhibitors who have been awarded Prize Medals from having obtained high places in the trials at the Royal Observatory in the last few years are—Messrs. Dent (No. 55, p. 413), C. Frodsham (No. 57, pp. 414, 415), Parkinson and Frodsham (No. 35, p. 411), Hutton (No. 7, p. 407), and Loseby (No. 12, p. 408); and we should have been glad to have the opportunity of similarly acknowledging the merits of Messrs. Poole, E. J. Massey, and Eiffe, as the makers of chronometers, which, together with those of Loseby and Dent, have exclusively occupied the first three places in all the trials of the last four years.

Among the foreign chronometer-makers we have had the satisfaction of being able to award Prize Medals to three of the highest reputation in their respective countries, viz., M. Vissière, of Paris (No. 733, p. 1215), M. Urban Jürgensen, of Altona (No. 17, p. 1356), and M. Louis Richard, of Neufchâtel (Cl. I., Zollverein) (No. 342, p. 1070); the last of whom has exhibited a chronometer in which the necessity for a fusee is superseded by a remontoire escapement of a more simple construction than usual, the impulse being given to the balance, not by any teeth of a scape-wheel, but by a small spring which is wound up sufficiently for the purpose by the scape-wheel every time it escapes.

The single point in which there is any material difference in the construction of the best chronometers, is the mode of effecting what is called the secondary or auxiliary compensation of the balance, or that which is required in addition to the ordinary compensation, to prevent the chronometer from gaining at mean temperatures if it is adjusted for two extreme ones, such as 20° and 100°, or losing at the extremes of heat and cold if the compensation is adjusted only for temperatures within moderate limits, as from 40° to 80°.

The earliest inventions for this purpose, as well as the discovery of the necessity for a secondary compensation, appear to have been made by Mr. Eiffe and Mr. Dent about the same time, and independently of each other; and their methods are still in use, and evidently very successful. But we agree with the opinion expressed by the Astronomer Royal in a report made by him to the Admiralty, that the most ingenious contrivance for this purpose, and probably the best adapted to the wants of chronometers—at least of those which are likely to be exposed to extreme temperatures—is Mr. Loseby's (p. 408), in which small curved thermometer tubes are set upon the ends of the ordinary compensation bars, so that the mercury advances along the tubes towards the centre of the balance, and at an increasing rate the nearer it approaches the centre. The effect of this, as of most of the other contrivances for the same purpose, is evidently to diminish the moment of inertia of the balance still more than it is diminished by the bending inwards of the ordinary compensation bars, on the ends of which the mercurial tubes are fixed.

The three makers who have been mentioned in addition to those who have received Medals not being exhibitors, we can give no account of their methods of compensation. Mr. Dent's (p. 413) consists in placing the balance weights on small additional compensation bars set on the ends of the common ones, in such a position that the weights advance and recede in a radial direction more rapidly the nearer they are to the centre, for any given number of degrees of heat. There is also a chronometer exhibited by Messrs. Barraud and Lund (No. 34, p. 411), with a contrivance which is substantially the same in principle, and perhaps equally likely to answer, though not so simple in form; besides others which do not appear to us to require particular notice.

We desire to draw attention to a chronometer with a glass balance and balance-spring, exhibited by Mr. Dent, on account of the remarkable fact that such a spring only requires about one-tenth of the compensation of a steel spring, and one-twelfth of a gold one. We have been furnished with a copy of the Observatory report of the rate of a chronometer with this balance and spring, and the small amount of compensating materials which it requires; and the variation of rate during the five months it was tried was very small. It is necessary to add, however, that Mr. Dent told us that some difficulties in making these glass springs have hitherto prevented their being generally used, even by himself; and we mention these facts in the hope that he and other persons may be thereby induced to exert their ingenuity in overcoming these difficulties, so as to bring into use a material for springs which requires so little compensation, and consequently no secondary compensation, and which is also free from liability to rust, a point of manifest importance in instruments to be used at sea.

Astronomical Clocks.

Among these clocks, which are also sometimes called *regulators*, there is little that requires special notice. There are several of the usual construction, with Graham's escapement and mercurial pendulum, by the eminent makers who have already been noticed, as well as by some others, both English and foreign. But astronomical clocks which will go accurately within two or three seconds a week may now be had of all good clockmakers; and it would be absurd to give a prize to any one for sending an instrument here, which a hundred other persons could have sent if they pleased; except in a few cases, such as that of chronometers above mentioned, where the exhibition of an article, not in itself distinguishable from others of the same kind, has enabled us to make a proper acknowledgment of the well-established reputation of the maker.*

Besides these astronomical clocks of the usual construction, there are several with new escapements, chiefly on the remontoire principle, but none that appear to us likely to supersede the old dead escapement. We have nevertheless given Prize Medals to Mr. **GOWLAND**, of London (No. 27, p. 410), and M. **GANNERY**, of Paris (No. 516, p. 1203) for gravity escapements, which are substantially the same; the impulse being given in both of them, not by arms turning on pivots, but by small weights, which in M. Gannery's clock are hung by threads to the pallet arms, but in Mr. Gowland's are still more independent, being small inverted cups resting on the pallet arms, and alternately taken up by spikes projecting upwards from another pair of arms attached to the pendulum: on the other hand, in M. Gannery's escapement there is less tendency to *trip*; and it ought to be known to the inventors of remontoire escapements, that independently of the risk of actual tripping (or letting two or three teeth slip past at once), any tendency to drive the pallets too far, if the force of the clock happens to increase, is fatal to the accurate performance of such an escapement.

It should be added, that Mr. Gowland claims as an advantage of his escapement (and M. Gannery may do the same, and so may M. Wagner for one of his turret-clocks, which will be noticed afterwards) that the pendulum is independent of the friction of unlocking, because that is done by the little remontoire weight, which is stopped for a moment as it descends on to the pallet arm by reason of the inertia of the pallets and their arms. This was also the case in the late Captain Kater's escapement, which is described in the Transactions of the Royal Society, but is too complicated for use. And indeed the contrivers of all such escapements should remember, that no new escapement has any chance of coming into use unless it is as cheap and easy to make as Graham's, and is really so independent of the force of the train that a common house-clock movement will do as well for it as a well-finished train with high-numbered pinions: an experiment which the makers of remontoire escapements seldom venture upon.

We have also given a Prize Medal to M. **DUBOIS**, of Locle (No. 9, p. 1266), the only Swiss maker who has exhibited a pendulum clock, for a regulator, with a gridiron pendulum in which the compensation is adjustable, and an escapement, which is a sort of imitation of the chronometer escapement. A construction of much the same kind was suggested by Mr. Airy, in the Cambridge Philosophical Transactions, in the year 1827; and we do not mean, by giving this Medal, to express any opinion on the probability of such an escapement superseding the ordinary one.

Besides these escapements, which are all intended exclusively for astronomical clocks, there is one lately patented by Mr. C. **MACDOWALL** (No. 68, p. 417), which is intended as a substitute, not only for Graham's escapement, but for the common recoil escapement; and we are informed, as a proof of its cheapness, that a tender has been made to supply clocks to a public office, either with this escapement, or the usual recoil escapement, at the same price. Instead of a scape-wheel there is only a small disc, with a single ruby pin set in it, very near the arbor: the disc turns half round at every beat of the pendulum; and the pallets are both together on an arm, which may be the crutch of the pendulum, or may be in the pendulum-rod itself; and they are so formed, that the impulse is given chiefly by direct action across the line of centres, and not obliquely, as in all the anchor escapements, and therefore with less friction. It is also a dead escapement, and by the simple addition to it of two long teeth or arms for the locking part (on the principle of the duplex escapement in watches), the friction on the dead part of the pallets may be reduced almost to nothing, in clocks intended for very accurate performance. Mr. Macdowall is now making a clock with a remontoire escapement, on the same principle, which may evidently be as well applied to such an escapement as to impulse escapements. He has also successfully applied it to a lever-watch.

The greater velocity of the disc than of a scape-wheel renders another wheel in the train necessary; but as the clock, notwithstanding, goes with even a less maintaining force than usual, the friction of this extra wheel is evidently compensated by the diminished friction of the escapement, in consequence of the impulse being given directly instead of obliquely.

We are quite aware that an escapement, in general appearance similar to this, was made some years ago, both in England and France; and specimens of it were produced to us from each country. But in both those specimens there was a roller instead of the fixed pin in the disc; and, what is perhaps of more consequence, they both had a much larger angle of escape than Macdowall's clock, and consequently, required a larger vibration of the pendulum: and we are not surprised that escapements so made had never come into general use, which was admitted with respect to the French one; or had been abandoned, as those who produced the English one assured us that it had been long ago. Mr. Macdowall's escapement avoids the *shake* and the uncertainty of a roller, and does not require a larger arc of vibration than a common clock; and, on the whole, we think that it combines, in a high degree, the several qualities which we are directed to regard in our distribution of prizes, viz., simplicity, cheapness, durability, and at least probable accuracy of performance, and therefore we have given Mr. **MACDOWALL** (No. 68, p. 417), a Prize Medal for what he calls his "single-pin escapement."

Turret-Clocks.

After astronomical clocks, those which are intended for public buildings are of the greatest importance. Indeed, in some public clocks a degree of accuracy may now be properly required, as it can be obtained, exceeding that of most astronomical clocks. Considering the number of persons who make turret-clocks in this country, the smallness of the number of them in the Exhibition is rather surprising: and those which deserve any favourable notice are still fewer. It is remarkable, too, that the only ones in the English Department which appeared to us to deserve such notice, are two clocks with cast-iron wheels; and they are both of them such as ought to convince anybody, that the prejudice against cast-iron clock-wheels is altogether unfounded, now that they can be made so well that the teeth do not even require touching with a file after they come out of the mould. Both of these clocks also have a remontoire apparatus in the going train, the effect of which is, that the escapement is driven, not by the great clock weight, but by a small weight, or a spring, wound up at intervals by the train, which is discharged like a striking part, or in some other way, at every minute or half minute, by the revolution of the scape-wheel. Most of the turret-clocks in M. Wagner's collection (No. 736, p. 1215), which will be noticed presently, are also on the remontoire principle. And there can be no doubt that, since it can be applied at a moderate expense, all turret-clocks of high character, at least if they have large external dials, ought to be so made, because it renders the escapement independent of all variations in the force of the train, which are sometimes very considerable, and also allows a sufficient weight to be applied to the clock to drive the hands in all weathers, without making the pendulum swing too far; and moreover, as the hands of a clock of this kind do not move an almost invisible quantity at every beat of the pendulum, but by a very sensible jump at every letting off of the remontoire, the time can be taken from the minute-hand, at a considerable distance, as accurately as from the seconds-hand of a regulator; and for the same reason the striking part is also discharged more exactly at the right time.

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* It is a bare act of justice to the other exhibitors to mention, that in this desire to acknowledge the reputation of makers whose works have been tested by a much better criterion than we had the means of applying, we were nearly misled into giving a Medal to an exhibitor of astronomical clocks and watches, on the ground of his being really, as he very conspicuously designated himself, "Maker to the Royal Observatory." We fortunately ascertained from the best authority that the only ground on which this person so distinguished himself from all the other exhibitors was, his having once performed certain services for the Observatory establishment, by no means of a high order, and even those performed in such a way that they have been discontinued, and are particularly unlikely to be resumed.

As regards the going part, the principal advantage of cast-iron wheels over brass or gun-metal is their much greater cheapness. But in the striking part they have the further advantage of greater strength, which, in large clocks, is the chief thing to be attended to, and the thing in which they are most frequently deficient. In Mr. Roberts's clock the striking is done on a new plan, with a very light hammer; but the clock has only a small hemispherical bell attached to it, and we have no proof that this very ingenious contrivance, in which neither fly nor hammer-spring is required, would answer for a large bell, such as that on which Mr. Dent's clock strikes, or even a much smaller bell of the usual form. In the latter clock the hammer is raised by broad cams cast on the great wheel of the striking part, and of such a shape, and with the lever so arranged, that there is the smallest possible waste of power: in fact, very little more than one-fourth of the force of the great striking weight is lost in friction, the resistance of the air to the fly, and in the necessary interval between the fall of the hammer and the beginning of its next rise,—a proportion which is much less than usual.

Both Mr. Roberts's (No. 130, p. 422) and Mr. Dent's (No. 55, pp. 413, 414) clocks have compensated pendulums. The former has a steel and brass compensation, which, Mr. Roberts says, is made in accordance with his own experiments on the relative expansion of the two metals; though it differs from the result of all the ordinary tables of expansion, the length of the brass compensation-tubes being much less than usual. Mr. Dent's pendulum has an iron and zinc tube compensation, made according to the usual tables, and agreeing with his experience of the Royal Exchange clock pendulum, which has a similar one, and has now been sufficiently tested for several years.

Mr. Roberts's escapement is a new one of his own contrivance: the pendulum only receives its impulse on a roller at every alternate beat. The remontoire is on the endless chain plan, which is described in Reid's book on clock-making, except that the mode of letting off is different. The form of the clock-frame is pyramidal, with the pendulum hung from the top; and it is consequently very steady, provided the floor it stands on be so; though the plan of fixing turret-clocks on beams let into the wall for the purpose, is, in most instances, steadier than any fixing to a floor can be. All the wheels are made to take out separately, as they should always be, and the Jury were particularly struck with the goodness of the casting and the form of the wheels. Mr. Roberts is well known as an eminent engine-maker at Manchester, and by the application of his machinery to the manufacturing of these clocks he is able to sell them at a much lower price than usual. On the whole, without expressing any opinion on the supposed advantages of the escapement, or the mode of striking, or some other peculiarities of this clock, we consider it well deserving of a Prize Medal.

The escapement in Mr. Dent's clock is the ordinary pin-wheel dead escapement, but the wheel is smaller than usual, being only four inches in diameter, and it contains forty pins. It is driven by a spiral spring, which is merely part of a large watch-spring, and is wound up a quarter of a turn after every quarter of a turn of the scape-wheel. The pinion, or small-wheel to which one end of the spring is fixed, does not ride on the arbor of the scape-wheel, in which case there would be considerable friction between them, but on a stud fixed into the clock-frame; so that the scape-wheel is driven by the spring without any friction whatever, except that of its own pivots, and the very small friction which is due to the upward pressure of the ends of the remontoire fly on the arbor of the scape-wheel. The consequence is, that there cannot possibly be any variation in the force on the pendulum, except that which may arise in the escapement itself, if the pallets are not properly oiled,—as in all other anchor or pin-wheel escapements. It may be worth while to state that the variation of force in the spring due to changes of temperature, if it were ten times as great as it is, would produce no sensible effect upon the pendulum. And as this pendulum is eight feet long, and weighs above two cwt., such a clock may be reasonably expected to go as well as any astronomical clock; and, in fact, it has gone since the opening of the Exhibition, at least as well as a highly-finished astronomical clock, which was placed by the side of it, and every week compared with the time brought from Greenwich.*

The maintaining power for keeping it going while winding is of a new construction; as the common spring-going barrel is difficult to construct with both sufficient play and sufficient power for large clocks of this kind, which take several minutes to wind up. This maintaining power is of the "bolt-and-shutter" kind, but not requiring any click, and so made that it is impossible to begin winding without raising the maintaining weight high enough to keep in action for seven or eight minutes, and yet it can be thrown out of gear as soon as the winding is done. There is another point in which the arrangement is different from usual: the great wheel and barrel of the going part, and of both the striking parts, are set in the great frame, and the smaller frame, which carries all the other wheels of the going part, can be taken off entire, without disturbing either the great wheel or the pendulum. Mr. Dent uses wire ropes, because by that means he obtains the advantage of many turns of the barrels in the eight days, without the inconvenience of long barrels, or the bad practice of letting the rope go twice over them.

A Council Medal has been awarded to Mr. Dent (p. 413) for this clock, on the recommendation of all the members of this Jury, except the Chairman, who declined to express an opinion upon it, on account of having himself furnished the design. But as it contains hardly anything which had not been either previously used by Mr. Dent, or suggested in print, and therefore equally open to the adoption of any other maker, he is entitled to full credit for it, as well as for his enterprise in attempting to introduce a new description of clock, possessing both greater accuracy and greater strength than usual, and one which can be made for less money than equally large turret-clocks, of the common construction and of good quality.

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* Since the close of the Exhibition, we have been informed that the accumulated error of the large clock, from the 8th August to the 15th October, was − 2·8 seconds; or, in other words, the pendulum lost not quite two beats in the four millions of vibrations it performed during that period.

We have already referred to M. Wagner's (of Paris) (p. 1215), collection of turret-clocks which displays great fertility of invention; and we have awarded him a Council Medal for the collection, but especially for his clock with a continuous motion, intended for the purpose of driving equatorial telescopes, so as to keep them pointed at any given star, and for all other purposes for which a continuous, instead of an intermittent motion is required. The mode by which this is effected is particularly ingenious as well as simple. In this, as in several others of M. Wagner's clocks, there is a gravity remontoire apparatus, on the bevelled-wheel principle, on the arbor of the wheel below the scape-wheel. For the construction of these remontoires we must refer to books, as it would be difficult to give an intelligible description of them without drawings; but assuming that to be understood, the arm which carries the remontoire weight is in this clock prolonged to a convenient distance, so as to carry a kind of bell hung to it by a couple of wires, and within the bell a fly is driven by a train of wheels connected with the great wheel of the clock. This fly is so adjusted, that the velocity with which it allows the train to move is equal to the *average* velocity which it would have if connected with the pendulum, or to the velocity of a train with a revolving instead of a vibrating pendulum of the same period. If the force on the clock be too great, the remontoire arm becomes raised above its average height, and the bell rising with it lets in more of the external air upon the fly, which reduces its velocity, and *vice versâ*. In this way, the hand, or telescope, attached to that part of the train which has the continuous motion, is always made to keep pace with the average velocity of the scape-wheel with its vibrating pendulum.

M. Wagner has exhibited a movement of this kind applied to a long vertical barrel for measuring the force of gravity, as in Attwood's machine. The barrel revolves in a second, and by the side of it a weight descends freely in a groove, with an inked brush attached to it; and as the barrel revolves, the falling brush traces a curve on the surface, which exactly indicates the space descended in any given portion of the time which the barrel takes to revolve.

Two of M. Wagner's turret-clocks have this same bevelled-wheel remontoire in the train, only with a provision for letting it off at every half-minute, instead of a continuous motion; and one of them has a remontoire escapement also, but by no means incapable of tripping, if the force is increased.

There is another clock in the same collection which deserves particular notice on account of there being a remontoire in it, without any additional wheel in the train. This is managed by setting the second wheel in a swinging frame, having its axis in a line with the arbor of the scape-wheel, and so allowing a little play sideways to the arbor of the second wheel. In this clock, also, the pallets are set in the pendulum without any crutch, the scape-wheel being put outside the frame.

Another of M. Wagner's clocks has an escapement with a direct recoil, as in Harrison's once famous but long ago abandoned escapement; and in this clock, also, the pallets are set on the pendulum without a crutch. It is certainly a superior contrivance to Harrison's; although, as in his, the recoil is necessarily very great and sudden.

All the smaller clocks in this collection have cast-iron striking parts, though the two large ones are of brass, probably for the sake of appearance; and they all strike from the great wheel, like Mr. Dent's clock; but most of them have two hour-hammers, striking alternately, and none of them appear to have barrels of sufficient length, in proportion to the number of striking pins, to go a week without the rope going twice over the barrel. They have also compensated pendulums, all on the lever principle; in some cases applied to the pendulum rods, and in others fixed to the bar at the top of the clock-frame, so as to draw up the pendulum spring through a slit in the clock. The lever compensation seems to be the only one used in France, except occasionally the gridiron pendulum, with nine bars of brass and steel. In English clocks, hardly any compensation is now used, except the mercurial cylinder in the best astronomical clocks, and the zinc tube compensation in clocks where the mercurial pendulum would be too expensive.

We have given a Prize Medal to M. Gourdin (p. 1204), a maker of some celebrity in France, for a small well-executed turret-clock, with a train remontoire of a different construction from any of M. Wagner's, the remontoire wheels being employed in changing velocity, or as part of the clock train, and not merely in changing direction, which is the case in the bevelled-wheel remontoire.

There are also some small turret-clocks, both by M. Chavin (p. 1200) and by M. Bailly Comte (p. 1197), which we mention on account of their extraordinary cheapness.

Electrical clocks may be considered as connected with turret-clocks, especially in this Exhibition, in which the experiment has been made of working three large dials by electricity, not merely as a means of connection with one large clock driven by a weight in the usual way, but using electricity as the motive power. It is needless to inform any one who has frequented the Exhibition, how far that experiment has been successful; but whenever the practical difficulty is overcome, of obtaining unfavourable electrical action, *i. e.*, of securing perfect contact of the wires at every proper epoch, there is no doubt that some kind of remontoire action will be the proper way of maintaining the motion of the pendulum, as has been attempted by Mr. Shepherd (pp. 419, 422) in these clocks, and by several other exhibitors. The other plan, of making the pendulum drive the train, cannot possibly avoid such variations of force as will be fatal to the isochronism of any clock pendulum.

There is no instance in the Exhibition of a large weight-clock driving dials at a distance by electrical connection, either galvanic or magnetic; although there is not found to be any difficulty in doing it by the latter method, by a strong permanent magnet, such as in Henley's magnetic telegraph, set on an axis, so that it can be twisted out of contact with the armature by the force of the great clock, whenever the remontoire is let off. The wires are coiled round the armature, in the well-known manner which is employed in telegraphs of this kind; and they make and unmake the temporary magnets placed behind every dial, of which the hands are to be kept in motion with those of the great clock by means of ratchet-work, or pallets, worked by the alternations of the temporary magnets, just as in the two electrical dials in front of the South and West Galleries.

House Clocks.

In what are called by the French civil clocks, or clocks for domestic use, there is not much room for difference, except in the merely ornamental parts, which we have nothing to do with. There are many such clocks, of various shapes, in the English part of the Exhibition, as well as the foreign, and most of them sufficiently good for their purpose. But it is impossible to distinguish any of the English ones as manifesting such superiority over the rest as would justify us in giving Medals for them, because such Medals could only mislead the public into the belief that there are not many other makers from whom equally good house clocks may be obtained: indeed, some of the best makers have not thought it worth while to exhibit any.

Among the French exhibitors, however, we have given a Prize Medal to Messrs. Detouche and Houdin (p. 1253), who exhibit a very handsome collection of well-made clocks, of various sizes, some with compensated pendulums and uncommon escapements, and with what is called *equation work*, or a hand to show solar as well as mean time. They also exhibit some of their pinions separately, which are very well made. Altogether, their collection is well worthy of notice.

We have also given a Prize Medal for small clocks to M. Brocot (p. 1199), the originator of an elegant and popular form of a nearly dead escapement in ornamental clocks, in which the pallets consist of semi-cylinders of jewels, at right angles to the plane of the scape-wheel. These clocks are generally made with the escapement in front of the dial, so as to be visible, and also to allow the scape-wheel to be taken out without disturbing the rest of the clock.

In addition to these Medals, which we have awarded chiefly on account of the good execution or arrangement of the movements, we have given one to Messrs. Reyder and Colin (No. 984, p. 1226), who exhibit a number of house clocks of various kinds, all remarkable for the lowness of their price, and sufficiently well executed for the ordinary uses of such clocks. And in speaking of cheap house clocks, of course the American clocks ought not to be unnoticed, though we have thought it unnecessary to attempt to distinguish any of them by a Prize Medal, as they are all substantially alike; and they are now so universally known for their cheapness—a quality which generally receives its own reward—that the additional distinction of a Medal on that account would be more than usually superfluous. There is, however, one quality for which they are entitled to greater credit than is generally known, and that is the small weights or moving force which they require, showing that there is much less power wasted by friction and the inertia of the train than in most other clocks. The small amount of inertia is caused by the lightness of the wheels; and the small friction (which certainly cannot be attributed either to the high finish or high numbers of the pinions) is accounted for by the use of lantern pinions, which (when driven by the wheels) have much less friction than leaved pinions of such low numbers, and are also less liable to be clogged with dirt, and are less affected by the wheel-teeth being inaccurately cut, as they generally are in clocks of much greater pretension than these.

To this class of domestic clocks belong the various forms of striking and chiming clocks, and alarums, and also tell-tale or watchmen's clocks, and clocks going a long time without winding, and perpetual almanac clocks, whatever be the number of phænomena which they profess to show. There is now so little difficulty in making these things, and so little use in most of them when made, that we do not think it necessary to distinguish any of them by a Medal, although in some instances they display ingenious contrivances for effecting their different objects. The Jury, however, agreed to mention some small alarum clocks by M. Pierret, of Paris, (No. 958, p. 1225), on account of their cheapness, and because alarums really are, for certain purposes, useful articles of household furniture.

Watches.

The only horological instruments which remain to be noticed are watches, in which term are included carriage clocks, since these are, in fact, only large watches, set in cases like those of small clocks, and with the balance placed at right angles to the rest of the wheels, so that its axis may stand vertically, because it vibrates with less friction in that position—a fact of which some of the exhibitors do not seem to be aware.

Watches, like house clocks, are so much an article of general manufacture, and there is so little difference in the quality of those of several of the best makers, that it is difficult to establish any principle on which prizes can be given for them, except with reference to the general reputation of the exhibitors of articles which appear in themselves to be good.

The three principal places in England where watches are made, are London, Liverpool, and Coventry. Among the London makers, several who have received Medals for chronometers or other articles, would have been entitled to receive them for their exhibition watches alone. There is a very beautiful collection of carriage clocks and watches, of various kinds, by Mr. Dent; some of them exhibiting, besides the compensated balance, which all first-rate watches now possess, a contrivance (different from most others for the same purpose) for winding up and setting the hands without a key, by turning the knob in the handle or *pendant;* and others having what is called a split seconds-hand, that is to say, two seconds-hands, which travel together and appear as one, till you move a pin in the case, whereupon one of the hands separates from the other, and stops until you move the pin again, when the hand starts forward and rejoins the proper seconds-hand, after any length of stoppage; and this is done without the use of an independent train to drive the extra seconds-hand. There are various contrivances, of different kinds, for the same purpose, among the other watches in the Exhibition. Mr. Dent also exhibits a night-watch, or a watch for blind persons, technically called a *tac*-watch, with an external hand, which moves round with the hour-hand, and the position of which can be felt with tolerable accuracy, with reference to twelve studs set round the rim of the case, for the twelve hours, reckoning of course from the handle. There is also a watch similar to this among the Swiss ones; but Mr. Dent's has a special provision to prevent the position of the hand from being altered by the act of feeling it. He is to be considered as entitled to a Prize Medal for his collection of watches, independently of the Council Medal awarded to him for the large clock.

In like manner the Prize Medals awarded to Mr. C. Frodsham (No. 51, pp. 414, 415), and Messrs. Parkinson and H. Frodsham (No. 35, p. 411), for chronometers, are to be understood as awarded also in respect of their exhibition of watches.

The former of these exhibitors states that his watches are made on a certain *caliper* (as the watchmakers call the working plan of a watch), in which the sizes of the wheels are determined according to a set of rules, partly arbitrary and partly founded on experience, according to the size of the barrel, or, in other words, according to the power of the mainspring. All makers of watches on a large scale must have some such system of their own; but Mr. Frodsham proposes that a general system shall be adopted, in which the sizes of the various pieces of a watch shall not be expressed by the usual conventional numbers, known only to those who have to use them, but in decimals of an inch, and according to certain tables of proportion with reference to the size of the barrel, as above mentioned. It would probably be convenient if some such system were adopted, either according to Mr. Frodsham's rules (so far as they are arbitrary), or any others which might be generally agreed on.

Such a system as this is still more completely carried out by Mr. Roberts's watch-plate drilling machine (No. 130, p. 422), a most ingenious and apparently successful invention, by which any given caliper or proportion of the parts of a watch of any size can be at once transferred, by a mere mechanical process, to any other watches of any other sizes; piercing all the holes required for the pivots of the wheels, and other purposes, with unfailing accuracy. And in connection with this machine there is a *sector* for proportioning the sizes of wheels for any required number of teeth, also by a mechanical operation without the necessity of calculation. The Prize Medal before mentioned as given to Mr. Roberts (p. 422) for his cast-iron clock is therefore to be considered as awarded equally in respect of his watch-plate drilling machine.

It should be mentioned also that he exhibits some watches with a remontoire escapement, and one, which he calls a *recorder* watch, with two seconds-hands, of which one can be stopped to denote the exact time of any observation, as is done in various other watches in the Exhibition. Indeed, the number of them is so great that we have not been able to give a Prize Medal to any maker solely on account of such a contrivance, except to M. Rieussec (No. 1685, p. 1257), a well-known watchmaker of Paris, for his watches with a seconds-hand, which, on touching a pin at the time of observation, makes a black spot on the dial; and this can be repeated at very close intervals, so as to record the exact epochs of a number of observed phænomena succeeding each other very closely, without the necessity of taking the eye off the object to be watched for in order to look at the dial.

What are called the *movements* of watches and small clocks are made by machinery, on a very large scale, by MM. Japy Brothers, of Paris (No. 275), to whom we have awarded a Council Medal; although the objects themselves, as they appear in the Exhibition, are by no means striking, inasmuch as these watch movements are in fact only the two plates and some of the larger wheels of the train, and the clock movements are the internal parts of the clock without the escapement. The most, indeed the only, remarkable quality in these movements, is their extraordinary cheapness. They are, however, at least as good as any others of the same kind made in the usual way by hand; and Messrs. Japy, we are told, sell no less than half a million of them to watch and clockmakers in the course of a year. The great cheapness of these articles being obtained by means of a peculiar process of manufacture, it was considered that Messrs. Japy might properly receive a Council Medal for their watch movements, as a specimen of the produce of such improved mode of manufacturing.

Messrs. Rotherham, of Coventry (No. 124, p. 419), exhibit a large collection of watches in all stages of manufacture, for which we have awarded a Prize Medal. We have also given one to Mr. Roskell, of Liverpool (No. 123, p. 419), an eminent maker, who exhibits a handsome collection of watches and small clocks, some of which are so constructed as to show the action of the various forms of watch escapements in general use; and to M. Redier, of Paris (No. 1425, p. 1244), for a cheap kind of watch alarum, of which a great number are sold both in France and in this country.

It may be mentioned here that M. Kralik, of Pesth (No. 169, p. 1016), exhibits a set of models, in which thirteen different escapements can be fitted to one clock movement, by merely unscrewing the part containing the escapement. This is apparently intended for illustrating lectures on watchmaking, or for experiments on the effects of different escapements.

Mr. Jackson exhibits what he calls (with some disregard of etymology) a *soliclave* watch (No. 32, p. 411), whereby he means a watch with a solid key. However, his invention of the thing fortunately deserves more credit than his name for it. Most people are aware that the pipes of watch-keys wear out; and, in so doing, they wear off the corners of the winding square on which they act. The shorter this winding square is, the sooner of course this will happen; and in thin watches of the common construction the winding square cannot but be short. With the view of avoiding this, Messrs. Aubert and Klaftenberger's watches (No. 52a, p. 412), and several foreign ones in the Exhibition, which have no fusee, have the arbor of the barrel hollow and squared for a solid key to fit into it the whole depth of the barrel. But this will not do for watches with a fusee, because the fusee arbor has to turn while the watch is going, though the barrel-arbor of a watch without a fusee only turns while it is being wound up; and a hollow fusee arbor would be much too thick. Mr. Jackson, therefore, winds up his fusee by a small auxiliary wheel, analogous to what is called a jack-wheel in turret-clocks; and the arbor of this small wheel is made hollow and squared to receive the solid key. As the little wheel has nothing to do, and no pressure on it when the watch is going, the friction of its thick arbor is inconsiderable, even supposing it not to be thrown out of gear, as it might be. This also allows the fusee arbor to be smaller, and therefore to turn with less friction than usual. We have consequently given Mr. Jackson (p. 411) a Prize Medal for this invention.

We have also given a Prize Medal to M. Montandon, of Paris (No. 601, p. 1207), for his mainsprings, of which he is a maker of high reputation; and it is unnecessary to say that the goodness of the mainspring is of great importance to the accurate performance of watches, especially of foreign ones, in which there is generally no fusee, and so the spring must be capable of acting with nearly uniform force for four or five turns of the barrel.

We agreed to mention the names of two other French watchmakers: M. Le Roy (No. 1186, p. 1234), for a collection of well-finished clocks and watches; and M. Laumain (No. 292, p. 1190) who exhibits some well-made pocket chronometers, with the escapement part made to take off separately: as well as the name of Mr. Bolton (No. 94, p. 418), an English exhibitor of some very cheap watches in German silver cases.

The Swiss exhibition of horology consists entirely (with the single exception of a clock before mentioned) of watches and watch-work; and, as is well known, a large proportion of the watches of the world, especially the small and cheaper ones, are made in Switzerland. But in this instance, as in some others, it is not to be inferred that we intend the superiority of the works of one nation over another, in any particular department, to be measured by the number of medals which have been awarded to each, as they were given on no such consideration.

We have given Prize Medals for watches to the following Swiss exhibitors:—Messrs. Audemars (Switzerland, No. 22, p. 1267), Grandjean (No. 8, p. 1266), Grosclaude (No. 24, p. 1268), Lecoultre (No. 262, p. 1283), Mercier (No. 175, p. 1277), Patek and Philippe (No. 99, p. 1273), and Retor (No. 101, p. 1273), except that for the last a grant of money has been substituted.

M. Audemars (No. 22, p. 1267) exhibits a watch with a contrivance for winding up the train which is required for driving what is called an "independent seconds-hand," as well as the ordinary train, by the handle or pendant, so that when either train is fully wound up, the winder acts on it no longer, but proceeds with the other train alone. He has likewise a watch with several dials, one of them indicating one-fifth of a second, and with provisions for stopping the different hands independently. It may be mentioned here that Messrs. Cousins and Whiteside, of London (No. 86, p. 417), also exhibit a large watch with a stop seconds-hand, indicating one-sixth of a second. M. Audemars' collection contains various other watches, with different kinds of escapements and other peculiarities, which cannot be particularly described here.

M. Grandjean (p. 1266) exhibits some pocket chronometers, *i. e.*, watches with the chronometer escapement; and one of them has a balance-spring of a spherical form instead of a flat or a cylindrical one.

M. Grosclaude (p. 1268) has sent some watches with "independent seconds-hand," and only a single mainspring.

M. Lecoultre's (p. 1283) watches are remarkable for the good execution of the wheels and pinions. He is stated to make all his watches with the corresponding wheels of the same size, so that when any wheel is damaged, it can at once be replaced by a new one without any other trouble than that of putting it in. And he, like some other makers, has a method of winding up and setting the hands without a key, and with a provision to avoid the risk of a slight derangement of the hands in the act of putting their adjusting work in gear, to which some other methods are said to be liable.

M. Mercier (p. 1277) exhibits among other well-made articles, a watch with a new recoiling escapement with a double scape-wheel, which is ingenious and simple; but we do not profess to give any opinion on the probability of its success.

MM. Patek and Philippe (p. 1273) exhibit a large and valuable collection of watches and pocket chronometers. Their articles are generally of moderate price, besides being well made, and some of them are highly finished. They have a repeater with two barrels, both winding in the handle, and a watch for the blind. They are the makers of the very small watch only ·35 of an inch in diameter, which attracted much notice as the smallest in the Exhibition.

We have recommended M. Retor (p. 1273) for a reward in money instead of a Prize Medal, as we understand that he is a person of very small means, who has had some difficulty in getting up the articles which he has sent to the Exhibition, and that he is also engaged in making experiments in watchmaking, which are of course at present unremunerative. He has exhibited a pocket chronometer with an ingenious escapement.

We conclude the notice of the Medals to the Swiss exhibitors of watches with the award of a Council Medal to M. Lutz, of Geneva (No. 94, p. 1272), for his watch balance-springs. On the balance-spring, more than any other single piece of a watch, its isochronism depends; and these springs present a marked difference in some of their qualities from those of any other exhibitor (even of some who specially directed our attention to the alleged superiority of their springs), inasmuch as they bore the tests both of heating and stretching out nearly straight without at all altering their permanent form, which was not the case with any other springs which we tried.

Besides these, we agreed to make Honourable Mention in our Report of the following Swiss exhibitors of watches:—Elfroth (No. 78, pp. 1271, 1272), the maker of the small watch in the end of a pencil-case; Bock (No. 31, p. 1268), Courvoisier (No. 34, p. 1268), Mermooz (No. 15, p. 1266), and Messrs. Baron and Uhlmann (No. 74, p. 1271); also of M. Favre Brandt (No. 23, p. 1267), on account of his ingenious instrument for tracing out (not cutting) the teeth of watch-wheels in the epicycloidal form.

And lastly, we have awarded a Prize Medal to M. Benoit, of Sardinia (No. 33, p. 1303), for his watches and watch movements, and for a machine for rapidly polishing the teeth of the scape-wheel of a horizontal or cylinder escapement.

The following is a summary of the awards in this Class:—

COUNCIL MEDALS.

Nation.	Number in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	55	Dent, E. J.	Great clock and collection of other articles.
France	275	Japy Brothers	Cheap clock and watch movements, made by machinery.
Switzerland	94	Lutz, C.	Hair springs.
France	736	Wagner, J. (Nephew)	Continuous motion remontoire, and collection of turret-clocks.

PRIZE MEDALS.

Nation.	Number in Catalogue.	Name of Exhibitor.	Objects Rewarded.
Switzerland	22	Audemars, L.	Watches and watch movements.
Sardinia	33	Benoit, A.	Watches and tooth-polishing machine.
France	441	Brocot, A.	Half-dead jewelled escapement.
——	1589	Detouche and Houdin	Collection of clocks.
Switzerland	9	Dubois, F. William	Astronomical clock.
United Kingdom	57	Frodsham, C.	Chronometers and watches.
France	516	Gannery, V.	Astronomical clock.
——	525	Gourdin, J.	Small turret-clock.
United Kingdom	27	Gowland, J.	Astronomical clock.
Switzerland	8	Grandjean, H.	Pocket chronometers.
——	24	Grosclaude, C. H	Pocket chronometers.
United Kingdom	7	Hutton, J.	Chronometers.
——	32	Jackson, W. H., and S.	Watches, solid key.
Denmark	17	Jürgensen and Sons	Chronometer.
Switzerland	25	Lecoultre, A.	Watches, movements, and pinions.
United Kingdom	12	Loseby, E. T.	Chronometer compensation balance.
——	68	MacDowall, Charles	Clock escapement.
Switzerland	96	Mercier, S.	Watches.
France	601	Montandon Brothers	Watch mainsprings.
United Kingdom	35	Parkinson and Frodsham	Chronometers and watches.
Switzerland	99	Patek, Philippe, and Co.	Chronometers, watches, &c.
France	1425	Redier, A.	Cheap watch alarums.
Switzerland	101	Retor, F. (money prize, 50*l.*)	Pocket chronometer with new escapement.
France	984	Reydor Brothers, and Colin	Cheap house clocks.
Prussia (1 Zollv.)	342	Richard, Louis	Chronometer.
France	1685	Rieussec, N.	Watch with hand printing seconds.
United Kingdom	130	Roberts, R.	Turret-clock, and watch-plate drilling machine.
——	123	Roskell, J.	Collection of models and watches, and small clocks.
——	124	Rotherham and Sons	Collection of watches.
France	733	Vissière	Chronometers.

HONOURABLE MENTION.

Nation.	Number in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	52A	Aubert and Klaftenberger	Watches.
France	407	Bailly-Comte and Son	Cheap turret-clocks.
Switzerland	74	Baron and Uhlmann	Chronometers and watches.
United Kingdom	34	Barraud and Lund	Compensation balance, and watches.
Switzerland	31	Bock, H.	Watches.
United Kingdom	94	Bolton, T.	Cheap watches.
France	450	Chavin (Elder Brother)	Cheap turret-clocks.
Switzerland	34	Courvoisier, F.	Chronometers and watches.
United Kingdom	86	Cousens and Whiteside	Stop-watch.
Switzerland	78	Elffroth, D. H.	Watch in pencil-case.
——	23	Favre Brandt	Watches and tooth-tracing machine.
——	23	Favre, H. A.	Chronometer, with pointing seconds-hand for marking minute portions of time.
France	292	Laumain, C.	Pocket chronometers.
——	1186	Leroy and Son	Carriage clocks and watches.
Switzerland	15	Mermooz, Brothers	Chronometers and watches.
France	350	Pierret	Cheap clock alarums.
United Kingdom	128	Shepherd, C.	Electric clock escapement.

October, 1851.

E. B. DENISON, Reporter.

CLASS Xc.

REPORT ON SURGICAL INSTRUMENTS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

J. H. GREEN, F.R.S., *Chairman and Reporter*, Hadley, Middlesex.
Dr. THOMAS CHADBOURNE, United States.
JAMES PHILP, 67 St. James's Street; Surgical Instrument Maker.
Dr. ROUX, France.
Dr. LALLEMAND, France.
W. LAWRENCE, F.R.S., Whitehall Place; Surgeon to Bartholomew's Hospital.

THE Jury have the honour of submitting to Her Majesty's Commissioners the following Report, under the impression that the task has been confided to them of furnishing an intelligible account, as far as may be derived from an inspection of the contributions to the Great Exhibition, of the present state and condition of the art of manufacturing surgical instruments.

The relation between the instrument employed and the scientific objects of the surgeon, is, however, so intimate and essential, that in order to arrive at a just conception of the scope of the instrument-maker's business and art, it will be necessary to make some brief observations on the purposes of surgical instruments, and on the conditions of what may be properly called improvement in connection with the art and science of surgery.

The instruments of the surgeon may be regarded as aids to those organs by which, on the one hand, man receives the notices of outward objects, and on the other, to those by which he re-acts upon the external world—namely, his senses, and as the representative and vicegerent of the motive powers, his hands. By this armature, then, of the senses and hands, and in proportion as it is efficient, is he endowed with the means of assisting and relieving those who require his services. There is, however, this peculiarity in the surgeon's instruments, that they are scarcely otherwise employed than in operations on living and sensible parts. To supply such aids as the surgeon requires is the business of the instrument-maker; often only as the mechanical artificer, but not unfrequently contributing, by his inventive ingenuity, to carry out more completely the surgeon's designs. The art of the instrument-maker has, indeed, a twofold character. He has, in the first place, to arm the operator for the various exigencies which his office implies—for example, with knives, saws, and the like, for removing parts which have been spoiled by violence or disease; with tourniquets, and other means, for arresting bleeding; with needles, for closing wounds; and with the various means for ascertaining the presence and for the extraction of foreign bodies: and, in the second place, he has to supply the needs of the mutilated sufferer, and to furnish compensation for defects, as far as such can be mechanically provided, in the shape of crutches, supports, and bandages, and of artificial eyes, palates, and even limbs. He must be then an able mechanist, and such, be it said to the credit of instrument-makers, he will generally be found. But with, and almost in proportion to, his mechanical ingenuity arises the danger that it will induce him to adopt in his works unnecessary mechanical refinement and pernicious complexity; for, if the principle above enunciated be correct, it may be admitted that the nearer any instrument, consistently with its use, approaches to the organic simplicity of the hand and fingers, unembarrassed by mechanical details and complex adaptations, the nearer will be its approach to perfection.

If we now turn to the progress of improvement in the construction of surgical instruments, it will be found that, as it necessarily stands in intimate relation to the advance of surgical science, it cannot but exhibit a tendency to the same simplicity that characterises improved operative surgery—perhaps by discarding as useless a whole group of instruments, always by the gradual introduction of methods which require fewer and less complex instruments; or if the aid of new instruments be required, it can scarcely happen but that those answer their purpose best which are in accordance with the principles already laid down.

Let the surgical student look into any old book of surgery, with its quaint cuts and illustrations,—such a work as Heister's, for instance, which is intended especially to afford information on the apparatus and instruments of this science,—and he cannot but be at once struck with the cumbrous, coarse, and complex character of the instruments, when compared with those now in use, which are intended to accomplish the same objects. A remarkable illustration offers itself in the formidable array of tools which were employed in the operation of trepanning. But further inquiry will also show that, in consequence of the improvement of the healing art, many instruments may become altogether useless. What surgeon would think of having recourse to the terrible cauterizing irons, formerly in use for the purpose of searing the palpitating stump after amputation, and of preventing the otherwise inevitable death of the patient by bleeding? This barbarous method, which rendered the operation dangerous, and the healing of the wound tedious, was, as is well known, happily rendered unnecessary by the celebrated Ambrose Paré, who adopted the simple expedient of tying the bleeding end of the divided artery.

In the above instance, the cauterizing irons, as far at least as dependence on their use in arresting hemorrhage was concerned, were banished for ever from the equipment of the surgeon. But if amputation, in this case, was robbed of the greater part of its terrors and dangers, so great a step in the amelioration of operative surgery might not unnaturally beget a hope that, by the advance of surgical science, in consequence of a better knowledge and clearer insight into the laws of the animal economy, the operation of amputation itself might be dispensed with, or limited to the fewest possible emergencies. Would that it were so, at least in all the diseases under which it is still unavoidably adopted; but in one instance, at all events, the genius of John Hunter has enabled surgeons to discard it, and to supersede its employment by a process at once simple, effectual, and almost void of suffering. In the disease called aneurism, produced by the yielding, at some point, of the coats of an arterial trunk, until it bursts externally, and the patient dies of loss of blood, Hunter taught surgeons, instead of depriving the patient of a limb, as had been most commonly heretofore done, to cure the disease by applying a ligature to the artery feeding the aneurismal sac, and thereby arresting the flow of blood, which contributed to the increase of the disease. It seems, however, probable, from recent cases, that even this mild plan of treatment may be superseded, in many cases, by the simpler method of a merely graduated compression on the exterior of the limb.

It might seem, then, that the skill of the instrument-maker is destined to be less and less required in the progress of the healing art; but if his ingenuity may be thus balked of its fruit, sometimes it would appear to be evoked by the very improvements which are the pledge of the advance of surgery. A remarkable instance in point is the comparatively recent operation of lithotrity, the principal merit of which will be cheerfully accorded to the French surgeons. The only method of effectually relieving a sufferer from the torture and health-destroying consequence of stone in the bladder had been by cutting into the part, and by extracting the stone through the wound, which, in such cases, extends deeply, and involves parts which it would be dangerous, or even fatal, to injure. But by the novel process entitled lithotrity, instruments, ingeniously contrived for the purpose, are introduced into the bladder, and, in the hands of a skilful operator, are made to break, crush, and pulverize the stone, without the necessity of any incisions, and without those dangers to the patient which attended the operation of lithotomy. Here the aid of the mechanist was called in to contribute to the success of one of the greatest triumphs of modern operative surgery; and though the various modifications of the apparatus may have been suggested by surgeons, it may be safely said that the instruments would not have reached the perfection they have attained, as shown in the present Exhibition, without the skill and ingenuity of the instrument-maker. It should be remembered also, in connection with this subject, that Sir Astley Cooper devised a plan of extracting stones from the bladder whole and entire, when of small size, and that it was successfully carried out by means of an instrument constructed by the late Mr. Weiss, who will ever be regarded more as an artist than as a mere artificer, in the line in which he earned his deservedly high reputation.

If, then, the improvements in the apparatus and instruments of surgeons, during the last half-century, be considered in the spirit here vindicated, they will be found to depend on simplification, and if on novel appliances, yet on inventions, which have afforded new means of relief to the sufferer, or have tended to introduce the gentler and less formidable methods of operation, which are ever the characteristic of the enlargement of surgical knowledge. Among these, besides the capital instances adduced of modes of instrumentation of proved efficacy for relieving the sufferings of stone in the bladder, there may be mentioned—the stethoscope, invented by the celebrated Laennec, for aiding the ear in examining the morbid sounds of the chest, and which is not without its use to the surgeon; the stomach-pump, the valuable auxiliary in the treatment of poisons; Weiss's dilator of the female urethra, for the purpose of facilitating the extraction of foreign bodies from the bladder; the water-bed of Dr. Arnott, calculated, in all cases, to afford equal pressure in lying, and to prevent or remove the suffering and danger of bed-sores; various apparatus for facilitating and improving the treatment of fractures, especially the bed invented by Mr. Harrold for fractures of the spine, and the useful appliance of the gummed roller; the instruments for the cure of aneurism, by the graduated compression of the artery leading to the sac; the mechanical contrivances in aid of orthopædic processes; and the different forms to which caoutchouc has been made available in air and water-cushions, and in a variety of bandages and similar surgical appliances.

With these premonitions the Jury now proceed to give a brief synopsis of the contents of the present Exhibition.

Instruments deserving notice.

In looking over the assortment of instruments, which display not only all the ordinary contrivances required by the surgeon, but many novelties and ingenious adaptations and combinations, we may notice—in the instruments for operations *on the eye*—specula, knives, needles, scissors, hooks, which are admirably calculated for the delicacy of the requisite manipulations. In those for operations *on the ear*, some novelties for the exploration of the meatus auditorius and Eustachian tube, and for the removal of polypi and foreign bodies from the external passage; an instrument for perforating the membrana tympani; and we may add to these a variety of acoustic contrivances for aids to imperfect hearing, many of which are so contrived as to be disguised as articles of furniture or personal attire. In those for operations *on the nose, mouth*, and *pharynx*, some modifications of the forceps for the extraction of polypi; syringes for injecting the nares and antrum; a variety of tonsillar guillotines; staphyloraphic instruments, and new aids to dental surgery, especially Gilbert's chair, with a fulcrum, and instruments adapted to the forms of the several kinds of teeth, for their more easy extraction. In those for operations *on the air-passages* and *thorax*, various instruments for tracheotomy, and amongst them a novel tracheotome, and a valvular canula. We may include with these various forms of inhalers for the administration of medicinal vapours, stethoscopes of novel construction, and instruments for measuring the capacity of the chest, amongst which will be found Dr. Hutchinson's spirometer, Coxeter's portable spirometer, and Quain's stethometer. In those for operations, or other surgical ministrations, *on the abdominal walls* or *alimentary canal*, we may mention some improvements in the gullet forceps and in œsophageal tubes; modifications of the stomach-pump, which are calculated to facilitate its use; enema fountains; specula of different kinds for the examination of the rectum, or subservient to operations on the part; and a large assortment of trusses and herniary bandages, including most of those in use, and others of novel construction, especially such as those by which the wearer can vary at pleasure the force of the spring and the direction of the pad.

In those for operations *on the genito-urinary system in the male*, we find all the recent modifications of the instruments for lithotomy; lithotrites, of various novelty, including contrivances for the use of the screw and lever, as mechanical forces for breaking calculi, and one instrument for the purpose of pulverizing calculous fragments; syringes for injecting the bladder, together with contrivances for maintaining a double current of the injected fluid; dilators and various instruments to remove calculi from the bladder and urethra without cutting; trochars for puncturing the bladder, together with a form of canula so contrived as to prevent its slipping from the opening in which it is intended to remain; and, lastly, varieties of bougies, catheters, sounds, and instruments for applying caustic and for dividing strictures; and we may here notice the invention, patented by Charrière, of flexible ivory, as a novel material in their make. We may also draw attention to the speculum and lamp of Mr. AVERY (No. 631A, p. 478) for exploring the urethra and other lengthened canals; and the same gentleman exhibits a new instrument for lithotomy.

In those for operations *on the genito-urinary system in the female*, we have a large assortment of specula, dilators, syringes, forceps for removing polypi, instruments for applying ligatures, pessaries, and artificial supports of various kinds; an instrument for the cure of vesico-vaginal fistula; and different instruments for obstetrical purposes.

In those for operations *on the extremities*, we find, in connexion with some varieties in the knives and saws used for amputations, several noticeable modifications in the form and adaptation of tourniquets;—for the adjustment and co-aptation of fractures, numerous contrivances claim attention in the way of fracture-beds, inclined planes, splints of various form and materials, a cradle with a moveable sling to enable the patient to sit up in bed, an apparatus for a fractured clavicle, together with pads and bandages in different materials;—for the reduction of dislocations several contrivances, in one of which the extending force is produced by a lever, and a neat apparatus for the reduction of the thumb or other small extremity.

In those for operations *on the osseous system*, the osteotomes claim attention, especially the revolving saw of HEINE, the circular saw of MACHELL, and, in addition to various instruments for the resection of bone, one will be found for dividing and extracting lengthened sequestra. We noticed also a trephine-crown, which is made capable of expanding and contracting.

In those for operations *on the vascular system*, we find some variations of the scarificators for cupping, improved leech-tubes, and artificial leeches;—for the control of hæmorrhage, new forms of tourniquet;—instruments for transfusion;—for aneurism, various instruments for holding needles and applying ligatures, and instruments subservient to the new method of cure by graduated compression;—and for varices, elastic stockings and bandages.

Besides all these praiseworthy attempts to improve and extend the ministrations of the surgeon, we observe that great attention has been paid to *orthopædic processes* for the removal of deformities produced by weakness, misgrowth, or habitual position, in the form of spinal supports, corsets, chairs, and a system of machines exhibited by Mr. Caplin for combining gymnastic exercises with orthopœdic objects.

In the *mechanical compensation of lost parts* great success has been obtained, as will be seen in examining the assortment of artificial eyes, noses, palate, teeth, arms, and legs. Among the arms, the apparatus and tools contrived by Major Little to meet the loss of the right hand, is well worthy of inspection; and among the contrivances for supplying the loss of the lower limb, the admirable mechanism of Mr. B. F. Palmer's artificial leg (United States, No. 39, p. 1435) deserves particular notice.

In addition to the above list, the Jury may be permitted to draw attention to Chapman's invalid couch (No. 601c, p. 476), Dr. Veitch's invention, "denominated the medico-chirurgical ambulance" (No. 6, p. 407); and Gowing's instruments of veterinary surgery (p. 475*).

The Jury cannot, indeed, pretend to have noticed in this report every article worthy of the surgeon's attention, or to have mentioned all the names of exhibitors whose merits deserve a permanent record. This remark applies, perhaps, in the greatest degree, to the exhibitors of collections of instruments, several of which, such as those of Charrière (No. 1145, p. 1233), Coxeter (No. 482, p. 469*), Evans (No. 274, p. 38), Ferguson (No. 638, pp. 477, 478), Luer (No. 1333, p. 1240), Philp and Whicker (No. 641, p. 465*), Simpson (No. 642, p. 465*), and Weiss (No. 631a, p. 478), form a complete and instructive epitome of the instrument-maker's art.

In concluding this account of the surgical instruments contained in the Exhibition, the Jury have to acknowledge the valuable assistance they have derived from Mr. Philp; and to regret that, in consequence of his office as Juror, the house of Philp and Whicker (No. 641, p. 465*) have renounced all competition in the award of prizes. The Jury deem it, however, no more than just to remark that the house of Savigny, of which Messrs. Philp and Whicker are the representatives, embraces the history of the manufactory of surgical instruments in this country for a period of scarcely less than two centuries; and that the late Mr. Savigny, as is shown by his well-known work on the subject, was in his day almost the sole improver of instruments, which up to that time had been of a very rude construction. They desire to add that Mr. Philp has been practically engaged during the last fifty years in the manufacture of the justly-prized instruments, for which Savigny's firm has been celebrated, and that on the present occasion Messrs. Philp and Whicker, in the complete and excellent collection of instruments which they exhibit, have efficiently sustained the high reputation of their long-established house.

Thus in the Great Exhibition will be found the complete armoury and equipment of a surgeon, comprising a choice assortment of all the instrumental aids, in their most perfect form and finish, with which the ingenuity of the artist or artificer can furnish the operator or the patient, for the relief of the manifold ills of suffering humanity,—as far, at least, as their remedy depends upon mechanical skill and contrivance. To attempt any critical examination of this admirable collection would be, however, in the opinion of the Jury, as hopeless as it would be invidious. The Jury appointed to report on surgical instruments could not, consistently with the objects and limits of this Report, enter upon the discussion of subjects which involve references to a large portion of the surgical records and literature of the last half-century; and they have no wish to make their Report the vehicle of advertisement, or to render it the occasion of controversy. They do not arrogate to themselves any judicial authority to decide on the claims of inventors, or on the comparative merits of improvers. They have endeavoured conscientiously, as far as their means of judgment have extended, to award prizes in those cases in which the objects exhibited display inventive talent, useful ingenuity, or superior mechanical skill; and if in some instances they may have left talent unrewarded, either from the imperfection of their judgment, or from the impossibility of acknowledging every degree of merit, they desire to record most unequivocally their sense of the general excellence manifested both in the contrivance and execution of the surgical instruments exhibited.

To the same Jury has been intrusted the duty of examining and reporting on the models of anatomy. Of these some beautiful examples have been exhibited by Auzoux (No. 13, p. 1170), Simpson (No. 641, p. 465*), Towne (No. 625, p. 477), and Gordon (No. 639, p. 465*). The opinion which the Jury entertains of their merits they have expressed, by awarding to each of these contributors the Prize Medal. And whilst saying that such models are admirably calculated to aid the teacher in his demonstrations, the Jury, without detracting from their merit, may be permitted to observe that, especially in respect of human anatomy, they can never supply the place of actual dissection. They cannot, however, omit this opportunity of recording their approbation of the value of the labours of M. Auzoux, who, in respect of the durability of the material he employs, and of the scientific exactness of the structures he displays in the anatomy of man, and in that of various well-chosen examples of animals, both vertebrate and invertebrate, has earned the gratitude of teachers of anatomy and zoology. And they desire especially to express their admiration of the series of models in wax, which display the anatomy of the torpedo, not only as highly-interesting specimens of Florentine art, but as patterns of scientific accuracy and artistic beauty.

Finally, in accordance with the philanthropic designs of His Royal Highness the Prince Albert, and of those who have promoted, under the Royal sanction, this great national undertaking, the Jury beg to express their sincere wish that the department of the Great Exhibition, on which they report, may contribute to produce that interchange of knowledge and of amity which this assemblage from all parts of the world is calculated to foster, and which it is alike the interest and the duty of all nations, as integral parts of the human family, to cherish and to cultivate.

In making the following awards, the Jury intrusted with this delicate and difficult duty, desire to say, that in conformity with the directions of the Royal Commissioners, and without the means of marking degrees of merit, they have been under the necessity of avoiding a regard to comparative excellence. Also, that as they do not intend it to be understood, that others than those included in the prize list might not have properly received some testimonial of merit, so they trust, that the Exhibitors distinguished by the recommendation of the Jury will severally accept the prize awarded to them, not as a measure of their merit, but as a tribute to the excellence of the objects they exhibit.

PRIZE MEDALS.

Nation.	Number in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	619	Arnott, J., M.D.	A novel mode of applying cold as a therapeutical agent.
France	13	Auzoux, Dr. L.	The excellence of his anatomical models, admirably calculated to promote and aid the study of anatomy, human and comparative.
United Kingdom	631A	Avery, John	An illuminating apparatus, designed to explore long and narrow canals, especially the male urethra.
——	676	Bigg, H., and Son	Surgical instruments, excellent both in materials and workmanship.
France	79	Burat Brothers	Improvements in the construction of herniary bandages.
Tuscany	85	Calami, Professor L.	A series of models in wax, representing the anatomy of the torpedo in the most exact and beautiful manner.
United Kingdom	570	Caplin, I.	Various kinds of apparatus, orthopædic and gymnastic, especally those the value of which consists in removing the weight of the trunk, and at the same time increasing muscular strength by exercise.
——	570A	Caplin, Madame	Corsets, ingeniously adapted for giving support to the trunk without confinement of the thorax.
France	1145	Charrière, J. F.	Instruments of various kinds, exhibiting novelty, inventive and adaptive ingenuity, and great perfection of mechanical execution.
United Kingdom	682	Coxeter, J.	Surgical instruments, excellent both in materials and workmanship.
——	643A	Evans and Co.	Surgical instruments, excellent both in materials and workmanship.
——	274A	Evans, W.	An artificial leg, the peculiar excellence of which consists in giving a firm bearing on the stirrup in riding.
——	631	Ferguson and Sons	Surgical instruments, excellent both in materals and workmanship.
——	639	Gordon, J.	An anatomical model of a human figure in ivory, exhibiting the parts as they appear in dissection, and displaying an unwearied application of labour in the execution.
——	736	Gowing, T. W.	Improvements in veterinary instruments.
——	565	Grossmith and Desjardins	Artificial eyes, remarkable for their close imitation of the natural appearance of these parts.
——	729	Hutchinson, Dr.	His spirometer, an apparatus adapted to measure the quantity of air expired, in conformity with the proportion said to exist in healthy individuals, between the height of the stature and the capacity of the lungs.
Switzerland	106	Junod, T.	An apparatus for hémospasie, namely, for determining blood to large surfaces of the body, on the principle of dry cupping.
France	1333	Lüer, A.	The general excellence of his instruments, and especially for the great ingenuity and admirable workmanship of several instruments for operations on the eye.
United Kingdom	654	Machell, T.	A circular saw, intended to be used as an osteotome.
United States	39	Palmer, B. F.	An artificial leg, the contrivance of which combines lightness and a successful imitation of the motions of the joints.
Portugal	633	Polycarpo, A.	A case of surgical instruments.
United Kingdom	629	Rein, F. C.	Acoustic instruments, ingeniously contrived for the aid of deaf persons, in a variety of highly convenient forms.
——	624	Simpson, G.	An anatomical model of the human figure, consisting of pieces that may be combined and detached at pleasure, and calculated from its construction to bear the heat of tropical climates.
——	642	Simpson, H.	Surgical instruments, excellent both in materials and workmanship.
France	1505	Thier	An apparatus called Tétrelle, an ingenious contrivance for artificial lactation.
United Kingdom	625	Towne, J.	His admirable models in wax, illustrating the process of incubation, and representing some parts of the human body as they appear in dissection.
——	631A	Weiss and Son	Instruments of various kinds, exhibiting novelty, inventive and adaptive ingenuity, and great perfection of mechanical execution.

Hadley, October 1851.

JOSEPH HENRY GREEN, Reporter.

P.S.—Since the above Report has been in type, the attention of the Reporter has been drawn to "Photographic specimens of vaccine produced by inoculating the cow with the small-pox, showing the character of the vesicles in their different stages;" exhibited by Mr. John Badcock, of Brighton. The Reporter does not venture to offer any opinion on the comparative value of such a mode of obtaining a fresh supply of vaccine matter; but he has great pleasure in having this opportunity of acknowledging the highly commendable zeal and public spirit of Mr. Badcock.

CLASS XI.

REPORT ON COTTON MANUFACTURES.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Sir James Anderson, Lord Provost of Glasgow, *Chairman*, Glasgow; Cotton Manufacturer.
Philipp Ellissen, *Deputy Chairman*, Frankfort-on-the-Maine; Merchant.
Thomas Ashton, *Reporter*, Hyde, near Manchester; Cotton Spinner.
C. Buschek, Austria; Vice-President of the Austrian Committee.
Col. R. E. Coxe, United States; Planter.
W. Gray, Mayor of Bolton, Wheatfield, Bolton; Cotton Spinner.
George Jackson, Corporation Road, Carlisle; Cotton Spinner.
Paul Kirchhofer, Switzerland.
Aug. Mimerel, France; President of General Council of Manufactures.
J. Aspinal Turner, Manchester; Cotton Spinner.

Associates.

Thomas Coath, 7 Bread Street, Cheapside; Linen and Manchester Merchant.
Robert Johnson, 95 Watling Street, City; Warehouseman.
John Pittman, 11 Bow Lane, Cheapside; Merchant.

Cotton Yarn.

The Jury appointed to examine cotton yarn and plain and coloured woven cotton cloths, have to report on yarn, that the specimens from England, Scotland, Switzerland, the Zollverein, France, and Austria, which they have considered it necessary to notice, are those manufactured by machinery. In the numbers of usual production and use (say from 6s. to 250s.), they have found it impossible to do more than report upon the general character of the specimens from the various countries, any superiority appearing to arise, not from greater skill in working, or superior mechanical appliances, but from the character of the cotton used.

Cheapness is the only other quality for which they could have made special mention; but they have found it impossible to arrive at any satisfactory results on this point, and have hence deemed it advisable to award no medals.

The yarns exhibited from England and Scotland are chiefly of second qualities, suitable for use in the trade, which supplies clothing to so large a portion of the working population of all parts of the world.

Swiss yarns, exhibited by eleven different spinners, are of very beautiful quality, and are adapted to the production of those cloths in which softness of texture and beauty of dye are required; great attention has been successfully paid to the selection and preparation of the cotton.

The specimens from France possess similar qualities, whilst those of the Zollverein are of various kinds; but are not in sufficient quantity to illustrate fully, the trade of the countries in that union.

In fine yarns, Messrs. T. Houldsworth and Co., of Manchester (p. 482); Messrs. Gardner and Bazley, of Manchester (p. 279); and M. Mallet, of the firm of Vantroyen and Mallet, of Lille, in France (p. 1213), have each exhibited yarn of No. 600s.; in the first and last instances made into net and muslin, and in the second instance made into 9-cord sewing thread, believed to be the finest ever yet produced. Messrs. T. Houldsworth and Co. also exhibit small specimens of various degrees of fineness to 2150s., and Messrs. Gardner and Bazley to 2070s.; but it does not appear that they are produced in sufficient quantity to be of any utility.

Various specimens of yarns of hand-production are exhibited from India—(curious on account of the shortness of the fibre of the cotton, and the fineness of the yarn produced), from Malta, and from Turkey. All these yarns have that peculiar excellence of softness and pliability never yet attained by machinery, but are very uneven and irregular in thickness.

Dyed Yarns.

In dyed yarns, with the exception of the Turkey red shown by Leumann Brothers, Mattwiel, Switzerland, (p. 1274), the specimens exhibited by Great Britain, the Zollverein, Switzerland, Belgium, and Austria, do not merit especial mention; good Turkey red and other fancy colours being produced in each country.

Thread, &c.

In thread there are few specimens exhibited from foreign countries.

Calicos, &c.

In plain calicos the specimens of English manufacture show how successful the efforts to produce good articles of general utility have been. The colour and finish of the bleached goods are very superior.

It is, however, unfortunate that the manufacture, which forms a very large portion of both our export and home trade, should have been so imperfectly represented, that many of its most important varieties are entirely wanting in the Exhibition.

From the United States there is a good selection of drillings, grey sheetings, and jeans of excellent quality; and from Belgium and France a few specimens only of plain grey and white calicos, made, however, of cotton unusually fine for the purpose.

Specimens of white calico, prepared according to the patent of Mercer (p. 556), of Accrington, Lancashire, are exhibited, possessing the increased thickness resulting from this process; but as this invention is more important in dyed or printed goods, the Jury connected with that Class will report fully upon it. This Jury would, however, add, that, as far as the specimens enable them to judge, it promises to be a most valuable discovery when applied to bleached cotton cloth.

The Jury regret that no specimens of cords and beaverteens were exhibited, or of the very important article of grey velvets or velveteens.

Muslins, &c.

Very good specimens of muslins (tarlatan, book, mull, lawn, &c.) are exhibited from Glasgow, Switzerland, and France, and of jacconot and cambric muslin from Manchester and Saxony. The British goods are suitable for the Indian and American, as well as the home markets. The plain muslins exhibited by native merchants of Dacca have great merit, especially when the rude mode of production is considered; but their cost is relatively high, and the finish universally defective; the yarn too is uneven, and frequently overtwisted.

In figured harness muslins, Scotland, Saxony, Switzerland, and France, exhibit articles of considerable beauty and utility, at comparatively low cost.

Coloured Woven Cottons.

In ginghams, the large exhibition from Glasgow, Carlisle, France, Switzerland, the Zollverein, and Belgium, shows that the manufacture of these useful articles has received great attention, and attained great perfection in all those countries.

An interesting collection of woven checked goods is exhibited from India and the Archipelago, many of them being the originals from which the European manufactures (now much superior) have been copied.

In the class of goods submitted to their inspection, although many of them are of very great excellence, and evince the application of great skill, taste, and industry in their production, the Jury have found nothing possessing the pre-eminent merit which would induce them to recommend the award of a Council Medal. In the performance of their duties they have endeavoured to avoid making any invidious distinctions, or using any expressions which might tend to injure the interests or the feelings of the exhibitors.

The Jury award Prize Medals to the following Exhibitors:—

Amoskeag Manufacturing Company, New Hampshire, United States (2, United States, p. 1433), for a very good assortment of drillings, tickings, sheetings, and cotton flannel.

Anderegg, Tobie, Wattwyl, Switzerland (111, Switzerland, p. 1293), for cambric muslin made of unusually fine yarn.

Anderson, D. and J., Glasgow (16, Class XI., p. 481), for a good general assortment of ginghams.

Brook, Jonas, and Brothers, Huddersfield (24, Class XI., p. 481), for their 2 to 9-cord thread, for its superior smoothness, strength, and freedom from fibre.

Christy and Sons, Fairfield, near Manchester (44, Class XI., p. 481-82), for their improved manufacture of the Turkish bath towel.

Daudville, Alphonse, St. Quentin, France (156, France, p. 1178), for excellence of manufacture in harness window curtains and in harness piece muslins.

De Bast, Camille, Ghent, Belgium (189, Belgium, p. 1157), for beautiful grey calicos made of very fine cotton.

Dubar, Delespaul, Roubaix, France (148, France, p. 1178), for cotton trouserings of excellent taste and quality.

Duranton, J. B., Paris (494, France, p. 1201), for shirt fronts, produced by the loom in imitation of needlework.

Fehr, J. C., St. Gall, Switzerland (122, Switzerland, p. 1274), for coloured Jacquard muslins.

Ferouelle and Rolland, Paris (200, France, p. 1183), for novelty of design and beauty of manufacture in coloured figured muslins.

Finlayson, F., and Co., Glasgow (8, Class XI., p. 480), for beauty of design and superiority of execution in fast-coloured sprigged lappets.

Gardner and Bazley, Manchester (53, Class, XI., p. 482), for fine yarns.

Hartmann and Son, Munster, France (256, France, p. 1189), for brillantés, or figured cottons, of excellent make and assortment.

Horrockses, Miller, and Co., Preston (60, Class XI., p. 482), for the superior make and bleach of their shirtings and long cloths.

Houldsworth, T., and Co., Manchester (54, Class XI., p. 482), for fine yarns.

Johnson, Jabez, Manchester (48, Class XI., p. 482), for coloured quiltings and toilet covers, of excellent manufacture.

Jourdain, X., Altkirch, France (1631, France, p. 1255), for muslin made by power of 190s. warp and 250s. weft.

Lamberts, A. Christ., Son, Gladbach (604, Prussia, p. 1084), for cotton kalmucks and beavers, as an improved manufacture of general utility.

Lang, J., Vienna (185, Austria, p. 1017), for ginghams, the quality and design of which are suited to French and German taste.

Leumann, Brothers, Mattwiel, in Switzerland (130, Switzerland, p. 1274), for specimens of Turkey red, of great brilliancy and force of colour. The award is made irrespective of the cost of this yarn.

Lisbon Weaving Company, Portugal (707 to 712, Portugal, p. 1315), for specimens of blankets and shawls of cotton, a manufacture apparently peculiar to that country.

M'Bride and Co., Glasgow (6, Class XI., p. 480), for cotton diaper for table cloths and towelling woven by power.

Mair, J., Son, and Co., Glasgow (59, Class XI., p. 482), for beauty of design and execution in window-curtains, produced at a reduced cost by a new arrangement of the Jacquard loom.

Major and Gill, Manchester (49, Class XI., p. 482), for double contils and nankeens for corsets produced in the loom.

Mallet, —, of the firm of Vantroyen and Mallet, Lille, France (715, France, p. 1213), for fine yarns.

Martin, W. and Son, Bolton (37, Class XI., p. 481), for very superior furniture dimities.

Myerscough, Steele, and Co., Bolton (39, Class XI., p. 481), for excellence of design and workmanship in toilet quilts and bed covers.

Naef, Matthias, Niederuzwyl, Switzerland (131, Switzerland, p. 1274), for the brightness of colour and good assortment of levantines.

Nef, J. J., Herisau, Switzerland (198, Switzerland, p. 1279), for white spotted muslins.

Ourscamp, the Company of, (Peigné Delacourt, Manager), France (379, France, p. 1195), for bleached madapollams, of excellent quality and superior roundness of thread.

Owtram, R., and Co., London (62, Class XI., p. 483), for figured and checked cambrics of very superior manufacture.

Pansa and Hauschild, Chemnitz, Saxony (42, Saxony, p. 1106), for 4-thread knittings and good general assortment of other numbers of knitting cottons.

Patterson, Jamieson, and Co., Glasgow (11, Class XI., p. 480), for imitation of Madras handkerchiefs of fast colours.

Ransauer Aebly, Herisan, Switzerland, for very perfect specimens of tarlatan and book muslin.

Raschle and Co., Wattwyl, Switzerland (168, Switzerland, p. 1277), for imitation Madras handkerchiefs, of fast colours; those with blue grounds being especially good.

Symington, H. H. and Co., Glasgow (14, Class XI., p. 480), for beauty and appropriateness of design and excellence of manufacture of harness window curtains.

Tanner and Koller, Herisau, Switzerland (206, Switzerland, p. 1279), for scarf, shawl, and dresses with flounces, produced by an improved adaptation of machinery, and for beauty of design. Medal awarded in Class XIX.

Thümer and Töpffer, Chemnitz, Saxony (90, Saxony, p. 1109), for two coloured cotton table-cloths, of good design.

Tolson and Sons, Huddersfield (116, Classes XII. and XV., p. 490), for vestings of great beauty of design and superiority of manufacture. Medal awarded in Class XII.

Vogel and Carner, Gera, Saxony (711, Zollverein, p. 1089), for the cheapness and good quality of their levantines.

Weigle, J. J., Ludwigsburg (29, Wurtemburg, p. 1115), for very useful and good waistcoatings relatively to their cost.

Willimentic Duck Manufacturing Company, Connecticut, United States (352, United States, p. 1457), for a specimen of cotton sail-cloth of very superior strength and evenness.

The Jury make Honourable Mention of:—

Clarke, J. P., Leicester (32, Class XI., p. 481), for the great taste and ingenuity shown in winding and making up the specimens exhibited by him.

And also of the following manufacturers for very good assortments of ginghams and striped and checked goods. These are all useful, being suited to various markets, and all valuable as cheap productions; and the Jury have found little difference in their relative merits:—

Baenziger and Co., Ebnat (112, Switzerland, p. 1273-74).

Breitenstein and Co., Zofingen (117, Switzerland, p. 1274).

De Cuyper, J. F., St. Nicholas (192, Belgium, p. 1157).

Dixon, Peter, and Sons, Carlisle (19, Class XI., p. 481).

Jansen and Lühdorf (56, Bavaria, p. 1100).

Lienhardt, F., Hof, Bavaria (43, Class XI., p. 1100).

Lowthian and Parker, Carlisle (22, Class XI., p. 481).

M'Gibbon, Edward, Carlisle (20, Class XI., p. 481).

Pearson and Co., Carlisle (21, Class XI., p. 481).

THOMAS ASHTON, Reporter.

June 1851.

CLASS XII.

REPORT ON WOOLLEN AND WORSTED MANUFACTURES.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

DR. VON HERRMANN, *Chairman*, Munich; Privy Councillor in Finance Department.
HENRY FORBES, J. P., *Deputy-Chairman*, Bradford; Merchant.
SAMUEL ADDINGTON, *Reporter*, 105 St. Martin's Lane; Woollen Merchant.
HENRY BRETT, Wood Street, Cheapside; Woollen Merchant.
C. C. CARL,* Zollverein; Manufacturer.
JOHN COOPER, J. P., Leeds; Woollen Merchant and Manufacturer.
GEORGE LAWTON, Mecklehurst, near Ashton-under-Lyne; Flannel Manufacturer.
THOMAS MARLING, Stroud; Retired Manufacturer.
J. RANDOING, France; Member of Central Jury, &c.; Member of the Legislative Assembly of France.
LAON SAMOILOFF, Russia; President of the Council of Manufactures at Moscow.
P. SCHÖLLER,† Austria.
ARM. SIMONIS, Belgium; Merchant; President of the Chamber of Commerce, Verviers.

Associates.

JOHN BARNES, Leeds; Salesman.
JOSEPH BATESON, Leeds; Merchant.
THOMAS DEWHIRST, Bradford; Worsted Spinner.
BENJAMIN HARRISON, Bradford; Worsted Manufacturer.
HENRY JENNINS, Leeds; Merchant.
HENRY KELSALL, Rochdale; Flannel Manufacturer.
DARNTON LUPTON, Leeds; Woollen Merchant.
EMILIUS PRELLER, Bradford; Merchant.
GEORGE TETLEY, Bradford; Merchant.

* F. LUCIUS, Proxy for M. CARL.
† C. OFFERMANN, Proxy for M. SCHÖLLER.

THE Jury appointed to decide on the merits of the various examples of Woollen and Worsted Fabrics, found it requisite to divide their duties, and to constitute four Sub-Juries for the consideration of the several subjects demanding their attention; the Report will therefore be found to present four general heads, viz., Woollen Cloths; Flannels and Blankets; Worsted and Mixed Fabrics; and Yarns.

In the course of their labours, the Jury were compelled to call in much additional assistance, and they have to acknowledge the valuable aid afforded them by the several Associate Jurors in simplifying duties of no ordinary character, since the great mass of articles coming under their cognizance rendered those duties as onerous as the responsibility was serious, owing to the great similarity and equality of merit displayed in almost every department.

In presenting their awards without recommending one Council Medal, the Jury consider it only due to the important branches of industry represented in Class XII., to state their conviction that in no point can they consider them as unworthy of the highest recognition which the Jury had the power to give or recommend; but feeling, from the great amount of merit displayed, that the recommendation of a Council Medal "for excellence of manufacture, beauty of design, or progress" in any one instance, would have involved the same recommendation in so many others, as utterly to destroy the value of that reward, besides creating those invidious distinctions which the recognition of various degrees of the same kind of merit must suggest, the Jury determined to equalize such acknowledgments of excellence by awarding the Prize Medal only; leaving to the public, as the best arbitrators, the decisions on question of relative degrees.

WOOLLEN CLOTHS.

Before proceeding to report upon the articles contributed by the several Exhibitors, the Jury consider it desirable to give some short account of certain differences of manufacturing treatment between our home productions and those of the Continent.

In ENGLAND a new era for this trade may be said to have commenced, in the year 1824, by the introduction of what is called the *roll-boiling process*, which produces a permanent lustre on the face of the cloth, that neither spots by rain, nor is removed by damp. This process was introduced by Messrs. Daniell and Wilkins, of Twerton, near Bath, who took out a patent for it in the above year. The permanent face is imparted by rolling the cloth, before being racked or tentered, round a cylinder, not very tightly, and putting it in scalding water for two or three hours, then taking it out and letting it cool: this has to be done several times during the process of dressing. About the same period great improvements were made in the milling and weaving departments, which enabled the cloth to bear this severe test. Other manufacturers had to pay a premium to the above-named firm for three years, when the patent was disputed, and ultimately lost through the evidence of a Yorkshire manufacturer, who proved that he had used it several years before; but, owing to his connection being very limited, it did not answer his purpose to continue it. However, the credit must remain to Messrs. Daniell and Co. for the perfection and general introduction of a plan which has since been universally acted upon.

Up to this time the general plan had been to dye blacks in the piece, of a common dye; but this new method was found to interfere with that of dyeing, from its being found difficult to make the dye penetrate through the improved fabric; this led to the gradual introduction of dyeing in the wool of a permanent kind,—a process which, in its execution, requires considerable skill and experience, but which is now so perfected as to leave little or nothing to be desired. While speaking of the improvement in woollen manufacture, it is but justice to mention the introduction, by Messrs. Daniell and Wilkins, of a new method of weaving stout beaver cloth for winter wear, called the "patent double cloth," which was patented by them in 1838, the material possessing considerable merit for its soft pliable character, united with great durability, causing it to entirely supersede the old *milled cloth*, which was hard and uncomfortable. By this mode of weaving a coarse and warm material is obtained on one side, and on the other the very finest cloth; an important consideration in olden times, when railway travelling was unknown, and the requirement more felt.

This kind of cloth has a good sale, and is much sought after by foreigners, who require the stouter kind of fabrics.

The continental methods of producing a permanent face are totally different, much shorter in their processes than our's, and performed at a much cheaper rate. Their methods are,—the one by rolling the cloth tightly round a hollow perforated cylinder, into which the steam is introduced to produce the desired effect; the other, and more general one, by folding the cloth and putting it under very powerful pressure, then allowing steam to penetrate the whole bulk. Both these methods cause a hardness, which is observable in all the continental productions, and would be more so if applied to stouter fabrics. There are also to be seen, on cloths that have been so treated, marks of the folds, which cannot be effaced by any ordinary means. Several houses in Leeds have tried this plan, but found that the fold-mark and hardness of the fabrics formed obstacles to their sale in the home market, though not for exportation; consequently it has been adopted to meet the competition abroad.

Considerable attention has been given to the dyeing of cloth in the different countries; especially the finer fabrics, which are all equally well and permanently dyed. In the middle qualities some are permanently dyed and others not; this is the case in all countries, and in the lower qualities (with some few exceptions) they are all of a common dye. This is a circumstance easily accounted for by the cost of the permanent dye being considerably more, and from its detracting slightly from the appearance and feel of the fabric; facts which must be admitted are great impediments in these competitive times, although there can be no doubt that real and ultimate economy must remain with a permanently dyed article.

We shall now proceed to enumerate the different seats of manufactures from which this department of the Exhibition has been supplied.

The woollen manufactures of the West Riding of Yorkshire, and those of the West of England, were established in the reign of Edward the Third, in the year 1336; and from that period to the present time, the principal woollen trade of Great Britain has been located in these two important districts.

Leeds is the most important town in England for the extent and variety of its manufactures in wool, and exhibits here a fair specimen of its productions; but its principal trade is in the middle and lower qualities, of which a large amount are exported.

The borough of Leeds, which, according to the census of the present year, contains a population of 171,805 inhabitants, and the populous small towns and villages around it, are occupied, to a large extent, in the manufacture of woollens. This district has contributed to the Exhibition an extensive assortment of woollen cloths in fine, middle, and low qualities, cloakings, beavers, mohairs, cashmerettes, tweeds, and pilots, which, for appearance and cheapness, maintain the high position for which it has been so long in repute. Lately the manufacture of doeskins and cassemieres has been partially and successfully introduced, and some good specimens of these goods have been exhibited. The merchants and manufacturers engaged in the woollen trade of this important district supply, very extensively, the home, foreign, and colonial markets; and adapt the fabrics manufactured to the peculiar taste of each.

Much attention has, of late, been devoted to perfecting the woollen manufacture in all its branches. It is probable that the opportunity afforded to our local manufacturers of seeing the various productions of other nations in the Great Exhibition, will materially assist in effecting this object.

Huddersfield, with its neighbourhood, is the second place in importance for the quantity and great variety of woollen cloths which it produces. Here, an immense portion of the fancy trouserings are made, besides broadcloths; but the productions of this town are principally for home consumption, and of the middle and lower qualities. This town, in 1820, made goods from home-grown wool only, but since that period it has gradually risen into great importance. The manufacturers of this neighbourhood exhibit a great variety of fabrics which fairly represent their products; among these may be noticed a number of double-faced cloths, presenting a different colour on each side, which have attracted considerable attention; but this idea is evidently taken from Daniell and Co.'s patent; and although interesting, these double-sided cloths of different colours appear to be more ornamental than generally useful as an article for clothing.

West of England.—Stroud, or Stroudwater, Gloucestershire, is so called for the purity of its waters, which have been in repute for dyeing scarlets and light dyes for centuries. This town and neighbourhood, with Ebley Eastington, Stonehouse, and Minchinhampton, are the great seats of manufacture in the West, principally for fine broad-cloths. They exhibit a great variety, in colours of the finest character and permanent dye, but few in regard to quality, arising principally from their not precisely comprehending the exact object of the Exhibition, which they imagined to be for the display of goods of a pre-eminent character, rather than for variety of production.

Trowbridge, Wiltshire, is the next town and neighbourhood of importance in the West, exhibiting principally narrow or trouser goods of the finest quality and permanent dye.

Chippenham, Melksham, and Bradford, Wilts, also exhibit a variety of very choice and fine permanent dye, in black and coloured cloths.

Frome, Somersetshire, and Twerton, near Bath, exhibit likewise some beautiful specimens of cloths, beaver, and Venetians.

Scotland.—Galashiels, Aberdeen, Selkirk, Hawick, and other places exhibit a great variety of fabrics in trouser goods, of a beautiful soft character and permanent dye.

Ireland.—Mr. J. Reid, of Dublin, exhibits a good variety of frieses, and ¾-tweeds of considerable merit, particularly deserving of encouragement, as a fair specimen of the products of that country.

France.—The principal seats of this manufacture in France are Sédan and Elbœuf:—Sédan, of blacks, broads, and narrows. Sédan exhibits a choice and beautiful thin fabric in these articles, all dyed in the piece, but beautiful of their kind. Elbœuf shows a great and beautiful variety of fancy doeskins and cloakings of great taste. Abbeville, Lacviers, and Vire, also contribute a number of woollen articles of considerable merit.

Belgium.—Verviers and its neighbourhood are the principal seat of manufactures for woollens in this country. The value of manufactured goods is about one million sterling per annum (population 24,000), the markets for which are the interior of the country, Holland, Switzerland, Italy, and America. The manufacturers of this country exhibit a small quantity, but a nice assortment of very choice piece-dyed blacks and satin cloths of a thin fabric.

Zollverein.—The Zollverein, including Saxony, exhibit an immense quantity of woollen goods, from a great number of places and manufactories, chiefly of the middle and lower qualities, though several are of a fine character, all very well manufactured and of considerable merit. The chief market for these goods is America.

Austria.—Brunn is the chief seat of manufacture in this country. The products exhibited are without any face, or are of what we should call the "old make;" but this appears to be the fashion in Vienna: in other respects they are of a good character. Reichenberg, in Bohemia, also exhibits a variety of middle and lower qualities of considerable merit, dressed after the German plan.

Russia exhibits a small quantity of woollen fabrics of good character, prepared after the German plan; and being of a stout make, they exemplify what the Jury previously stated of the hardness produced by that method.

Spain has sent a small variety of woollens; some of these made of wool from their own sheep, others from the fleece of German sheep, which is much superior—a singular fact, as the Germans formerly imported their sheep from Spain.

America exhibits a small quantity of woollen goods of moderate pretensions.

Switzerland sends a small and indifferent lot of woollen productions.

Turkey forwards a small assortment, tolerably good for a first attempt.

Holland contributes a few coarse woollens.

Portugal exhibits a pretty good variety, but of very primitive character.

Canada shows but few woollen goods.

South Australia.—From Sydney are exhibited three pieces of ¾-tweeds, manufactured by J. Walker, which deserve great praise, as coming from a young colony, and certainly show that with a few such men, aided by capital and machinery, the colonies might soon be made to produce many of their absolute necessaries of this description.

Three exhibitors and manufacturers of woollen cloths are members of this Jury, and are therefore not strictly within their cognizance, or eligible for any award. The Jury, however, desire to record their opinion of the goods exhibited by them. These exhibitors are:—

Cooper, D. and J., of Leeds. (42, Classes XII. and XV., p. 486.)

Randoing, J., Abbeville, France. (No. 973, France, p. 1226.) The principal of one of the oldest establishments for the manufacture of woollen cloths in that country.

Simonis, E., Belgium (464, Belgium, p. 1166),—who presents a particularly beautiful assortment of piece-dyed blacks for exportation, of permanent dye and finish.

Each of these gentlemen would have been entitled to a Prize Medal for the excellence of his productions, had he not been a member of the Jury.

The Jury have carefully examined all the woollen goods in the Exhibition—a task which has been much prolonged by the non-attendance, in due time, of any Juror from the Zollverein, Russia, or Austria, to explain or give information as to prices. This was a source of great difficulty; but after a long and patient investigation, the Jury have come to the resolution to award Prize Medals to the following manufacturers and exhibitors:—

Aksenoff, J., Klintz, Government of Tshernigoff. (182, Russia, p. 1372.) For excellence of manufacture and finish.

Apperley, J. and D., Stroud, for the fine specimens of black cloth exhibited by Messrs. Bull and Wilson, St. Martin's Lane (12, Classes XII. and XV., p. 486). The Jury conceive that the merit of the production is due to the manufacturer, and not to the exhibitor, and therefore award the Medal to Messrs. J. and D. Apperley, whose name appears on the cloth.

Armitage Brothers, Manufacturers, Huddersfield. (103, Classes XII. and XV., p. 489.) For excellence of manufacture, combined with economy.

Astorian Company, Huddersfield. (276, Classes XII. and XV., p. 490. Exhibited through Lewis and Allenby.) For a variety of articles made of fur from the common hare.

Bacot, Paul, & Sons, Sédan. (1062, France, p. 1229.) For excellence of manufacture in fancy black and satin doeskins, and fine piece-dyed black cloths of a thin make, of permanent dye and finish.

Barnicot and Hirst, Manufacturers, Huddersfield. (105, Classes XII. and XV., p. 489.) For great excellence of manufacture.

Beardsell, Isaac, and Co., Manufacturers, Thongsbridge, near Huddersfield. (109, Classes XII. and XV., pp. 489, 490.) For excellence of manufacture, with great beauty of design.

Beardsell, C., and Co., Manufacturers, Holmebridge. (120, Classes XII. and XV., p. 490.) For beauty of manufacture, with great taste.

Bennett, J. and A., Bradley Mills, near Huddersfield. (95, Classes XII. and XV., p. 489.) For ingenuity in the application of new materials.

Bernhard, W., Leisnig. (121, Saxony, p. 1110.) For general excellence of manufacture.

Berteche, Chesnon, and Co., Sédan. (1082, France, p. 1230.) For excellence of manufacture and beauty of design in fancy doeskins.

Biolley, F., and Son, Verviers. (195, Belgium, p. 1157.) For superior manufacture in piece-dyed blacks of a thin fabric for exportation, of permanent dye and finish.

Braun Brothers, Hersfeld, Hesse. (491, Prussia, p. 1079.) For excellence of manufacture.

Brooke, John, and Sons, Manufacturers, Honley, near Huddersfield. (86, Classes XII. and XV., p. 489.) For general excellence of manufacture, finish, and dye.

Brown, J. and H., and Co., Manufacturers, Selkirk, Scotland. (469, Classes XII. and XV., p. 501.) For general excellence of manufacture.

Carr, T. and W., Manufacturers, Twerton, near Bath, Somersetshire. (273, Class XII. and XV., p. 499.) For excellence of manufacture in fine cloths of permanent dye and finish, with beavers of a superior quality and considerable novelty of production.

Chenneviere, Theodore, Elbœuf. (1559, France, p. 1251.) For extraordinary merit of manufacture and novelties of design, in great variety.

Clark, J. and T., Manufacturers, Trowbridge, Wiltshire. (13, Classes XII. and XV., p. 486.) For excellence in manufacture, permanency of dye, and finish, in a variety of articles.

Crombie, James, and Co., Manufacturers, Aberdeen. (228, Classes XII. and XV., p. 497.) For superior manufacture and beauty of design.

Davies, R. S., and Sons, Manufacturers, Stonehouse Mills, near Stroud. (214, Class XII. and XV., p. 496.) For excellence of manufacture in fine scarlets.

Dicksons and Laings, Manufacturers, Hawick and Glasgow. (234, Classes XII. and XV., p. 497.) For superior manufacture and extraordinarily fine qualities.

Dubois, G., and Co., Verviers. (196, Belgium, p. 209.) For general excellence of manufacture in trouser goods.

Eyres, William, and Sons, Leeds. (27, Classes XII. and XV., p. 487.) For excellence of manufacture, with economy.

Fielder, A. G., Upatovka, near Kalish. (351, Russia, p. 1383.) For excellence of manufacture and dye.

Fortin-Boutellier, Beauvais. (484, France, p. 1201.) For beautiful production of felt cloths for pianofortes.

Förster, Fr., Grueneberg, Silesia. (220, Prussia, p. 1060.) For excellent manufacture of Spanish stripes.

Geissler, C. S., Görlitz, Silesia. (100, Prussia, p. 1054.) For excellence of manufacture, and permanent dye and finish.

Gevers and Schmidt, Görlitz. (50, Prussia, p. 1050.) For excellence of manufacture, dye, and finish.

Gott and Sons, Manufacturers, Leeds. (47, Classes XII. and XV., pp. 487, 488.) For excellence of manufacture, in a great and beautiful variety of colours, for exportation.

Gray, Samuel, Manufacturer, Calverly, Leeds. (67, Classes XII. and XV., p. 488.) For general excellence of manufacture.

Grossman, C. G., Bischofswerda. (124, Saxony, p. 1110.) For excellence of manufacture, dye, and finish, for exportation.

Haas, L. F., and Sons, Burtscheid. (357, Prussia, p. 1071.) For general excellence of manufacture.

Haberland, G. A., Finsterwalde. (99, Prussia, p. 1054.) For general excellence of manufacture.

Hagues, Cooke, and Wormald, Dewsbury. (25, Classes XII. and XV., p. 487.) For excellent production of Spanish stripes.

Hargreave and Nusseys, Manufacturers, Farnley Low Mills. (28, Classes XII. and XV., p. 487.) For general excellence of manufacture, and great ingenuity in the application of new materials.

Helme, W., Manufacturer, New Mills, Stroud. (207, Classes XII. and XV., p. 496.) For very superior black doeskins, with a very great variety of cass and cashmeretts, in a variety of beautiful and delicate colours.

Hendrichs, Francis, Eupen, near Aix-la-Chapelle. (367, Prussia, p. 1071.) For excellence of manufacture and finish.

Henry, A. and S., and Co., Manufacturers, Leeds. (38, Classes XII. and XV., p. 487.) For excellence of manufacture, economy, and uniformity.

Herrmann, W., Leisnig. (139, Saxony, p. 1110.) For general excellence of manufacture.

Hooper, C., and Co., Manufacturers, Eastington Mills, near Stroud. (210, Classes XII. and XV., p. 496.) For superior merit in the manufacture of fine cloths of permanent dye and finish, and for great variety; also for a beautiful production of elastic cloths for gloving.

Inglis and Brown, Manufacturers, Galashiels. (191, Classes XII. and XV., p. 495.) For general excellence of manufacture and style.

Isaieff, P., of Klintzou, Government of Tshernigoff. (184, Russia, p. 1372.) For general excellence of manufacture.

Itzigsohn, Marcus, Neudamm. (97, Prussia, p. 1054.) For excellence of manufacture in low-priced productions, combined with strength.

Juhel-Desmares, J., Vire. (278, France, p. 1190.) For excellence of production, economy, and utility.

Kesselkaul, J. H., Aix-la-Chapelle. (371, Prussia, p. 1071.) For excellence of manufacture and finish.

Lenormand, A., Vire. (588, France, p. 1206.) For excellence of production, cheapness, and utility.

Lockwood and Keighley, Manufacturers, Huddersfield. (104, Classes XII. and XV., p. 489.) For excellence of manufacture in woollen cords and velveteens.

Lutze Brothers, Cottbus, Silesia. (103, Prussia, p. 1054.) For excellence of manufacture and of permanent dye and finish.

Marling, S. S., and Co., Manufacturers, Ebley Mills, Stroud. (209, Classes XII. and XV., p. 496.) For general excellence in manufacture and dye.

Meissner, F. T., Grossenhain. (129, Saxony, p. 1110.) For excellence of manufacture and finish, for exportation.

Offermann, F. W., Muntzou, Imgenbruch. (350, Prussia, p. 1070.) For excellence of manufacture in fancy trouser goods.

Palling, W., Manufacturer, Painswick. (213, Classes XII. and XV., p. 496.) For excellence of manufacture in billiard cloths and scarlet hunters' or milled cloths.

Parnuit, Dautresme, and Co., Elbœuf. (673, France, p. 1211.) For excellence of manufacture, design, and cheapness.

Pawson, Son, and Martin, Manufacturers, Leeds. (40, Classes XII. and XV., p. 487.) For general excellence of manufacture, and permanent dye and finish.

Peill and Co., Düren. (369, Prussia, p. 1071.) For general excellence of manufacture, dye, and finish.

Pocock and Rawlings, Chippenham, for a variety of very beautiful cloths—blacks, blues, and medleys—all of great merit of manufacture, permanence of dye, and finish, exhibited by Messrs. Barber, Howse, and Mead, St. Paul's Churchyard. (19, Classes XII. and XV., p. 487.) The Jury, in awarding the Medal to the manufacturer instead of the exhibitor, do so upon the principle above stated. In this case, however, there are additional circumstances to guide the Jury in their award, as Messrs. Pocock and Rawlings' application for space had been overlooked; and when an allotment was made to them it came too late, as the cloths made for the Exhibition had been sold to Messrs. Barber, Howse, and Mead, for whom Messrs. Pocock and Rawlings had expressly manufactured other cloths included in the award.

Reid, J., Dublin, for very fine specimens of frieze cloths and milled tweeds, exhibited by Mr. R. Allen, Sackville Street, Dublin. (259, Classes XII. and XV., p. 498.) The Jury award the Medal as an encouragement to this branch of manufacture in Ireland.

Roberts, W., and Co., Manufacturers, Galashiels. (480, Classes XII. and XV., p. 502.) For general excellence of manufacture and style.

Salter, Samuel, and Co., Manufacturers, Trowbridge, Wiltshire. (250, Classes XII. and XV., p. 498.) For excellence of manufacture, both as to quality and variety in fancy doeskins, and other trouser goods.

Schöll, A., Brunn. (226, Austria, p. 1017.) For excellence of manufacture of stout goods for overcoats and trousers.

Schöller, L., & Sons, Düren. (374, Prussia, p. 1071.) For excellence of manufacture in fine cloths, of permanent dye and finish.

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Schürmann and Schröder, Lennep. (496, Prussia, p. 1079.) For superiority of manufacture, dye, and finish.

Shaw, J. W. and H., Manufacturers, Victoria Mills, Huddersfield. (98, Classes XII. and XV., p. 489.) For excellence of manufacture and dye.

Siegmund, W., Reichenberg. (230, Austria, p. 1018.) For general excellence of manufacture.

Signoret-Rochas, P., Vienne. (1013, France, p. 1227.) For economy of production.

Snell, John, Leeds. (24, Classes XII. and XV., p. 487.) This gentleman is not a manufacturer, but a finisher of cloth, and the award is for the beauty of finish only.

Spengler, Karl, Crimmitzchau. (117, Saxony, p. 1110.) For general excellence of manufacture.

Stancomb, W. and J., juns., Manufacturers, Trowbridge, Wiltshire. (17, Classes XII. and XV., p. 487.) For excellence of manufacture in a great variety of trouser goods.

Sykes D., and Co., Finishers, Leeds. (75, Classes XII. and XV., p. 488.) For beauty of finish.

Sykes, J. and Son, Leeds. (34, Classes XII. and XV., p. 487.) For uniformity of make and general excellence of finish.

Tchetverikoff, —, near Moscow. (187, Russia, p. 1372.) For excellence of manufacture and finish.

Thornton, Firth, Ramsden, and Co, Leeds. (32, Classes XII. and XV., p. 487.) For general excellence of manufacture, finish, and great variety of character.

Tolson and Sons, Manufacturers, Dalton, Huddersfield. (116, Classes XII. and XV., p. 490.) For superiority of make and style in trouser goods.

Victoria Felt Cloth Company, Leeds. (327, Class XIX., p. 572.) For superior felt cloth for flooring or carpets. Medal awarded in Class XIX.

Walker, Joseph, and Sons, Lindley, Huddersfield. (87, Classes XII. and XV., p. 489.) For excellence of manufacture and finish in mohair cloths.

Walker, J., and Sons, Manufacturers, Millshaw Mills, Leeds. (79, Classes XII. and XV., p. 488.) For excellence of manufacture and economy.

Wilkinson, John, Inventor and Manufacturer, Leeds. (51, Classes XII. and XV., p. 488.) For felt cloths for ships' sheathing, and medical purposes, in great variety.

Wrigley, J. and T. C., and Co., Manufacturers, Huddersfield. (117, Classes XII. and XV., p. 490.) For general excellence of manufacture, and ingenuity in new application of materials.

York and Sheepshanks, Manufacturers, Dyers, and Finishers, Leeds. (49, Classes XII. and XV., p. 488.) For general excellence of manufacture.

The Jury desire to make Honourable Mention of the following Exhibitors:—

Ginzel, R. C., of Reichenberg. (210, Austria, p. 1018.) For woollen cloths.

Moro Brothers, of Klagenfurt. (218, Austria, p. 1018.) for the beauty of their colours.

Walker, J., of Sydney. (23, p. 487.) For three pieces of tweeds, of great merit for so young a colony.

Worsted Stuff Goods.

The term "Worsted Stuffs" is applied to fabrics made from combed wool, including those in which combed wool is combined with cotton and silk. These fabrics are thus distinguished from woollen cloths, in which the wool is not combed, but only carded, and which are subjected, also, to the process of "fulling." The wool used in the worsted trade is mainly of long staple; that used in the cloth trade is short. The worsted manufacture, although of very ancient date, has only attained its present eminence in England during the last quarter of a century. According to a generally-recognised tradition, the invention of the wool-comb is attributed to St. Blaise, and the day of his canonization, February 3, was, until very recently, kept in Bradford as the gala-day of the trade. The term "worsted" is said to have been derived from a village in Norfolk of that name, in which these goods were first produced in the reign of Edward III. by weavers brought from Flanders. The cruel persecutions of the Duke of Alva, in 1570, drove over a large number of Flemish refugees, to whom both the woollen and the worsted trades were much indebted. Many settled in Yorkshire, especially at Halifax, which was, for many years, the principal seat of the manufacture, and has always maintained its superiority in the production of damasks, lastings, and other heavy goods. The inventions of the spinning-jenny, the mule, the throstle, and other machinery, in the latter half of the last century, were gradually extended from the cotton to the worsted trade. The first spinning machinery erected in Bradford was in 1790, when a few frames were set up in a private house. At this time the wool, after being combed, was carried into the villages to a considerable distance around, and there spun by the hand-wheel; a primitive method, which was gradually superseded by the spinning-frame. The first factory in Bradford was built in 1795; but it was not until thirty years afterwards that the power-loom was introduced, and considerably later before its use became general. From the year 1825, the worsted manufacture has made most rapid and unprecedented progress. Up to that period, and for some years afterwards, all the goods were made from wool alone;[*] but about the year 1834, manufactures of worsted weft and cotton warp were first brought forward, and gave a great impetus to the trade. This was still further increased by the introduction, in 1836, of the wool of the alpaca, an animal of the *llama* tribe, inhabiting the mountain ranges of Peru. This wool is of various shades of black, white, grey, brown, &c., and is remarkable for brightness and lustre, great length of staple, and extreme softness. Considerable difficulties were at first experienced in the working of this material; but they were ultimately overcome, and the alpaca manufacture now ranks as a very important branch of the worsted trade. About the same time, or shortly afterwards, mohair, or goat's wool, from Asia Minor, was brought into general use in the West Riding of Yorkshire, and many beautiful fabrics were produced from it: silk, also, in combination with wool, alpaca, and mohair, has been largely used. Improved machinery has been devised; more rapid processes of manufacture adopted; and the results of all these improvements, and the introduction of these new materials have been—the opening of new branches of industry,—the quadrupling, within thirty years, the number of workpeople employed,—and the production of an immense variety of fabrics for the purposes of clothing and furniture.

The rapid progress of the trade may be illustrated by a reference to the town of Bradford, which is the centre of the manufacture, and the great market where its productions are disposed of. The population of the borough has increased in the following ratio, viz.,—

In 1801 it was – –	13,264
1811 ,, – – –	16,012
1821 ,, – – –	26,309
1831 ,, – – –	43,527
1841 ,, – – –	66,718
1851 ,, – – –	103,782

At the beginning of the present century there were only three mills in Bradford; there are, now, upwards of 160.

The following returns will show the extent of its present manufacturing operation: they comprise the parish of Bradford, and the village of Bingley:—

Number of spindles – – –	355,792	
Number of power-looms – –	17,294	
Moving power, steam – – –	3,884	(horse power)
Do. water – – –	134	do.
Children employed under 13 years of age:—Males – – – –	1,469	
Females – – –	1,729	
Males from 13 to 18 – – –	3,426	
Do. above 18 – – – –	5,951	
Females above 13 – – – –	21,280	
Total persons employed:—Male	10,846	
Female	23,009	
Total – – – –	33,855	

The following is a summary of the whole of the worsted factories in Great Britain and Ireland, nearly seven-eighths of which belong to the West Riding of Yorkshire.—See Table, p. 355.

The classification of worsted stuffs contained in the list drawn up for the Jurors has reference to the materials of which they are composed; viz.—

1. Fabrics composed entirely of wool.
2. Ditto of wool and cotton.
3. Ditto of wool and silk.
4. Ditto of wool, silk, and cotton.
5. Ditto of alpaca and mohair, mixed with cotton or silk.

The first of these divisions comprises the well-known fabrics called "merinos," double-twilled, so denominated from the Spanish wool of which they were first manufactured. In this article the French have always had an unquestionable superiority, and many of the specimens in the Exhibition fully maintain their reputation. There are some goods of this class, however, in the Bradford department, but little inferior to them. In single-twilled merinos, the worsted manufacturers of Yorkshire have, at all times, had the decided pre-eminence. Shalloons, says, serges, lastings, all stout and heavy articles, are manufactured chiefly at Halifax and at Keighley. Damasks for curtains and hangings are also made at Halifax; and this branch of the trade has arrived at great perfection, both in excellence of material and elegance of design. Of the fabrics composed of wool and cotton, the articles denominated Cobourg and Orleans cloth,—the former being twilled and the latter plain,—have been staple manufactures, of which the consumption has been immense: they are made chiefly at Bradford and Keighley. Many of the silk warp and worsted weft fabrics are distinguished by their richness and durability. The alpaca and mohair manufactures (carried on at Bradford and Bingley) are remarkable for their softness and brilliancy, and the great variety of purposes to which they are applicable. The importation of alpaca wool has increased from 7,000 bales in 1836, to 20,000 bales in 1850; and of mohair, from 5,621 bales in 1841, to 12,884 bales in 1850. It is in the production of articles in which wool of various kinds is combined with cotton and silk, that the superiority of the British manufacturer is most apparent; no such goods being produced on the Continent in any extent, or of any great excellence. This result could not have been attained had not the skill and enterprise of the manufacturer been aided by that of the worsted dyer. The chemical processes required, in order that a fabric composed of both vegetable and animal substances may be made to receive an equal and regular dye, are necessarily varied and intricate; but so successful have been the efforts of the dyers, that goods made of white cotton warp and worsted weft, can be dyed quite as perfect in colour, as French merinos composed of wool alone.

The consumption of these various manufactures is immense. The looms are capable of producing upwards of 80,000 pieces per week, averaging 30 yards each. These goods are not only sold in the United Kingdom, but are largely exported, as the following returns will show, to the United States of America; and to Germany and other parts of the continent of Europe.

Exports, during the six months from the 1st of January to 28th June, 1851:—

Woollen and worsted yarns, 5,567,854 lbs.
Woollens and cottons, mixed (value) £830,478.
Stuffs, woollen, and worsted do. £1,896,228.

All that is now wanting in the English worsted trade is, that the same enterprise should be exhibited, as heretofore, in the working-up of materials into new forms, combined with greater taste in the production of fancy goods.

The goods of this division, contained in the Exhibition, include a very large variety of fabrics used for ladies' and children's dresses, for furniture hangings, for coatings, and other purposes, made from wool, alpaca, and mohair, combed and spun, either alone or in combination with cotton, silk, &c. The Jury have carefully and minutely examined all the fabrics brought under their

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[*] We except of course bombazines and other articles manufactured in Norfolk, which come under the head of "Mixed Fabrics."

SUMMARY of the WORSTED FACTORIES in GREAT BRITAIN and IRELAND; showing also the Number of Persons employed therein.

—	Number of Factories.	Number of Spindles.	Number of Power Looms.	Amount of Moving Power.		Number of Children under 13 Years of Age.		Number of Males between 13 and 18 Years of Age.	Number of Females above 13 Years of Age.	Number of Males above 18 Years of Age.	Total Numbers Employed.		
				Steam.	Water.	Male.	Female.				Male.	Female.	Male & Fem.
Factories employed in Spinning—													
England and Wales - - -	222	417,473	-	4,060	812	2,310	2,657	2,889	10,896	3,905	9,104	13,552	22,656
Scotland - - - - - - -	6	9,404	-	121	88	1	2	66	390	287	354	392	746
Ireland - - - - - - -	2	1,552	-	-	36	-	-	12	51	13	25	51	76
	230	428,429	-	4,181	936	2,311	2,659	2,967	11,337	4,205	9,483	13,995	23,478
Factories employed in Weaving—													
England and Wales - - -	97	-	12,814	1,124	76	78	55	770	11,321	3,489	4,337	11,379	15,716
Scotland - - - - - - -	-	-	-	-	-	-	-	-	-	-	-	-	-
Ireland - - - - - - -	-	-	-	-	-	-	-	-	-	-	-	-	-
	97	-	12,814	1,124	76	78	55	770	11,324	3,489	4,337	11,379	15,716
Factories employed in Spinning and Weaving—													
England and Wales - - -	155	447,177	19,797	4,387	608	1,836	3,005	3,703	23,789	7,031	12,570	26,794	39,364
Scotland - - - - - - -	-	-	-	-	-	-	-	-	-	-	-	-	-
Ireland - - - - - - -	-	-	-	-	-	-	-	-	-	-	-	-	-
	155	447,177	19,797	4,387	608	1,836	3,005	3,703	23,789	7,031	12,570	26,794	39,364
Factories not included in either of the above descriptions—													
England and Wales - - -	19	234	6	198	5	12	-	255	452	460	727	452	1,179
Scotland - - - - - - -	-	-	-	-	-	-	-	-	-	-	-	-	-
Ireland - - - - - - -	-	-	-	-	-	-	-	-	-	-	-	-	-
	19	234	6	198	5	12	-	255	452	460	727	452	1,179
Total of Worsted Factories—													
England and Wales - - -	493	864,874	32,617	9,769	1,501	4,236	5,717	7,617	46,460	14,885	26,738	52,177	78,915
Scotland - - - - - - -	6	9,404	-	121	88	1	2	66	390	387	354	392	746
Ireland - - - - - - -	2	1,552	-	-	36	-	-	12	51	13	25	51	76
Total - - - - - -	501	875,830	32,617	9,890	1,625	4,237	5,719	7,695	46,901	15,185	27,117	52,620	79,737

notice, and award Prize Medals to the following Exhibitors:—

Akroyd, James, and Son, Manufacturers, Halifax. (130, Classes XII. and XV., p. 491.) The productions of this firm are eminently diversified and beautiful. The damasks are distinguished by elegance of design, richness of colour, and superiority of weaving. The "union damasks," composed of worsted and cotton, are noticeable also for economy of production. The satin Turc goods have a regularity, which shows that all possible care has been bestowed on their production. Some fabrics, entitled "Moirés d'Exposition," are remarkable for their novelty and the brilliancy of their effect. The articles made with silk warp and China grass are very beautiful. The patterns, colours, and combination of materials, are alike deserving of praise. The ponchos are well made and adapted for the markets of South America.

Biétry and Son, Manufacturers, 102, Rue Richelieu, Paris. (356, France, p. 1194.) For cashmere fabrics of great fineness and regularity.

Bottomley, Moses, and Son, Shelf, Bradford. (165, Classes XII. and XV., p. 493-4.) The goods shown by this firm are woven with great regularity, and the designs of the figured fabrics are good.

Bouchez-Pothier. (34, France, p. 1173.) For merinos of excellent manufacture.

Brown, W., Manufacturer, Halifax. (129, Classes XII. and XV., p. 490.) For damasks composed of combinations of wool, silk, and cotton. Great taste is displayed in the designs; and in brilliancy of effect, and perfection of manufacture, the goods approach very nearly to those exhibited by Messrs. Akroyd.

Bruhm and Nägler, Manufacturers, Gera. (816, Prussia, p. 1095.) For cloths made with worsted weft and silk warp, well woven and dyed.

Caillet-Franqueville, Marfeu. (82, France, p. 1175.) For merinos of excellent manufacture.

Dauphinot-Pérard, Manufacturer, Isles-sur-Suippes (Marne). (471, France, p. 1200.) For merinos of excellent manufacture.

David, Brothers and Co., Paris. (157, France.) For merinos, and cloths mixed with organzine and spun silk. The average of these fabrics is very good, the weaving satisfactory, and the colours and elegance of design very praiseworthy.

David-Labbé and Co., Sains, Richaumond. (138, France, p. 1178.) For the lowness of the prices at which their fabrics are produced.

Delattre and Son, Manufacturers, Roubaix (Nord). (142, France, p. 1178.) This firm is eminently distinguished by the excellence of its productions, and the specimens, now shown, fully justify the numerous distinctions which the French Government has, at several preceding Exhibitions, accorded to it. The Jury has noticed particularly a fabric, all wool, denominated "Chambard," of which the work is admirably perfect; the cloth named "Toile Victoria,"—equally beautiful; and the "satin de Chiné"—made of the finest materials and with unequalled accuracy of workmanship. These goods occupy a very eminent position amongst the French productions, and in the judgment of the Jury fully entitle the manufacturers to a Prize Medal.

Delfosse, Brothers, Manufacturers, Roubaix (Nord). (144, France, p. 1178.) For great merit in the articles they display. The "Chambard" is very admirably manufactured, and some of the "satins de Chiné" are remarkably fine in their texture.

Foster, John, and Son, Manufacturers, Black Dyke Mills, near Bradford. (143, Classes XII. and XV., p. 492.) The goods exhibited by this house are interesting, not only on account of their intrinsic excellence, but as displaying the great variety of fabrics produced in the worsted stuff trade. They comprise articles for ladies' dresses, coatings, vestings, linings and serges, umbrella and parasol cloths, and damasks for hangings. The display of alpaca and mohair manufactures is remarkably varied, and the weaving is even and regular. The combination of materials is very good; several designs of the fabrics brocaded by the Jacquard looms are elegant, and the effects well brought out. The coatings shown (of which large quantities are exported to the Continent and the United States of America) are distinguished by their stoutness, fineness, and general excellence.

Goutchkoff, E. and J., Manufacturers, Moscow. (189, Russia, p. 1373.) For cloths, "satins de Chiné," all wool, brocaded; fabrics of worsted and organzine silk warp, and cashmere-de-laines. These goods are distinguished by unsurpassed neatness of manufacture, excellence of design, and economy of production.

Grüner, F. W., Glauchau. (101, Saxony, p. 1109.) For merinos, all wool, of great regularity in weaving, and of excellent colours.

Haas, P. and Sons, Manufacturers, Vienna. (259, Austria, p. 1019.) Damasks for furniture, of excellent combinations. The styles are magnificent, and the shades beautiful; and altogether the goods are of unquestionable merit.

Holdsworth, John, and Co., Halifax. (166, Classes XII. and XV., p. 494.) For damasks and other furniture cloths, which are well made, and of good colours and considerable variety; some of the styles being very elegant.

Hooper, G., Carroz, and Tabourier, Manufacturers, Paris. (1625, France, p. 1255.) For a great variety of light goods of the Barège class, plain, checked, and brocaded, of excellent combinations. The cloth called "Bresilienne," though very difficult of execution, is admirably worked. Medal awarded in Class XIII.

Horsfall, J. G., and Co., Manufacturers, Bradford. (174, Classes XII. and XV., p. 494.) For fabrics made entirely of wool, and of wool combined with cotton and silk. The Jury have noted, as particularly deserving of commendation, the article denominated "Saxony cloth," for ladies' dresses. The weft is made from the finest Saxony wool, and the warp from the finest Australian wool, both combed by hand. The "Cobourgs," in cotton warp wefted with worsted, are admirable, and manifest a high degree of regularity, obtained by the excellence of the yarn employed and the talent of the weaver. The "Henrietta" cloths are made from spun silk warps and weft of the finest Saxony wool, and are distinguished by a softness, combined with firmness of texture, that has never been surpassed.

Hösel, R. and Co., Chemnitz. (86, Saxony, p. 1108.) For damasks of superior manufacture.

Jowett, Thomas, and Co., Manufacturers, Bingley, near Bradford, Yorkshire. (144, Classes XII. and XV., p. 492.) For a great variety of articles produced from alpaca weft, and silk and cotton warps, plain and figured. These goods are very well made, and show a good lustre. A new fabric of silk warp and linen weft is very neat, and affords encouragement for increased attempts in this direction.

Kay, Richardson, and Wroe, Manufacturers, Manchester. (186, Classes XII. and XV., p. 495.) For a very admirable range of Chiné goods produced from combinations of worsted, cotton, silk, and linen, with printed warps. These are distinguished by the excellence of the designs and the economy of their production.

Knuepfer and Steinhäuser, Manufacturers, Greiz. (528, Prussia, p. 1080.) For merinos and brocaded satins de Chiné.

Lohse, Edward, Manufacturer, Chemnitz. (85, Saxony, p. 1108.) For damask goods, made with worsted and cotton, and worsted and silk. Their designs are in good taste, the combination of colours and materials very creditable, and the weaving of superior regularity.

M'Crea, H. C. and Co., Manufacturers, Halifax. (135, Classes XII. and XV., p. 491.) For damasks of great excellence.

Mathieu, Robert. (France, 1443, p. 1245.) For merinos of superior manufacture.

Milligan, Walter, and Son, Manufacturers, Bingley, Yorkshire. (140, Classes XII. and XV., p. 492.) For a series of embroidered alpaca goods, produced by a process which they have patented; a style of manufacture noticeable for its elegance and novelty. The patterns are printed on white silk, and the greatest possible accuracy is necessary in the weaving, in order that the printing blocks may fit; this point has been very successfully accomplished. All the designs are neatly executed, and the whole of the goods shown by this firm are highly creditable to their ingenuity and industrial skill.

Mollet-Warmé Brothers, Manufacturers, Amiens. (648, France, p. 1109.) For goods composed of worsted, mixed with silk, largely used for foreign consumption. The designs are in excellent taste, and the fabrics of beautiful texture.

Morand and Co., Manufacturers, Gera. (731, Prussia, p. 1090.) For draps d'été, or summer cloths, twilled like merinos, very creditable in their manufacture.

Mourceau, —, Manufacturer, 27, Rue du Mail, Paris. (1668, France, p. 1256.) For a remarkable exhibition of stuffs for furniture hangings, screens, table-covers, &c. The goods manifest an eminent superiority in their manufacture; being stout, woven with great care, and peculiarly rich in their effect. The colours are beautiful, and perfectly shaded; and the designs indicate an artistic taste. This species of manufacture is adapted, mainly, for the saloons of the rich and the elegant.

Paturle-Lupin, Seydoux, Sieber, and Co., Manufacturers, Paris. (1381, France, p. 1242.) This firm has long been celebrated for the decided superiority of its manufactures; and the fabrics now displayed fully maintain its high position. The merinos are of various qualities and admirable manufacture, the finer goods being especially beautiful; and, for evenness, softness, and fineness, never surpassed. The draps d'été, or summer cloths, are made with great skill. The "mousselines-de-laine," composed entirely of wool, the Bareges and Chalés, of wool and silk, and the bombazines, are also of great excellence. The yarns of which all these fabrics are made are most carefully spun from the choicest wool; the cloths are woven in the most perfect manner possible, and, altogether, the members of the Jury cordially unite in awarding a Prize Medal to this firm.

Pease, H. and Co., Manufacturers, Darlington. (184, Classes XII. and XV., p. 495.) For Cobourg cloths, single and double twill worsted weft and cotton warp. The lower and middle qualities are much stouter than the majority of such goods, and are remarkably even and regular. The fine qualities are equally commendable.

Pesel and **Menuet**, Paris. (678, France, p. 1211.) For cashmere fabrics of great fineness and and regularity.

Petit-Clément, Manufacturer, Boult, Marne. (679, France, p. 1211.) For merinos of excellent manufacture.

Pin-Bayard, Manufacturer, Roubaix (Nord). (682, France, p. 1211.) For fabrics all wool, of great excellence. The texture of the satins de Chiné is magnificent, and the yarn employed in them is perfectly spun.

Rand, John, and **Sons**, Manufacturers, Bradford. (173, Classes XII. and XV., p. 494.) For a variety of articles made entirely of wool, and of wool combined with cotton and silk. The yarns employed are free from knots and irregularities, and the cloths produced are evidently woven with great care. The merinos made in the French style are without defects. The Cobourg cloths made from worsted weft and cotton warp are very excellent specimens of a fabric most extensively used for dresses; and the cloths made from worsted weft and silk warp are remarkably soft, fine, and even. The whole of these goods evidence the perfection which has been attained in this department of the worsted stuff manufacture.

Rogers, George, Manufacturer, Bradford. (142, Classes XII. and XV., p. 492.) For a series of Cobourg cloths, composed of worsted and cotton, of various qualities, which are praiseworthy for the regularity and evenness of their texture, and their economy of production.

Salt, Titus, Manufacturer, Bradford, Yorkshire. (139, Classes XII. and XV., p. 491-92.) For a complete series of alpaca and mohair manufactures—(a branch of business carried on almost exclusively in England),—which illustrate, very strikingly, the great capabilities of these materials. The articles are of much variety, including fabrics composed of alpaca with cotton warps, and with silk warps yarn-dyed, and dyed in the piece: they are plain, twilled, figured, and Chinés, or made with printed warps. There are, also, goods composed of mohair with similar combinations. All are characterised by peculiar lustre and brilliancy, equal in many cases to silk; they are also remarkable for regularity of texture, softness, and fineness. It may be confidently stated that similar goods have never before been produced; and the great increase in the consumption of articles of this description among all classes of the community, renders the display an interesting and important one. Mr. Salt was one of the first to introduce alpaca wool into the Bradford trade, and by his enterprise and skill has mainly contributed to the extent and perfection which this department of industry has attained. In addition to the articles already mentioned, Mr. Salt exhibits an assortment of moreens used for furniture hangings; one series being made from English wool, and the other from the Russian Donskoi fleece wool. Both are worthy of notice for the perfection of their manufacture; the latter, especially so, considering the difficulties in the way of successfully working up so coarse a material, which had never been combed prior to Mr. Salt having effected that object.

Schlumberger, Gaspard, and Co., Manufacturers, Mulhause (Haut-Rhin). (1000, France, p. 1227.) For damasks for furniture hangings, composed of worsted and silk, woven with great regularity, and displaying superior taste in the designs of the patterns and the combinations of the colours. The effects produced are brilliant in the highest degree.

Schwann, Kell, and Co., Proprietors, Bradford. (141, Classes XII. and XV., p. 492.) The goods shown by this firm are different from those of any other Exhibitor, and confirm the observations already made on the variety of the fabrics produced by the Bradford manufacturers. They include Italian cloths, serges, says, and lastings, all worsted, and worsted combined with cotton, silk, and linen, of admirable manufacture; embossed alpaca lustres, "Alepinos de la Reyna," velillos, &c. Some articles, called "Shanghae dresses," plain and watered, made from silk and China grass, are exceedingly beautiful. The whole of these goods are adapted for foreign markets. Messrs. Schwann, Kell, and Co., are merchants, and not manufacturers; but, as they have, at great expense and trouble, directed the preparation of the articles exhibited, as to texture, combination of materials, and dyeing, the Jury wish to mark their sense of the enterprise, taste, and public spirit shown by this firm.

Sugden, Jonas, and **Brothers**, Manufacturers, Dockroyd, near Keighley, Bradford. (167, Classes XII. and XV., p. 494.) For says, princettas, cubicas, shalloons, &c., made of English wool,—alone, and in combination with cotton. They are chiefly intended for foreign consumption, and they are of great regularity in the weaving, and highly creditable to the producers.

Tremel, A., and Co., Manufacturers, Bradford. (147, Classes XII. and XV., p. 493.) For goods made chiefly for foreign consumption, consisting of worsted, alpaca, and mohair manufactures, shot with cotton, silk, and linen. The fabrics of these Exhibitors are commendable for their variety, good texture, and economy of production.

Vogel, William, Manufacturer, Chemnitz. (89, Saxony, p. 1108.) For damasks of great merit in their styles, colours, and combination of materials.

Volner, —, Manufacturer, Moscow. (190, Russia, p. 1372.) For plain de laines and "Cashmere d'Ecosse," made entirely of wool, which are distinguished by great regularity of manufacture. The "satins de Chiné," are nearly perfect in their make, and the colours are decidedly good. Bearing in recollection that Russia is only starting in this species of manufacture, the results now exhibited are quite wonderful.

Weissflog, E. F., Manufacturer, Gera. (720, Prussia, p. 1090.) For merinos and brocaded "satins de Chiné." Very superior fabrics, and the patterns elegant and tasteful.

Winkler and **Son**, Manufacturer, Rochlitz. (91, Saxony, p. 1109.) For display of Chambard fabrics, merinos, &c., of good manufacture, and for their economy of production.

Ziegler and **Haussmann**, Manufacturers, Glauchau. (92, Saxony, p. 1109.) For merinos, all wool, remarkably well made; "satins de Chiné," plain and brocaded; and figured goods, made of a combination of worsted and silk. All these are of good texture and commendable designs.

The Jury make Honourable Mention of the undermentioned manufacturers:—

Bottomley, Wilkinson, and Co. (165, Classes XII. and XV., p. 493-4.) For satin-faced figured goods, made with worsted and cotton. These goods are exhibited by Mr. Jacob Beyrens, merchant.

Bouchart, Florin, Tourcoing (Nord). (1103, France, p. 1230.)

Clough, Robert, Keighley. (151, Classes XII. and XV., p. 493.) For his merinos made from English long wool.

Craven, J. and Son, Prospect Mill, Thornton. (149, Classes XII. and XV., p. 493.) For excellence of manufacture of Orleans cloth, composed of worsted and cotton.

Dalby, James, Bradford. (152, Classes XII. and XV., p. 493.) For figured fabrics, composed of worsted and alpaca, with cotton and silk warps.

Drummond, James, Bradford. (150, Classes XII. and XV., p. 493.) For figured fabrics, composed of worsted and alpaca, with cotton and silk warps.

Ecroyd, William, and Son, Lomeshaye, near Burnley. (130a, Classes XII. and XV., p. 491.) For fabrics, including Cobourgs and mousselines-de-laines, made of worsted and cotton; bunting cloths for naval flags and signals, &c., made with great care. (Medal awarded in this Class for carded and Genappe yarns.)

Green, R. F., and Sons, Manufacturers, Leeds. (65, Classes XII. and XV., p. 488.) For Orleans cloths of excellent manufacture.

Guilbert and Wateau, Manufacturers, Paris. (860, France, p. 1221.) Their fabrics being of such a character as to merit commendation.

Harris and Fison, Bradford. (145, Classes XII. and XV., p. 492.) For a new and perfectly original fabric, made with weft spun from the down or fur of the Angola rabbit. It is exceedingly soft, and much resembles cashmere. As an experiment to introduce a new material, it is very interesting and worthy of encouragement.

Hoadley and Pridie, Damask Manufacturers, Halifax. (128, Classes XII. and XV., p. 490.)

Kershaw, S. and H., Laisterdyke, near Bradford. (161, Classes XII. and XV., p. 493.) For excellence of manufacture of Orleans cloth, composed of worsted and cotton.

Milner, John, and Co., Clayton, near Bradford. (168, Classes XII. and XV., p. 494.) For excellence of manufacture of Orleans cloth, composed of worsted and cotton.

Scheppers, F., Loth, Brabant. (497, Belgium, p. 1166.) For a great variety of woollen stuffs, &c., which evince considerable merit.

Shepard and Perfect, Damask Manufacturers, Halifax. (131, Classes XII. and XV., p. 491.)

Taylor, J., and Sons, Damask Manufacturers, Halifax. (88, Classes XII. and XV., p. 489.)

Ward, J. W., Damask Manufacturer, Halifax. (134, Classes XII. and XV., p. 491.)

Wilson, J., Ovenden, near Halifax, Manufacturer. (138, Classes XII. and XV., p. 491.) For ponchos of regular make, well adapted to the markets for which they are intended.

An article of a novel and unique character, contributed by Russia, deserves especial notice. It is made from camels' hair, spun by hand, and is produced by the Bashkirs, a wandering tribe on the banks of the Caspian Sea. The yarn is of astonishing regularity, and the texture remarkably good. The dresses made of it, the Jury are informed, are intended for Her Majesty the Queen of England.

His Royal Highness Prince Albert exhibits in Class XII. (p. 495) cashmere brocade fabrics, manufactured by Thomas Gregory and Brothers, of Shelf, near Halifax. These goods are composed of silk warp, and weft of wool shorn from the Cashmere goats in Windsor Park, the property of His Royal Highness. The Jury have examined these goods with peculiar pleasure, as being the first made from cashmere wool grown in this country, and as one amongst innumerable manifestations of the deep and active interest which His Royal Highness has ever taken in promoting and encouraging British manufactures. Viewing these goods as distinguishable for the novelty of the materials employed, and the opening thereby offered for the production of a new class of fabrics, the Jury have unfeigned pleasure in drawing attention to this contribution.

Flannels.

Wales is the country in which this article was originally made, and the flannel produced there is still held in high repute, and deservedly so, for vests worn next the skin, though it is not so cheap as some others. It continues to be chiefly manufactured by hand-labour, but few power-looms being employed. The finest is made from the fleeces of the flocks of the adjacent mountains. The supply exhibited is not large, but sufficient to show the peculiar quality and finish of this fabric.

Lancashire, especially Rochdale and its neighbourhood, is the district where flannels are made more extensively than in any other part of the world, and in the greatest variety of widths, finish, and substance; that is, the thin gauze, the medium, and the thick, double-raised, or swanskin quality; both for home consumption and exportation. Machinery is more generally used here than elsewhere; that is, the mule for spinning, and the power-loom for weaving. The greatest number of goods and Exhibitors are also from this district.

Saddleworth and its neighbourhood are remarkable for the manufacture of Saxony flannels, especially those of very fine make, which have been very much admired in the London and other markets. A few are produced in the neighbourhood of Leeds, of common quality, and finished the natural colour of the wool.

In the west of England some white and dyed flannels and coatings are made, but not extensively. The fine dyed flannels partake somewhat of the quality of light cloths, but very few are in the Exhibition.

Ireland supplies a few low flannels and coatings, commonly called Galways, made of Irish-grown wool, and adapted for the native population.

Canada furnishes a few common and low flannels, but not much in this line has been yet attempted here. No prices were furnished for the few exhibited, nor do they profess to compete with those of England.

France.—There is considerable merit in the fine light flannels made in France. They are fine spun, and of a light texture, approaching nearest to the Saddleworth in wool and make: they are very suitable for printing, dyeing, and outer garments. The quantity exhibited is not large, but sufficient to show the style and quality: the prices are reasonable.

Belgium.—There is a very good assortment, especially from one house, here (but which furnishes no prices), of various kinds of flannels of the ordinary substance, and of medium and stout make, both twill and plain, white and dyed of various colours; and of dometts of cotton warps. The wool, make, finish, and dye are good.

United States.—The few flannels exhibited from America are well made and finished. They are made from wool of the United States' own growth.

The Jury desire to record their high opinion of the flannels exhibited and manufactured by Messrs. Kelsall and Bartlemore, of Rochdale (486, Classes XII. and XV., p. 502), the excellence of which would have fully entitled them to a Prize Medal, had not Mr. Henry Kelsall, one of the firm, been an Associate Juror; also the productions of Mr. Lawson, of Ashton-under-Lyne, as exhibited by Mr. J. Wilks, 79 and 80 Watling-street, London. (6, Classes XII. and XV., p. 486.)

The Jury award Prize Medals to the following manufacturers, viz.:—

Benoist, Malot, and Walbraume, Rheims. For fine flannels, well made and finished, and at reasonable prices.

Chatelain and Foron, Rheims, Marne. (86, France, p. 1175.) For flannels of fine qualities, well made and finished, and at reasonable prices.

De Heselle, A. J., Manufacturer, Themester, Dowiers, near Verviers. (203, Belgium, p. 1157.) For a large assortment of white and dyed flannels, swanskins, mediums, and dometts, well made, dyed, and finished.

Gilbert and Stevens, of Massachusetts. (441, United States, p. 1463.) For a good make of flannels of American grown wool, exhibited by Johnson, Sewell, and Co., Boston, United States.

Leach, J., and Sons, Manufacturers, Cailliards, Rochdale. (5, Classes XII. and XV., p. 486.) For a good general assortment of flannels, of meritorious make and finish, at reasonable prices.

Lloyd, William, and Co., Manufacturers, Newtown, Wales. (254, Classes XII. and XV., p. 498.) For the only assortment of real Welsh flannels, of good make and finish, and all made from the Welsh mountain wool.

Schofield, Brown, Davis, and Halse, 1 Gresham-street. (3, Classes XII. and XV., p. 486.) For a large assortment of meritorious flannels, well manufactured, and of new designs. The manufacturers of these are Messrs. John Schofield and Co., of Haybrook, Rochdale.

Smith, J., and Sons, Saddleworth, near Manchester. (235, Classes XII. and XV., p. 497.) For merit in very fine well-made flannels.

Tweedale, J., and Sons, Manufacturers, Healey Hall, Rochdale. (4, Classes XII. and XV., p. 486.) For flannel of excellent make and finish.

Money Award.

The Jury award a prize of 10*l.* to J. Bamford, Manufacturer, Rochdale, Lancashire (237, Classes XII. and XV., p. 497), hand-loom weaver. For fine light gauze flannels, well spun and woven.

Blankets.

In Tunis (pp. 5, 9, 11, 30) a very peculiar make of blankets is exhibited, some of these with a regular stripe across, others with alternate white and red stripes throughout, about an inch wide, made very similar to the gauze shawls worn by ladies in summer; also a very fanciful checked diamond pattern blanket, entirely knitted, the perfect workmanship of which possesses great merit.

The Jury award Prize Medals to the following Exhibitors:—

Albinet, jun., 19 Rue de la Vieille-Estrapade, Paris. (400, France, p. 1197.) For a small quantity of blankets, which are extremely fine.

Early, Edward. (269, Classes XII. and XV., p. 499.) For Witney blankets of a genuine character and moderate price.

Early, John, and Co., Manufacturers, Witney, Oxfordshire. (268, Classes XII. and XV., p. 499.) For an excellent assortment of real Witney blankets, of sterling useful qualities.

Firth, E., and Sons, Manufacturers, Heckmondwike, near Leeds, Yorkshire. (37, Classes XII. and XV., p. 487.) For blankets with cotton warp, with good workmanship and cheapness combined. This is a new article of produce, and it has become a great branch of trade to the slave states of America.

Gamble, W., of Milton Mills, Dundas. (139, Canada, p. 966.) For fine specimens of blankets, and well made.

Hagues, Cook, and Wormald, Dewsbury, Yorkshire. (25, Classes XII. and XV., p. 487.) For a great variety of excellent blankets, in all qualities, for the Irish, English, and American markets; scarlet and blue blankets, for the American trade; and travelling rugs of various kinds.

Patterson, J., Dundas Mills. (146, Canada, p. 966.) For fine specimens of blankets, and well made.

Robinson, Thomas, Dewsbury, Yorkshire. (54, Classes XII. and XV., p. 488.) For blankets. This person is a small manufacturer; but his goods are the best of their kind for quality and workmanship.

Wilson, J. J. and W., Manufacturers, Kendal. (245, Classes XII. and XV., p. 497.) For excellent qualities of railway wrappers and Windermere rugs, of good styles.

Zaalberg, J. C., and Son, Manufacturers, Leyden. (34, Netherlands, p. 1144.) These gentlemen have exhibited a fancy blanket, of particular merit.

The Jury desire to make Honourable Mention of the productions of the following gentlemen, viz.:—

Buffault and Truchon, Essonne. (1122, France, p. 1232.)

Guyon, E., 57 Rue Galande, Paris. (1264, France, p. 1237.)

Holden, B. T. and D., Concord, United States. (United States.)

Thornton, Firth, Ramsden, and Co., Leeds. (32, Classes XII. and XV., p. 487.) Awarded in this Class.

Zuerdeeg, I., and Son, Leyden. (33, Netherlands, p. 1144.)

Worsted and Woollen Yarns.

In reporting upon worsted, woollen, alpaca, and mohair yarns, we have agreed to class them under different heads, irrespective of the district or country whence they come,—and thus to speak of the merits of each spinner's yarn under the division of which it has formed a part. The Jury make no Report upon what are generally called Berlin or embroidery yarns, although in the English and foreign departments many samples were shown, which, so far as the character of the yarn (irrespective of colour) is concerned, were generally good; but as the merit of this article depends on shades of colour to as great, or even a greater, extent than on the character of the yarns, it was determined to leave the matter to be decided by other parties more competent to appreciate their peculiar excellence.

The Jury have divided the yarns which they considered to come within their province, into worsted, woollen, alpaca, mohair, cashmere, and mixture yarns, white and coloured. The worsted yarns again, although all come under the same general term, yet, being different in character, require to be mentioned separately. One class, which is the most numerous, the Jury will call "Merino Yarns;" another, "Lustre Yarns;" a third, "Genappe and Small Ware Yarns."

There might, perhaps, have been a further distinction made in the merino yarns; namely, between such as were combed by machinery and those which were combed by hand; but as this distinction was not in all cases expressed by the Exhibitors it has not been adopted. In woollen yarns, again, a further distinction might be observed; the term includes all such as are made from carded wool only, whether the same may have been from long or short stapled wool, fine or coarse. Wool, therefore, which has not passed through the process of combing, either by machinery or by hand, is termed "woollen yarn."

With these preliminary remarks the Jury begin their Report on worsted merino yarns. Of these there are a larger proportion than of any other, principally from France, the districts included in the Zollverein, and Austria. There were also one or two samples deserving of note shown by English spinners, and one sample by a Russian establishment. The samples of 160 weft shown by J. Rand and Sons, and of 144 shown by H. Pease and Co., are very good indeed; but although deserving great credit, as specimens of throstle-spun yarn, yet the Jury were of opinion that the same yarn, had it been prepared on the French principle, spun on the mule, and equally well managed, would have been improved in character. The mule, which is in all but universal use on the Continent for spinning short-stapled wools, is (combined with the French mode of preparation) better than the throstle for the production of yarns adapted to the manufacture of merino cloths; and this circumstance, no doubt, has been the chief cause why the French have been able to take the lead through the world in merinos and mousseline-de-laine fabrics. The best specimens of yarn, both as to softness, evenness, and fulness of thread for the number, belonged to Paturle-Lupin and Co.; computed by the English number it was No. 178, or 200 millimètre, and we have never seen a more perfect specimen of weft yarn.

The French house which exhibited the nearest approach as to number was that of Roger Brothers and Co.; but their yarn was not made from so fine a wool as that of Paturle-Lupin and Co., and certainly not so well managed in the spinning; they were, however, upon the whole pretty good, especially their finest numbers of warp yarn.

The samples shown by the house of Billiet and Huot (p. 1251) were equal to the best in the spinning of the yarns, although not spun to so high numbers. The finest number of merino weft yarn exhibited by the Leipzig Spinning Company (165, English, p. 1106) was very good, and deserving of great praise, being very little inferior to that of Paturle-Lupin and Co. In addition to those already named, there were very good specimens of merino yarns shown by the following houses:—

Hindenlang, sen. (p. 1238), La Chapelle, and Levarlet (p. 1238), Lucas Brothers (p. 1240), Pradine and Co. (p. 1243), Cauvet (p. 1232), Fournival, Altmayer, and Co. (p. 1187); Hartmann and Co. (p. 1189), Delegue and Co. (p. 1178), A. Thum (p. 1017), L. Thomas (p. 1017), Vöslau Worsted Yarn Spinning Company (p. 1017), A. Schmieger (p. 1018), C. F. Solbrig (p. 1108), Petzoldt and Ehret (p. 1107), Weiss, Jr. and Co. (p. 1090).

The Jury may also here mention a rather peculiar kind of Barège yarn, said to be spun by the hand, exhibited by Lantein and Co. (1205), used in the manufacture of very fine gauze cloth, chiefly for men's veils. In the medium numbers of merino yarns nothing appeared superior in management to a specimen of No. 72, shown by Mr. Preller, but spun by Jonas Smith and Sons; this yarn was shown in connection with specimens of tops combed by the patent machine of Mr. Preller, and if these were an average of the work done by this machine, it has almost attained to perfection in clearing the wool from noil, as well as leaving the staple unbroken. The No. 72 named appeared to be made from an ordinary quality of Australian wool, yet the yarn was clearer, fuller, and more even than any other we examined of the same number. Perhaps it ought to be stated here, that as Mr. Preller, one of the Jurors, is a relative of the Exhibitor, he gave no opinion in this case, but left the other members to themselves in the examination of this specimen.

Although there were many more Exhibitors of merino yarns beside those named, whose yarns were upon the whole good, yet the Jury are of opinion that the houses already named excel the remainder in one or other either in warp or weft yarns.

In lustre worsted yarns very few samples were shown, as compared with the merino yarns; those exhibited by J. Foster and Son were thought the best. There was a good sample shown by William Thomas (p. 502), dyed in the preparation.

In woollen yarns, or such as were carded only (not combed), the specimens exhibited are numerous and generally good. Among the best of those which were carded from long-stapled wools, of low quality, were J. Akroyd and Son (p. 491), and Franc and Martelin (p. 1236). In the fine numbers spun from better qualities of wool, there were beautiful yarns shown by Croutelle (Nephew) (p. 1177), Sentis, Son, and Co. (p. 1227), Lantein and Co. (p. 1205), Xhoffray and Co. (p. 1157), Joseph Keller (p. 1217), Clarenbach and Son (p. 1079), E. Leidenfrost (p. 1017), and L. Thomas (p. 1017).

There were also some good yarns shown by other houses, but not equal to those of the parties named.

The specimens of hosiery yarns shown by A. Burgess and Co. (p. 497), Brewin and Whetstone (p. 497), and Whitmore and Co. (p. 497), were good, and gave full proof of the deserved fame which the Leicester houses have long maintained for the production of this class of yarns; there were also good samples of this kind shown by R. Poppleton (p. 497), and J. G. Schmidt and Sons (p. 1106).

There were very few exhibitors of cashmere yarns; of these those exhibited by Hindenlang, sen. (p. 1238), were the best. Their finest number was a beautiful specimen.

In yarns made from a mixture of silk and wool (mixed in the carding and preparation), there were samples shown both white and coloured, which, so far as we were competent to form a judgment, were very good; but as this branch of the worsted trade is comparatively new (at all events to us), the Jury could not venture to give an opinion as to the relative merits of the different yarns of this class.

In alpaca and mohair yarns the samples shown appeared to be very good, both in evenness of thread and mixture of colours, for the various descriptions of fancy goods made from them. This branch of trade, although comparatively new, has made rapid strides towards perfection. A few years ago these raw materials were of little or no value, but through the skill and enterprise of those engaged in this trade, amongst whom Mr. T. Salt must by universal consent have a pre-eminent position, they have now become very valuable: and it cannot be doubted, from the beautiful specimens exhibited, that they are destined to maintain a high price as compared with ordinary qualities of sheep's wool. In the first stage of its progress, alpaca yarns were found to be very imperfect in their evenness for the manufacture of plain goods: this obstacle is now entirely overcome, and every specimen of alpaca yarn we examined was all but perfect in this respect.

Although the wool in its natural state is either black, brown, or white, yet from these three colours an almost endless variety is produced, enabling the manufacturer to secure shades adapted to all seasons. The specimens of fine numbers, exhibited by T. Salt (pp. 491-2) and J. Foster and Son (p. 492), show that it is capable of being spun so small in the thread as to render it available, either alone or in combination with cashmere yarns, or silk for fabrics of the lightest description.

Most of the samples of mohair yarn exhibited, single and folded, were very good, both in lustre and evenness of thread, especially those shown by T. Salt (pp. 491-2), J. Foster and Son (p. 492), Stowell and Sugden (p. 502), and Townend Brothers (p. 493). The mohair poplin yarn made by the last-named house, is the only yarn of this description prepared for the manufacture of poplin fabrics, and appeared perfect; they had also some beautiful specimens of coloured mohair yarns, suited for the small ware trade. There were also very good specimens of alpaca and mohair yarns exhibited by—

D. W. Sharp (p. 494), J. Whitley (p. 494), W. Milligan and Son (p. 492), and Baughen Brothers (p. 495).

The Genappe yarns shown were numerous and generally excellent in management: in the finer numbers of this class there are very good specimens shown by Townend Brothers, and J. Akroyd and Son. The variety of small-ware yarns shown by J. Sugden and Brothers was very great, and their general management must give them a good position in the market for this class.

The Jury recommend as deserving of Prize Medals the exhibitors named below, who, to the best of their judgment excel in this class of yarns:—

Akroyd, J. and Son, Halifax. (130, Classes XII. and XV., p. 491.) For carded and Genappe yarns.

Billiet and Huot, 43 Rue du Sentier, Paris. (1550, France, p. 1251.) For merino yarns.

Clarenbach and Son, Hutteswagen. (506, Prussia, p. 1079.) For woollen yarns.

Croutelle Nephew, Rheims (Marne). (132, France, p. 1177.) For woollen yarns.

Ecroyd, W., and Son, near Burnley. (130a, Classes XII. and XV., p. 491.) For carded and Genappe yarns.

Foster, J., and Son, Manufacturers, Black Dyke Mills, near Bradford. (143, Classes XII. and XV., p. 492.) For alpaca, mohair, and lustre yarns.

Hindenlang, sen., Cramoisy (Oise), and 24 Rue des Vinaigriers, Paris. (1269, France, p. 1238.) For cashmere and merino yarns.

Keller, Joseph, Brünn, Moravia. (191, Austria, p. 1017.) For woollen yarns.

Lachapelle and Levarlet, Rheims (Marne). (1285, France, p. 1238.) For woollen yarns.

Lantein and Co., Rheims and Tinqueux (Marne). (566, France, p. 1205.) For Barège and woollen yarns.

Leipsic Spinning Co., Puffendorf. (44, Saxony, p. 1106.) For merino yarns.

LUCAS BROTHERS, Bazancourt (Marne). (1331, France, p. 1240.) For merino yarns.

PATURLE-LUPIN, SEYDOUX, SIEBER and Co., le Cateau. (1381, France, p, 1242.) For merino yarns.

PEASE, H., and Co., Manufacturers, Darlington. (184, Classes XII. and XV., p. 495.) For merino yarns.

RAND, J., and SONS, Bradford, Yorkshire. (173, Classes XII. and XV., p. 494.) For merino yarns.

ROGER BROTHERS and Co., Trie Château (Oise). (1449, France, p. 1245.) For merino yarns.

SALT, TITUS, Bradford, Yorkshire. (139, Classes XII. and XV., pp. 491–92.) For alpaca and mohair yarns.

SCHMIDT, J. G., jun., SONS, Penig. (49, Saxony, p. 1107.) For folded card yarns.

SCHMIEGER, A., Neudeck, Bohemia. (193, Austria, p. 1017.) For woollen yarns.

SENTIS, SON, and Co., Rheims (Marne). (1011, France, p. 1227.) For woollen yarns.

SOLBRIG, C. F., Chemnitz. (47, Saxony, p. 1107.) For merino yarns.

STOWELL and SUGDEN, Bradford. (496, Classes XII. and XV., p. 502.) For mohair yarns.

SUGDEN, J., and BROTHERS, Dockroyd Mills, near Keighley, Bradford. (167, Classes XII. and XV., p. 494.) For Genappe, mohair, and poplin yarns.

TOWNEND BROTHERS, Cullingworth, near Bingley. (162, Classes XII. and XV., p. 493.) For Genappe and mohair yarns.

XHOFFRAY and Co., Dolhaim-Limbourg (Liege). (204, Belgium, p. 1157.) For woollen yarns.

The Jury also desire to make Honourable Mention of the two following houses:—

CAUVET, Chantilly, near Paris. (1138, France, p. 1232.) For merino yarns.

FOURNIVAL, ALTMAYER, and Co., Rethel (Ardennes). (221, France, p. 1187.) For merino yarns.

SAMUEL ADDINGTON, REPORTER.

London, September 1851.

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CLASS XIII.

REPORT ON MANUFACTURES IN SILK AND VELVET.

[The figures after the Names (between Parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

GEORGE TAWKE KEMP, *Chairman*, 35 Spital Square; Silk Manufacturer.
ARLES-DUFOUR, *Deputy Chairman*, France; Member of Central Jury.
THOMAS WINKWORTH, *Reporter*, Gresham Club, London; formerly Silk Manufacturer.
SAMUEL COURTAULD, 2 Carey Lane, Cheapside; Crape Manufacturer.
Lieut.-Colonel HENRY DANIELL, Turkey; Coldstream Guards.
THOMAS JEFFCOAT, Coventry; Ribbon Manufacturer.
HENRI MAHLER, Zurich.
ANTONIO RADICE, Austria; Vice-President of Chamber of Commerce, Verona.
J. VERTU, Sardinia.
CHARLES WARWICK, 132 Cheapside; Silk Warehouseman.

THE JURY of this Class have in their awards endeavoured to adhere to the instructions they received from the "Sub-Committee of Chairmen," as to the principles by which it was desirable they should be governed; and although in many cases the great merit of individual exhibitors seemed to justify such a deviation therefrom as would have enabled the Jury to recommend the Council Medal, they have abstained from so doing.

They have also made their awards rather with regard to individual merit, than to the rival claims which a comparison between the productions of exhibitors from different countries, or from the same country, might, if the Medals were limited in number, have rendered necessary. Had it been otherwise, the delicate, and to some extent invidious, duty of selection, where so much of approximation of merit exists, would have been still more onerous than they have felt it to be; and they confidently trust that credit will be given them for an anxious desire to do justice to all parties whose productions have been submitted to their inspection and judgment.

Not among the least of the difficulties under which the Jury have felt themselves placed, is that which arises out of the discretion they were allowed to exercise of naming exhibitors whose aggregate productions, though of high merit, are not yet sufficiently so to entitle them to Prize Medals.

It must be obvious that unless all these articles are of the first class as to quality, a line must be drawn between those which are and those which may be very nearly so: this the Jury have endeavoured to do, and in naming those exhibitors who in their judgment appear in this latter category, they think it better to abstain from mentioning the grounds on which in each instance their judgment is based.

As there is a very proper rule which prohibits Jurymen from receiving Medals in the Classes where they serve, the Jury can only mention that three of their number being exhibitors, no opinions on their productions are offered. They are Mr. J. VERTU, Silk Merchant, of Turin (p. 1303); Mr. Samuel Courtauld, of the firm of SAMUEL COURTAULD and Co, of Braintree, Bocking, and Halstead, also of London (p. 505); and Mr. G. T. Kemp, of the firm of STONE and KEMP, Silk Manufacturers, of Spitalfields (p. 504).

The important position which the silk trade, in all its stages and branches, now occupies, would appear to call for an extended report on its present condition in each country where it is cultivated; but the Jury do not feel it to be any part of their duty to go beyond such notices as the several classes of productions to be found in the Exhibition, and comprised in Class XIII., may suggest. They do not possess the elements necessary to a statistical detail and historical *résumé* of this trade, and will therefore address themselves to such points of interest as may arise out of the awards they have made, taking the several countries which have exhibited in alphabetical order.

Before, however, they proceed to these particulars, it may be proper to remark, that with respect to the staple of this manufacture, the several samples to be found in the Exhibition afford but faint evidence of the great perfection to which the cultivation of the raw material has arrived in many countries. Although it has been assigned to the Jury of Section IV. to report on this department, it is so intimately connected with the thrown article, and forms so essential an ingredient in the production of perfect manufactured goods, that a passing observation may be excused. France alone has responded heartily to the invitation to exhibit cocoons, as well as reeled and thrown silks, no less a number than fifty-four producers having sent samples; while other countries in which it abounds, as Piedmont, Lombardy, the Roman States, the Tyrol, Spain, Turkey, India, and China, have together only supplied about fifty exhibitors. Naples, the immediate seat of a valuable quality of raw silk, has only contributed a single sample.

The importance of this material to France, as an article of national industry, may be gathered from the fact that the annual value of the quantity produced is stated to be not less than six millions sterling. What proportion this large amount bears to the aggregate or separate value of the products of the other countries just mentioned, the Jury have not the means of ascertaining: it cannot, however, but be very considerable.

AUSTRIA.

The silk productions of this country, as seen in the Exhibition, consist principally of thrown silks, ribbons, garments, furniture, and ecclesiastical manufactured goods, handkerchiefs, crapes, &c., all of which are more or less indicatory of a high state of cultivation, and reflect credit on the skill of the manufacturers.

CHINA.

The exhibition of manufactured silks from this country, while it amply sustains the reputation she has long enjoyed for damask and other articles, is not sufficiently novel to justify more than a passing notice. The Jury have, however, much pleasure in tendering their thanks to Mr. H. H. LINDSAY (p. 1422), and to Mr. L. DENT (p. 604), for the beautiful collection they have made, and sent for inspection, of the goods peculiar to that nation.

ENGLAND.

A very slight glance at the goods exhibited by the English manufacturers will enable those who have attended to the state of the silk trade of this country, to observe the great progress which has been made in quality, design, and cheapness during the last twenty years. Until within that period this branch of manufacture was comparatively inconsiderable, but it is now one of great importance, both as regards the quantity and value of the goods produced, and the extent of the markets opened for their sale and consumption. It is remarkable that though the raw material is, like cotton, an exotic, the judicious application of skill and capital has overcome that natural impediment; and articles of extensive consumption, for the supply of which England was a few years since almost entirely dependent on foreign producers, are now nearly exclusively manufactured in Spitalfields, Lancashire, and other favourable districts. Of this fact the Exhibition furnishes many examples. The Jury do not allude to this as depreciatory of similar goods of foreign production, which are equally well made, but as illustrative of the beneficial effect of the policy by which the incubus of heavy duties on the raw and thrown material was removed, and that which operated as a practical prohibition on the foreign manufactured article was reduced to an almost nominal impost.

Goods are now made, both for the home and foreign markets, which were heretofore exclusively supplied by continental manufacturers. In Macclesfield, for instance, there are single houses which produce boys' ties, and ladies' silk handkerchiefs alone, both plain and fancy, to the extent of from 40,000 to 50,000 dozen per annum, averaging from 7*s.* to 20*s.* per dozen, employing 1500 hands, many of them under twenty years of age, and paying from 800*l.* to 1000*l.* per week in wages. In Essex, also, this liberal policy has been followed by results equally striking. Very extensive silk-throwing mills have been established in the towns of Colchester, Coggleshall, Braintree, Bocking, and Halstead; and in the three latter towns, where, under the system of heavy import duties or absolute prohibition, silk manufactures scarcely existed, articles of crape, gauze, and other similar fabrics are now produced upon the largest scale.

It may be doubtful whether excess of competition is not rather calculated to lower the standard of perfection than otherwise; but where, as in the silk manufacture, the market is the world, and the consumption unlimited, the scope for the exercise of taste and skill in all producing countries is proportionately extensive and profitable.

Before terminating these preliminary remarks, the Jury deem it right to mention that the house of LEWIS and ALLENBY, of London (p. 505), exhibit some brocaded silks of the highest order of artistic and manufacturing skill, of which they are the sole designers; but although they furnished both the pattern and the pecuniary means for producing it by the weaver, yet as they are not themselves manufacturers, the Jury did not conceive it to be within their province to award these exhibitors the Medal to which, under other circumstances, they would be entitled.

The Jury are of opinion that those only should have that distinction conferred upon them, in this Class, who embark their capital and talent in the manufacture of articles which, by the quantity and quality produced, assume a character of national importance; and that therefore an isolated case like the present, however meritorious, should not be made exceptional also. If the Jury had felt themselves justified in making exceptions to this rule, they would have noticed the silk goods exhibited by many firms, both wholesale and retail, which are distinguished by manufacturing talent and artistic taste. It is, however, due to their public spirit to make special mention of the following:—

CANDY and Co. (p. 1232); J. HOWELL and Co. (p. 505); MARSHALL and SNELGROVE (p. 505); J. W. PUGH (p. 503); REDMAYNE and Co. (p. 503); SEWELL, EVANS, and Co. (p. 504); SWAN and EDGAR (p. 504); and TUVÉE and Co., of Paris (p. 1212).

FRANCE.

Long the cradle and chief seat of the silk manufacture, amply sustains its position in the present Exhibition. It would be difficult to do adequate justice to the varied claims of the throwster, dyer, designer, and weaver, of the magnificent assortment of goods which occupies the department assigned to that country, and which excites the admiration of all who take an interest in this important branch of industry. The Jury have had no hesitation in awarding Medals to the large number of exhibitors whose names will be found below, and have reluctantly omitted others whose merits are scarcely less deserving of that mark of distinction. The well-merited reputation of the manufacturers of France, and the number and extent of the European and transatlantic markets they have hitherto so largely supplied, supersede the necessity for extended observations. The Jury cannot, however, conclude this brief notice without directing attention to the striking fact, that although Lyons has been unfortunately too frequently exposed to fierce local disturbances, and has shared in the misfortunes which attend national revolutions, the peculiar trade of the district has not degenerated in character or importance—a fact which they attribute mainly to the circumstance that prohibitive duties, which oppress other branches of manufacture, are removed from this.

GREECE

Only exhibits a few articles of comparatively small importance.

HOLLAND.

The same remark applies to the comparatively small assortment from this country.

INDIA.

The manufactured silks from this important dependency of the British Empire which have been exhibited, are inconsiderable in quantity, and not very novel in character. The Jury have been unable to award Medals to exhibitors, not only for this reason, but also because the parties exhibiting are not the producers or manufacturers. They are not, however, the less entitled to thanks for their liberality in causing the samples found in this department of the Exhibition to be manufactured and exhibited.

ITALY.

The reputation of this country, as the chief producer of the raw and thrown material, is well sustained by the samples exhibited. Manufactured goods of great merit are also to be found in this department, among which the velvets of Genoa and Turin must be signalised as fully sustaining their ancient character for beauty and quality.

PORTUGAL.

The manufacturers of this country exhibit a small assortment of rich gold and silver brocades for ecclesiastical purposes, and miscellaneous articles in gauze, velvet, satin, &c., but nothing of sufficient importance to merit special notice. Considering the advantages of climate, and the abundant labouring resources which this country enjoys, this sterility of skill, enterprise, and application is much to be regretted.

RUSSIA.

Although, as before observed, raw silks are not comprised in their Class, the Jury have noticed some very fair samples from this country; which, as also some thrown silks, afford promise of an important branch of trade being opened at no distant period. The same may be emphatically said of the manufactured silks to be found in this department. They are highly creditable to the producers, whether as regards the choice of the material, the colours, the design, or the manufacture. Some magnificent silks for furniture and ecclesiastical purposes deserve special notice.

The progress made in this important branch of manufacture during the last few years, is illustrative of the advantages which seldom fail to result from the removal of prohibitory duties, and the introduction of a low tariff.

SPAIN.

The Jury have only been able to award one Medal to an exhibitor from this country; but specimens of good raw silk, and of considerable manufacturing merit in ribbons, broad silks, &c., may be found in this department.

A very little attention to details might make this branch of manufacture of great importance to the country.

Sweden and Norway.

The few articles exhibited by these countries offer no feature for particular notice.

Switzerland.

The character of the silk manufacture in this country demands a discriminating notice. The goods exhibited are of a low class, as to weight and texture, but are well made in all respects. The material employed is generally from Italy, and excellent of its kind; the workpeople are economical in their habits; the manufacturers confine their attention to the precise kinds of goods which best suit their localities, and their means of obtaining a regular sale for them; and, altogether, a trade of much importance is sustained with Germany, Russia, Italy, and the two Americas.

Forty-two manufacturers of the canton of Basle exhibit. In one case (152) are shown the united contributions of twenty-six ribbon manufacturers. This case contains some very good specimens of figured ribbons, which are clearly indicative of the improved condition of this trade in that district.

Turkey.

The silk fabrics sent from this eastern part of the globe exhibit a peculiarity of taste and execution, such as might have been expected from a country so essentially different in all its habits from those of Europe generally. While there is much to excite curiosity, and even admiration, there are no goods so strikingly superior and novel as to justify the Jury in awarding more than two Medals. There is, however, in the articles exhibited by this country, the most satisfactory evidence that at length the more intimate intercourse with other countries which steam navigation has superinduced, has begun to tell favourably on their national character and domestic economy. It appears that, with the introduction pretty generally by the Sublime Porte of European attire, a relish for business, and an aptitude for mercantile transactions, have supervened. To the active exertions of the Turkish Consul-General, M. Zohrab, we are mainly indebted for the highly creditable display of goods in this department of the Exhibition, in which are to be found cocoons, raw and thrown silks from Brussa, Salonica, Adrianople, and Syria; manufactured silks from Constantinople, many of them very rich and handsome; and similar goods, made under the immediate superintendence and with the pecuniary assistance of the Turkish Government. The Jury would also direct attention to the light silk shirts, made from a comparatively inexpensive and otherwise useless raw material, specimens of which are worn by the boatmen who take charge of the graceful caïque now floating on the Serpentine, and sent as a model of the boats which line the shores of the Bosphorus. There are other woven fabrics, particularly some gold embroidery peculiar to Constantinople and Smyrna, which deserve notice, but which do not belong to this class.

Zollverein.

In this department, embracing the manufacturing talent of a large portion of Germany, including Prussia, a considerable variety of silk goods is exhibited. The greater part, however, are of low qualities, suitable only to the home and the American markets, in both which they command an extensive scale. The velvets are perhaps the most important of these products, and are characterised by the regularity and evenness of the pile, and the economical application of the skill and labour necessary to their manufacture. They are articles which are largely exported from Crefeld and Vierzen, which are the chief seats of this peculiar branch of the silk trade.

The Jury award Prize Medals to the following Exhibitors:—

Thrown, Sewing, and Spun Silk.

Alsop, Robins, and Co., of Leek (48, p. 506), for some excellent samples of sewing silks.

Barrès Brothers, St. Julien en St. Alban (Ardèche), (41, France, p. 1173), for the perfection of their trams for tulle, and for organzine 16/18, 20/22, and 26/28 deniers, for satin and plush.

Bonneton, J., St. Vallier (Drôme), (771, France, p. 1217), for his organzine for plush and satin.

Bravo, Michael, Pignerol (24, Sardinia, p. 1303), for excellent organzine for satins.

Bridgett, Thomas, and Co., of Derby (49, p. 506), for sewing silks, purse twist, and sarsnet ribbons.

Brough, J. and J. and Co., of Leek (44, p. 506), for some excellent samples of sewing silks.

Chambon, Casimir, Alaix (Gard), (113, France, p. 1170), for his fine six-thread grenadine, for the manufacture of "tulle bobin," and for his organzine 26/28 deniers, for satin.

Chartron and Son, Vallier, Drôme (796, France, p. 1218), for organzine 13/13 deniers, for tulle; 32/34, for ribbons; and 19/20, 24/26, and 26/28, for plush and satin.

Couderc and Soucaret, Montauban (Tarn and Garonne), (96, France, p. 1176), for gaze à bluter (used by millers), of extraordinary perfection, numbering from 10 to 220 threads per inch.

Dumaine, Xavier, Tournon (175, France, p. 1181), for organzines 18/19, 20/21, and 26/28 deniers.

Hadwen and Sons, of Halifax (42, p. 505), for beautiful spun silk yarns in all numbers.

Herme, Auguste, Crest (537, France, p. 1204), for organzine 18/19, 26/28, and 32 deniers, for satin.

Holdforth and Son, of Leeds and Congleton (61, p. 506), for spun silk yarns in all numbers, in the production of which they appear to have arrived at a high point of perfection.

Jame, Bianchi, and Duseigneur, Lyons (Rhône), (1087, France, p. 1230), for grenadine and organzines. The Jury consider the productions in raw silk of M. Duseigneur, and of other exhibitors of this material, as belonging to Class IV.

Langevin and Co., Laferté Aleps (Seine-et-Oise), (898, France, p. 1223,) for spun silks, in great perfection, from the lowest to the highest numbers.

Menet, Jean; Beaulieu and Annonay (Ardèche), (1657; France, p. 1256), for beautiful qualities of organzine, both white and yellow, especially those which are suitable for the difficult and delicate manufacture of blondes.

Poidebard, N., di Portici, near Florence (51, Tuscany, p. 1291), for organzines and trams 22/24 and 36/40 deniers.

Rignon, F. and Co., of Piedmont (30, Sardinia, p. 1303), for excellent organzine for satins.

Scheibler and Co., of Milan (80, Austria, p. 1011), for organzine, 28 deniers for satin, and for their grenadine, 48 deniers in four threads.

Soubeyrand, Louis, St. Jean-du-Gard (1490, France, p. 1248), for organzine 18/20 and 26/28 deniers.

Teissier Du Cros, L. and E., Vallerangue (1031, France, p. 1228), for organzine from 20/21 to 32/34 deniers, and for grenadines. (Prize Medal, Class IV.)

Verza Brothers, Milan (87a, Austria, p. 1012), for trams.

Ribbons.

Balay, Jules, of St. Etienne (1064, France, p. 1229), for ribbons made of silk in the gum, and dyed afterwards. They are well finished, and command a considerable sale.

Buisson and Co., of St. Etienne (1125, France, p. 1232), for the good taste and quality of their gauze ribbons.

Colliard and Comte, of St. Etienne, Loire (1154, France, p. 1233), for the assortment of ribbons, which are considerable in quantity, novel in design, and creditable to the manufacturer and draftsman in every way.

Cope, Hammerton, and Co., of Coventry (70, p. 507), for an assortment of figured ribbons made by power, which is good, when taken in connection with price.

Cornell, Lyell, and Webster (22, p. 504), of London and Nuneaton, for ribbons which are in good taste, well executed, and the colours judiciously blended.

Coventry Ribbons Committee (72, p. 507), for a ribbon exhibiting much taste and skill in its production.

Cox, R. S., and Co., of London and Coventry (66, p. 507), for an assortment of fancy ribbons of good qualities and mixtures.

De Bary and Bischoff, Basle (152, Switzerland, p. 1275), for good specimens of figured ribbons.

Freyvogel and Heussler, Basle (152, Switzerland, p. 1275), for good specimens of figured ribbons.

Larcher, Faure, and Co., St. Etienne, Loire (1293, France, p. 1238), for good specimens of ribbons.

Messat, Ant, Vienna (246, Austria, p. 1019), for an assortment of figured taffetas, gauze and crape ribbons, well manufactured.

Moering, Charles, Vienna (247, Austria, p. 1019), for a good and well executed assortment of figured and chiné ribbons.

Richter, Linder, Bâle (152, Switzerland, p. 1275). The ribbons exhibited by this manufacturer are all plain satin, of different qualities, and woven in the gum. Some are left undyed, to show the process. They command a large sale on account of their comparative cheapness.

Sarasin and Co., Basle (152, Switzerland, p. 1275), for good specimens of figured ribbons.

Sarasin, J. F., Basle (152, Switzerland, p. 1275), for good specimens of figured ribbons.

Soller and Co., Basle (152, Switzerland, p. 1275), for good specimens of figured ribbons.

Sulger and Stückelberger, Basle (152, Switzerland, p. 1275), for good specimens of figured ribbons.

Vignat Brothers, St. Etienne (1524, France, p. 1249), for chiné ribbons, which are beautifully designed and executed; and for some specimens of figured ribbons.

Manufactured Silks.

Andreae, C., of Mulheim on the Rhine, near Cologne (360, Prussia, p. 1071), for plain velvets and stamped fancy velvet ribbons, in good taste and cheap.

Balleidier, F., of Lyons (1065, France, p. 1229), for an excellent assortment of vestings in large variety, both plain and fancy; and for the figured velvets and terry, which also bear testimony to his extensive knowledge of the resources of the Jacquard loom.

Barth, Massing, and Plichon, of Sarreguemines, Moselle (21, France, p. 1172), for an assortment of black silk plush for hats, remarkable for the brilliancy of the colour and the excellence of the workmanship.

Bauman and Streuli, of Horgen (153, Switzerland, p. 1276), for plain and armure silks of the best workmanship, and for shot or glacé gros-de-Naples, which are excellent for a low-priced article.

Bellon, Joseph, and Co., of 2 Rue du Griffon, Lyons (1079, France, p. 1229), for black satins and taffetas, in great perfection as to colours and qualities, and variety as to price.

Bernoville, Larsonnier, and Chenest (1548, France, p. 1250), for printed silks, plain coloured grenadines, and novelties in silk-gauze dresses, all in excellent taste. Medal awarded in Class XVIII.

Bertrand, Gayet, and Dumontat, of Lyons (1085, France, p. 1230), for a beautiful assortment of chiné and figured silk shawls, scarfs, and cravats, in excellent taste.

Bischoff, Christopher and John, of Basle, (157, Switzerland, p. 1277), for black taffetas, and gros-de-Rhin, of excellent quality, and remarkable for the brilliancy of the colour; also for some good black satins.

Bonnet, J. and C., of Lyons (197, France, p. 1230), for black satins, from 2f. 75c. to 14f.; and black taffetas, from 4f. 25c. to 8f. 25c. These manufacturers confine their operations to these two articles, and have attained to great perfection in the production of them.

Bouvard and Lancon, of Lyons (1110, France, p. 1231). This house enjoys a high reputation for silks suitable for furniture and ecclesiastical purposes, and had prepared a large assortment for exhibition on this occasion, which was unfortunately consumed by a fire on the 31st of March last, which destroyed their premises. For the few specimens of their looms now shown, which exhibit manufacturing talent of a high order, a Prize Medal is awarded.

Brisson Brothers, Lyons (1117, France, p. 1232), for black silk plush, of excellent quality, principally made by power.

Brocklehurst, J. and T., and Sons, Macclesfield, (38, p. 505), for Persians, serges, sarsnets, gros-de-Naples, handkerchiefs, &c., in great variety, and well made.

Brosse and Co., Lyons (1118, France, p. 1232), for coloured velvets in great variety, and well manufactured.

Brunet, Lecomte, Guichard, and Co., of Lyons (1120, France, p. 1232), for a most splendid assortment of chiné and embroidered silk gauzes, grenadines, and crêpes for dresses, shawls, collars, scarfs, and cravats, the execution of all which is admirable in taste and in mixture of colour. Their printers, Perrigaux, Brunet, and Co., deserve great praise for the skill displayed by them in that department of art.

Campbell, Harrison, and Lloyd, of London (31), for some beautiful specimens of moiré antique; figured and brocaded silks, which are very superior in quality, taste, and execution.

Carquillat (Weaver), of Lyons (1134, France, p. 1232), for a woven portrait of Pope Pius IX., and another woven picture of the visit of the Duc d'Aumale to his workshop; and in the compartment occupied by Messrs. Potton and Rambaud there is also a portrait of the Queen by this superior weaver, all of which are executed with artistic skill of a high order.

Carter, Vavaseur, and Rix, of London (30, p. 505), for figured silks and moiré antique.

Casey and Phillips, of Spitalfields (23, p. 504), for plain black Radzimore and other plain silks, all of which are well made.

Chamber of Commerce of Lyons, for a magnificent assortment of fancy silks, in great variety, of the richest quality, in exquisite taste, of the choicest colours, and the best manufacture (awarded an unclassified Council Medal.)

Champagne and Rougier, of Lyons (1143, France, p. 1232, for a magnificent assortment of rich figured silks, in great variety of design and mixture, including some exquisite specimens of rich broché, at 36f. per mètre.

Chichizola, J., and Co., of Turin and Genoa (39, Sardinia, p. 1304), for an assortment of plain velvets, peculiarly fresh and brilliant in colour, and admirably manufactured; also for figured silks, well made, in good taste, and in considerable variety.

Critchley, Brinsley, and Co., of Macclesfield, (40, p. 505), for a great variety of figured silks, handkerchiefs, and cravats, in good taste, well made, and cheap at the prices quoted.

Diergardt, F., of Viersen (509, Prussia, p. 1079-80), for plain velvets, figured velvets for vestings, and an assortment of velvet ribbons in all qualities, all of which are excellent of their kind.

Donat and Co., Lyons (1193, France, p. 1234), for black silk plush, of excellent quality, principally made by power.

Donat, André, of Lyons (1192, France, p. 1234), for an immense variety of vestings and silks for cravats, in plain, figured and broché satin and grenadine. Also for some of the former in velvet grounds, brocaded in gold and silver; and for plain and figured moiré antique, the whole displaying fine taste, and artistic skill of a high order of merit.

Fontaine, Fr., of Lyons (1225, France, p. 1236), for a similar exhibition of vestings and garment silks of equal merit.

Gabain, George, of Berlin (119, Prussia, p. 1055), for a good assortment of silks in damask and brocatelle for furniture, in good patterns, and well executed.

Gindré, L., and Co., of Lyons (1247, France, p. 1237), for white and coloured satins, from 3fr. to 7fr., which are well made at the prices quoted.

Girard, Nephew, and Co., of Lyons (1248, France, p. 1237), for black and coloured velvets, in great variety, and admirably manufactured.

Graham and Sons, of Spitalfields (17, p. 504), for black moirés, satins, and velvets, well manufactured.

Grosvenor, W. and Co., of Kidderminster (52, p. 506), for furniture silks in great variety, of good design and texture, especially at the prices quoted.

Grout and Co., of London (36, p. 505), for black crapes, crèpe aerophane, crèpe lisse, &c., all well manufactured and in good colours.

Guillot and Co., of Turin and Genoa (41, Sardinia, p. 1304), for plain velvets of great excellence; for figured velvets for tapestry and furniture, remarkable for their width, good taste, and the ingenious method of weaving; and also for a beautiful imitation of white lace on velvet ground, in several varieties.

Harrop, Taylor, and **Pearson,** of Manchester (62, p. 506), for a good assortment of black and shot plain silks, well made at the prices quoted.

Heckel and Co., of Lyons (870, France, p. 1221), for satins in white, black, and colours, of all qualities, which are probably the finest specimens of which the article is susceptible.

Hell, George, of Vienna (260, Austria, p. 1019), for a considerable assortment of brocatelles, in excellent taste, and well made. Some of these show the design on both sides, and others are to be noted for their unusual width.

Hill, James, and Co., of Spitalfields (25, p. 505), for plain and figured silks, well made, and cheap at the prices quoted.

Hoehn and **Baumann,** of Horgen (53, Switzerland, p. 1276), for lustrings, which are well made for low-priced goods.

Hooper, G., Carroz, and **Tabourier,** Paris (1625, France, p. 1255), for plain, figured, and printed silk gauzes, well made and printed. Also for an assortment of illusion tulle, peculiar to the house, of excellent colours; and for a great variety of other goods deserving special notice.

Houldsworth, James, and Co., of Manchester (64, p. 506-07), for furniture silks in great variety, of good design and texture, especially at the prices quoted.

Ibrahim Aga, Turkey (p. 1390), for specimens of figured velvets, of some taste and well made.

Keith and Co., of London, Manufacturers (1, p. 504), for a great variety of furniture silks, in excellent taste, and exceedingly well made.

Kolokolnikoff, Paul, of Moscow (203, Russia, p. 1373), for magnificent specimens of gold and silver brocade, chenille, and other textures, principally for ecclesiastical purposes, from about 60*s*. to 70*s*. per yard.

Kondrasheff, of Moscow (353, Russia, p. 1383), for a variety of silks in brocade, damask portraits à la Jacquard, and other textures, in great variety of design and of good taste.

Lapeyre and **Dolbeau,** of Lyons (1292, France, p. 1238), for a beautiful assortment of damask reps, and some figured and chiné silk shawls.

Lemann, J., and **Son,** of Vienna (265, Austria, p. 1019), for brocatelle, embroidered in gold and silver, for ecclesiastical purposes. Also for broché gold on chenille and velvet grounds. The assortment is generally superior, and well deserving of notice and commendation.

Le Mare and **Sons,** of Spitalfields (21, p. 505), for black and coloured velvets, satins, moiré and glacé silks, some of which are made by power, and are cheap at the prices quoted.

Le Mire and **Son,** of Lyons (1649, France, p. 1256), an old-established and eminent firm, for some beautiful specimens of their earlier productions of figured silks for furniture of churches, combined with their newest styles in lampas, damask, brocatelle, and embroidery in gold and silver, for ecclesiastical vestments, and other purposes requiring even the introduction of jewellery.

Martin and **Casimir,** of Lyons (612, France, p. 1207), for an excellent assortment of black silk plush, from the highest to the lowest qualities, principally made by power. They produce annually in this article to the value of about 180,000*l*.

Massing, Brothers, Hubert, and Co., of Paris (333, France, p. 1193), for a similar assortment made by power.

Mathevon and **Bouvard,** of Lyons (1349, France, p. 1240), for some splendid specimens of rich silks for churches and ecclesiastical vestments, as well as for furniture in lampas, damask, brocatelles, and reps, worked in bouquets of flowers, in gold, silver, and silk, the cost of some being 300f. per mètre, and the mere labour of which costs from 60f. to 70f. per mètre; for moiré antique shot gold and silver, of the highest perfection; and for the woven medallion of Her Majesty, in a garland of natural flowers, beautifully designed and executed.

Menghius Brothers, of Viersen (530, Prussia, p. 1080), for a large variety of plain and fancy velvets, and velvet ribbons, well made, and cheap at the prices quoted.

Molinari, A., of Genoa (43, Sardinia, p. 1304), for plain velvets, and also for rich figured velvet for furniture, in antique designs and styles.

Montessuy and **Chomer,** of Lyons (1360, France, p. 1241), for crèpes, crèpe lisse, crèpe aerophane, and gauze of many kinds, all of which are very well made, and cheap at the prices quoted. They are manufactured by power.

Mustapha, Aga Hadgi, Turkey (596 and 663a, p. 1392), for crapes.

Naef and **Schwarzenbach,** of Thorweil (153, Switzerland, p. 1276), for lustrings and gros-de-Rhin, of various qualities, which are well made, and cheap at the prices quoted.

Orduña, V., Valencia (214, Spain, p. 1342), for damasks, velvets, and other silks of great merit.

Poliakoff and **Zamiatin,** of Moscow (205, Russia, p. 1373), for magnificent specimens of gold and silver brocade, of great originality and splendour, from 60*s* to 80*s*. per yard.

Ponson, C., of Lyons (1403, France, p. 1243), for plain silks, of different kinds and in great variety, particularly in glacé, all of which afford satisfactory evidence of the great skill and attention of the manufacturer.

Potton, Rambaud, and Co., of Lyons (1402, France, p. 1243), for a beautiful assortment of rich figured silks, in excellent taste. Their execution of a woven picture, from the original by Winterhalter, of Her Majesty, Prince Albert, and the Prince of Wales, merits the highest commendation as a work of art.

Reynier, Cousins, of Lyons (1435, France, p. 1245), for a great variety of very superior velvet, gauze, satin, and taffeta handkerchiefs, collars, shawls, and scarfs, in excellent taste.

Reichardt, F., of Vienna (268, Austria, p. 1020), for plain, figured, and moiré silks, and for black and coloured satins, all of which are well made and in good taste. A piece of wide black satin deserves particular notice for its quality and finish.

Repiquet and **Silvent,** of Lyons (1432, France, p. 1244), for a beautiful assortment of fancy vests in velvet and plush, in great variety and of excellent taste. This firm also exhibits a choice assortment of stamped velvet ribbons, of great merit.

Robinson, J. and **R.** and Co., of London (5, p. 504), for velvet vestings, black armozines, silks and satins for cravats, &c., all in good designs, and well made.

Robinsson, J. and **W.** and Co., of London (24, p. 504), for a great variety of satins, serges, velvets, plush, &c., for drapers and tailors, all of which are well made.

Robinson, J. and **T.,** of Spitalfields (6, p. 504), for black and coloured velvets.

Ryffel and Co., of Staefa, Switzerland (153, Switzerland, p. 1276), for half-Florence, Florence, and marceline, which are all good at the prices quoted.

Sanderson and **Reid,** of London (3, p. 503-4), for figured vestings, in good designs and well made.

Sapognikoff, Heirs of, of Moscow (372, Russia, p. 1384), for magnificent specimens of gold and silver brocade and other textures, chiefly for ecclesiastical purposes, excellent in design and good in execution.

Scheibler and Co., of Crefeld (534, Prussia, p. 1080-81), for a large variety of plain and fancy velvets and velvet ribbons, well made and cheap at the prices quoted.

School of Design, in Spitalfields (37, p. 505), for a brocaded silk, of considerable merit as to taste and execution.

Schopper, M. A., of Vienna (270, Austria, p. 1020), for an assortment of brocatelles, good in taste and quality.

Schwarzenbach, F. J., of Kilchberg (153, Switzerland, p. 1276), for gros-de-Rhin and poult-de-soie, all in good colours, well made, and cheap.

Seamer, Thomas, of London (15, p. 504), for moiré antique and plain velvets, well made.

Simons, J., Heirs of, of Elberfeld (514, Prussia, p. 1080), for a great variety of velvets, figured silks, cravats, handkerchiefs, scarfs, vestings, gauzes, &c., all indicating skill, taste, and good knowledge of all the appliances of their manufacture.

Soley, B., Turin (40, Sardinia, p. 1304), for rich figured silks, armures and a royale ground, for furniture; and for some gauze diaphane for the same purpose; all which are in good design, texture, and quality.

Stapfer, J., of Horgen (153, Switzerland, p. 1276), for plain, coloured, striped, and checked gros-de-Naples, which are neat in style and well made.

Staub Brothers, of Horgen (153, Switzerland, p. 1276), for figured silks deserving especial notice, exhibited by the canton. They are in good taste, and well made for the qualities and prices at which they are produced. The arms of the canton, woven in silk, deserve attention.

Teillard, C. E., of Lyons (1030, France, p. 1228), for plain glacé silks, armures in great variety, moiré antiques of the best colours, qualities, and execution, and rep silks; all of which are excellent in every respect.

Vatin and **Co.**, of Paris (1704, France, p. 1258), for an excellent assortment of fancy silk gauzes, dresses, and shawls, some brocaded and very rich.

Vom Bruck, H. Sons, of Crefeld (535, Prussia, p. 1081), for an assortment of plain velvets and velvet-ribbons, which are cheap at the prices quoted.

Walters and **Sons**, of Spitalfields (9, p. 504), for black plush for hats, in various qualities.

Wardle, H. and **T.**, Macclesfield (41, p. 505), for figured silks, handkerchiefs, and cravats.

Winkworth and **Procters**, of Manchester (65, p. 507), for shot and glacé gros, of excellent texture; also for figured and chiné silks, in chaste designs and mixtures of colour, all of which are characteristic of the taste and skill of the manufacturers.

Zeller, Felix, and **Sons**, of Hirslanden (153, Switzerland, p. 1276), for gros-de-Naples and satinet, both jaspé; all of which are in good taste and well manufactured.

Zurrer, Jacob, of Hausen (153, Switzerland, p. 1276), for Persians and sarsnets, which are well made and cheap. This house confines its manufacture to these articles, and deserves credit for the perfection to which they have arrived.

The Jury make Honourable Mention of the following Exhibitors in their respective departments:—

Alioth, T. S., and **Co.**, of Basle (154, Switzerland, p. 1276), for chappes and spun silks.

Amann and **Egli**, of Thorveil (153, Switzerland, p. 1276), for satinet chiné, lustrings, and gros-de-Naples.

Bachoven and **Vollschwitz**, of Zerbst (830, Prussia, p. 272), for black plush for travelling caps.

Bader Brothers, of Vienna (250, Austria, p. 1019), for an assortment of check and chiné silks, cravats, handkerchiefs, and scarfs.

Bert, —, of Lyons (763, France, p. 1217), for a collection of antique silks.

Bertrand, Ad., of Lyons (764, France, p. 1217), for figured umbrella and parasol silks, plaid poplins, chiné and figured silks.

Bischoff Brothers, of Basle (152, Switzerland, p. 1275-76), for plain sarsnet ribbons, being specimens of a low-priced article commanding a large sale.

Boelger, Mark, Canton of Zurich (158, Switzerland, p. 1277), for chappes and spun silks.

Bracci-Filanda, Al Fano (7, Rome, p. 294), for organzine.

Brooks, Thomas, of Spitalfields (26, p. 505), for plain silks, well made.

Bujatti, Franz, of Vienna (252, Austria, p. 1019), for damask and furniture silks; also black satins, and some table-covers for Greece, of a peculiar style.

Caldicott, R. and **R.**, of Coventry (68, p. 507), for ribbons.

Causse and **Garion**, of Lyons (1137 France, p. 1232), for white poil 12/13 deniers for ribbons, and for their organzines and trams, both white and yellow.

Champanhet-Sargeas, J., of Vals, near Aubenas (114, France, p. 1176), for organzine 18/21 and 26/28 deniers. (Awarded a Prize Medal by Jury of Class IV.)

Chwalla, Anton., of Vienna (71, Austria, p. 1010), for "drummed" silks (à tours comptés).

Delarbre, Victor, Ganges (Herault), (1176, France, p. 1234), for white organzine 10/11, and yellow 24 deniers.

Deydier, Paul, of France (1580, France, p. 1252), for organzine 18/21, and 26/28 deniers.

Eymieu, Paul, and **Son**, of Saillans (Drôme) (831, France, p. 1220), for spun silk, both weft and warp.

Fabrègue-Nourry, Son, Barnouin, and **Co.**, of Nîmes (832, France, p. 1220), for spun silk, both weft and warp.

Formento, L., of Piedmont (37, Sardinia, p. 1303), successor to Prandi, organzine 26/28 deniers.

Fries and **Zeppezauer**, of Vienna (255, Austria, p. 1019), for damask and broché shot cotton for furniture and ecclesiastical purposes; also for figured silks in low qualities.

Gantillon, T. E., of Lyons (1241, France, p. 1237), for his woven landscape.

Gessner, Auguste, of Wadenschweil (153, Switzerland, p. 1276), for armures, glacés, and striped and checked gros-de-Naples.

Greef, F. W., of Vierzen (533, Prussia, p. 1080), for velvets, and also silks for parasols and umbrellas.

Haas, P. and **Sons**, Vienna (259, Austria, p. 1019), for brocatelles of low quality. (Prize Medal awarded in Class XII.)

Hornbostel, C. G. and **Co.**, of Vienna (262, Austria, p. 1019), for an assortment of plain and figured silks in considerable variety; also for figured silk handkerchiefs, terry velvets, and figured crêpe shawls.

Huber-Rordorf, of Zurich (153, Switzerland, p. 1276), for striped and plain gros-de-Naples.

Iraf-Ogli, of Shemakha (207, Russia, p. 1373), for plain and striped goods made from Caucasian silk. Though deficient in quality and brilliancy, the low prices of these goods secure an extensive consumption.

Jacobs and **Bering**, of Crefeld (524, Prussia, p. 1080), for specimens of parasol silks.

Kaibel John, of Crefeld (525, Prussia, p. 1080), for chiné and figured silks in low qualities.

Knorr, F., of Zweybrucken (38, Bavaria, p. 1100), for silk plush for hats.

Kostner, Albert, of Vienna, Manufacturer (264, Austria, p. 1019), for an assortment of brocaded silks.

Krickl, Ernest, Vienna (263, Austria, p. 1019), for figured silks for ecclesiastical purposes. (Honourable Mention awarded in Class XIX.)

Lapteff, N., of Moscow (371, Russia, p. 1384), for plain, checked, striped chiné, and figured silks.

Lavernhe and **Mathieu**, of Uzès (1298, France, p. 1239), for poil or tram singles of 90 deniers for gaze à bluter and crêpe-de Chine, and for organzine 18/20 and 26/28 deniers.

Lokteff, J., of Moscow (204, Russia, p. 1373), for ribbons for orders of knighthood, &c., plush, vestings in gros-grains, and neckerchiefs.

Martel, Geoffroy, and **Valensot**, of Lyons (921, France, p. 1224), for an assortment of figured and broché silk cravats.

Meifredi, Armentario, of Rome, for organzine.

Méjean, A., Lyons (1353, France, p. 1241), for organzine 24/26 and 26/28, and grenadine for lace.

Meyer and **Engelmann**, of Crefeld (582, Prussia, p. 1083), for parasol silks, cravats, shawls, and vestings.

Meyer Brothers, of Zurich (227, Switzerland, p. 1281), for handkerchiefs, marceline, and flounce brochés, marceline jaspé, &c.

Max Meyer, and **Co.**, of Berlin (133, Prussia, p. 1055), for plush for vestings and caps. (Awarded in Class XV.)

Neviandt and **Pfleiderer**, of Mottmann (523, Prussia, p. 1080), for cravats and handkerchiefs in low qualities.

Pfenningberger, Joseph, Vienna (248, Austria, p. 1019), for ribbons suited for the use of the country districts of Austria, being low in quality, and cheap at the prices quoted.

Preiswerck, D. & Co., of Bâle (152, Switzerland, p. 1275), for ribbons.

Regard Brothers, of Darbres (1426, France, p. 1244), or white organzine, 32/24 deniers for ribbons. (Prize Medal awarded in Class IV. for raw silk.)

Rossi, G. M., of Sondrio (88, Austria, p. 1012), for trams and organzines.

Ryhiner and **Sons**, of Bâle (161, Switzerland, p. 1277), for chappes and spun silks.

Sauvage, R. and Co., of Lyons (1472, France, p. 1246), for moiré silks, armures, and taffetas.

Schipper, Carl, of Vienna (269, Austria, p. 1020), for black plush for hats.

Simon, H., of Zweybrucken (37, Bavaria, p. 1100), for silk plush for hats.

Sitoff Brothers, of Moscow (202, Russia, p. 1373), for an assortment of silver-gilt fringes, braidings, and wire thread, and samples of brocade.

Soper, Henry, of Spitalfields (29, p. 505), for an assortment of parasol silks.

Steiner, G., and **Sons**, of Bergamo (87, Austria, p. 1012), for trams 20/30, and organzine 22/24, and 28/30 deniers.

Stieff and **Harras**, of Potsdam (161, Prussia, p. 1057), for vestings and fancy cravats. (Prize Medal awarded in Class XV.)

Stilwell and **Son**, of Spitalfields, London (7, p. 504), for damask for furniture.

Thevenet, Raffin, and **Roux**, of Lyons (1500, France, p. 1248), for a collection of rich rep silks and chiné shawls, and crêpe-de-Chiné shawls.

Thibert and **Adam**, of Metz, Moselle (1037, France, p. 1228), for an assortment of black silk plush for hats.

Thomas Brothers, of Avignon (1040, France, p. 1228), for florences of various shades.

Troccon, A., of Lyons (1511, France, p. 1248), for a few silk shawls, and an assortment of silks for cravats.

Valansot, M., Lyons (921, France, p. 1224), for terry velvets and plushes for bonnets.

Vanner and **Son**, J., of Spitalfields, London (28, p. 505), for an assortment of parasol silks.

Von der Muehl Brothers, of Basle (162, Switzerland, p. 1277), for glacé gros-de-Naples in four qualities.

Washington and **Davis**, of London (8, p. 504) for plain and figured plushes for vestings, in great variety.

Wilson and Co., of London (10, p. 504), for silk plush for hats.

Wirz and Co., of Zurich (153, Switzerland, p. 1276), for satinet and black gros-de-Naples.

Zaloghin, of Moscow (209, Russia, p. 1373), for gros-de-Naples, glacé, and checked moiré, and satin.

THOMAS WINKWORTH, Reporter.

London, August 1851.

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CLASS XIV.

REPORT ON MANUFACTURES FROM FLAX AND HEMP.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Count Franz Ernst Van Harrach, *Chairman*, Austria; Chamberlain of His Imperial Majesty, President of Bohemian Society of Arts and Manufactures, Prague.
Charles Tee, *Deputy Chairman*, Pindar Oak, Barnsley; Manufacturer.
William Charley, *Joint Reporter*, Seymour Hill, Belfast; Bleacher.
Grenier Lefevre, *Joint Reporter*, Belgium; Member of Senate, President of Chamber of Commerce, Ghent.
Legentil, France; President of Chamber of Commerce, Paris, and of Central Jury, &c.
John McMaster, Guilford, Banbridge, Ireland; Manufacturer.
John Moir, Dundee; Manufacturer.
Carl Noback, N. Germany; German Commissioner.
Alexander Scherer, Russia; of the Ministry of Finance.
John Wilkinson, J. P., Leeds; Flax Spinner.

Before proceeding to describe the various flaxen products brought under our notice, we wish to offer a few observations on the progress and position of this important branch of manufacture. We shall, however, confine our remarks to those portions of it which are in some way exemplified by the objects collected in the Exhibition from the manufacturing countries of the world; as, in a Report like the present, a great accumulation of statistical details would be out of place, even were we prepared to offer such.

In consequence of the great antiquity of the Egyptian nation, we shall first call attention to the specimens of linen cloth sent from that country. These are in many respects much surpassed by the European manufacture. It may, however, be interesting to remark, that the first mention of linen in the ancient chronicles of the Jews certainly alludes to the productions of Egypt or some adjoining country. The Jewish priesthood were directed to use "linen garments and clothes of service;" and linen has been so generally looked upon as emblematic of purity, that it is still considered becoming in the costume of ministers, and in the services of the Christian churches.

From the Asiatic continent we have some specimens of cloth made from "*China grass.*" This article is no doubt, in its essential qualities and uses, a species of flax, and therefore properly comes under our notice. It has been produced for many years by the industrious and ingenious people of China. We have remarked that in the coarse kinds of cloth made from it, the fibre appears to be *split into lengths*, and attached to each other at the smaller ends. In this simple state the pieces are put together with great dexterity. This is an interesting example of the position of this manufacture amongst one of the most ancient nations of the world.

Beside the coarser kinds of cloth, there are exhibited some beautiful handkerchiefs and other fine linens made from this material. At the present day "China grass" is occasionally used in making coloured fabrics, combined with other substances, such as silk and cotton; and from the peculiar brilliancy of the fibre it shows to much advantage in this way. It has not as yet entered into extensive use for plain goods; but some very meritorious attempts to ascertain its utility for that purpose have been made, and are still in progress.—(See pp. 370, 371.)

Among the continental nations of Europe, the northern have long been celebrated for the production of flax and its manufactures; Flanders being especially distinguished for the beauty of its fine goods, and Russia and Germany for the strength and durability of their heavy and other linens.

It is a remarkable fact, that so long as hand-spinning was the only known way of producing yarn, Great Britain and Ireland were not much noted for the manufacture of linens. The wonderful change, however, wrought by the invention of the "spinning jenny," and its application to cotton machinery, speedily led to the development of the same principle in making mill-spun yarn from flax and hemp.

The immense and cheap supply of coal possessed by Great Britain, and the consequent facility in producing steam-power, combined with the privilege of first applying spinning by machinery to any great extent, has given her considerable advantage in the production of many descriptions of mill-spun yarns and manufactured goods. Lately this system is becoming more general on the Continent, although there has been for a long time a strong prejudice in favour of hand-spun yarn, especially in Flanders. This latter country (comprising portions of Belgium and France) has long been celebrated for the production of the finest kind of flax, and the superior texture of its hand-spun yarns. These latter require most careful and skilful manipulation, more particularly in the exceedingly fine description used in making the beautiful lawns and handkerchiefs of Cambray and Valenciennes. Ireland is producing, very extensively, both lawns and handkerchiefs, more distinguished, without doubt, in the lower and middle-priced qualities for general consumption than in the extremely fine goods. The same country has now for many years enjoyed a high and merited reputation for its linen manufactures, and supplies large quantities of the usual kinds to the different markets of the world. Scotland is pre-eminent in low-priced goods, of the qualities extensively used at home and abroad. The principle of weaving by power-loom appears to be coming into very general use in that country, and also on the Continent, as will be found by inspecting our Report further on.

The Jacquard loom is now much used in making damasks, and has tended to improve, in many respects, the manufacture of that article, both in the British dominions and on the Continent.

England produces a large quantity of mill-spun yarn from flax. Although her attention is more directed to the manufacture of cotton, she has contributed heavy linens, which, for texture and durability, are deservedly celebrated.

For the better elucidation of our decisions, we have divided our remarks on this Class into two principal departments, viz., 1st, *The prepared fibre and spun or twisted fabrics*, such as yarn, threads, and cordage; and, 2ndly, *The woven fabrics* of all kinds.

We have also divided these into minor sections, keeping, as near as possible, to the printed form of classification issued by the Royal Commissioners for the guidance the Juries. As a general rule, we have endeavoured ibstain from mentioning any person more than once in Report; but there are a few cases where such persons rve special mention in more than one of the subdivis or minor sections. Some of their productions might overlooked if all were mentioned together, and therefore we have occasionally noticed such cases twice.

We shall now proceed to detail the results of our examination.

I. FLAXEN FIBRE.

In the specimens of prepared flaxen fibre the Jury did not observe anything worthy of very particular comment, or any feature exhibiting a decided improvement in the management of flax for manufacturing purposes. Honourable Mention, however, is made of two Exhibitors:—

DESMEDT and Co., Zele, East Flanders, Belgium (104, Belgium, p. 1154); and **LOUIS DUMORTIER**, of Bousbecque, near Lille Nord, France (177, France, p. 1182).

There are other samples of Flemish flax which are meritorious on account of their extreme fineness.

The Jury regret that the specimens of good flax from Ireland are so few in number. Those exhibited by Messrs. **BERNARD** and Co. of Belfast, and rated on Schenck's patent hot-water steeping process in sixty hours, are the best samples; and those by **GAILEY**, of Coleraine, rated on the *old cold-water* principle, are good specimens of the material prepared in that way. Both are worthy of commendation, and the Jury make Honourable Mention of them. [See "Royal Belfast Flax Improvement Society:" 106, p. 203.*]

The particular attention of the Jury was directed to the specimens of English flax, as illustrating the successful growth of that useful and valuable plant by some of the agriculturists of this country.

The samples exhibited by Messrs. **HIVES** and **ATKINSON**, of Leeds (45, Class IV. p. 198*), and grown by Mr. **WARNES**, of Trimingham, Norfolk, possess a large proportion of the necessary qualities of perfect flax, and are equal, in point of quality and strength, to any the Jury met with of similar fineness. The dressed line, with the yarns from it, are excellent, and run up to a tolerable degree of fineness.

The specimens exhibited by Messrs. **CATOR, NELSON**, and Co., of Selby (46, Class IV., p. 198*), are also very good, the flaxen fibre being evidently well rated, scutched, and put out of hand. The quality is sound, tough, and good. Great credit is due to both these firms for the pains they have taken to bring forward such meritorious specimens of English-grown flax.

The Jury have also to notice that an excellent assortment of prepared flax, of various qualities, has been sent from Russia; but in comparing these with other specimens, the Jury did not observe anything worthy of special remark.

Before quitting the department of flaxen fibre, the Jury desire to report that as it was questionable whether the preparation of flax by the method of M. **CLAUSSEN** (Cl. IV., p. 202*-3*) should properly come under their cognizance, they have not pronounced any judgment on the merits of this novelty. After being disengaged from the flax straw, it may be said to become by M. Claussen's process "cotton," in all its essential qualities, and is intended to be manufactured by cotton machinery, and to compete with that material. The Jury, therefore, do not feel competent to venture an opinion as to its practical utility and value.

China Grass.

Among the specimens shown of the different stages of preparation, dressing, and manufacture of "China grass," the Jury consider the series exhibited by Messrs. **MARSHALL** and Co., of Leeds (Class IV., p. 199*), the most suitable for manufacturing purposes. This house is deserving of great commendation, for the trouble and expense it has incurred in testing the utility of this material.

Yarns.

In mill-spun yarns there appears to be little competition. The yarns exhibited by Messrs. **HIVES** and **ATKINSON**, of Leeds, and spun from the flax grown by Mr. **WARNES** (*ut suprà*), as already noticed, are superior in quality and spinning, without reference to price. They consist of from 40 to 200 leas line, and are, in all respects, good in quality, fully confirming the opinion already expressed of this flax.

Ireland produces a great quantity of flax yarns, but is not adequately represented in this department. There are a few specimens from Scotland, of fair quality.

In the exhibition of hand-spun yarns there is a great amount of excellence displayed in the various specimens, more particularly in those from Belgium. The samples shown by Messrs. **BERTHELOT** and **BONTÉ**, of Cambrai (p. 1158), are surprisingly fine, perfect, and beautiful, being up to 1200's warp and 1600's weft yarn, and are certainly equal, if not superior, to anything of the kind hitherto produced. The specimens from Ireland are also very creditable; that spun by **JANE MAGILL**, 84 years of age, being the finest (760 leas), and that by **ANN HARVEY** (about 600 leas), being the most perfect in quality and spinning (No. 106, p. 203* Class IV.) The Jury recommend the award of money premiums to these individuals, as, from their lowly condition, this will be the best and most useful recognition of their skill.

The yarns from the **HEEPEN SPINNING-SCHOOL**, Bielefeld (546, Zollverein, p. 1081), are also very excellent, considering the youth of the spinners. One sample produced by a little girl of 10 years old, is very fine, and exceedingly well spun out of a weak material. Another sample, by a child 8 years of age, is very good, but not quite so perfect. The Jury consider the former of these a proper subject for pecuniary reward, and have recommended that, and the two previously-noted cases, for this distinction.

Linen Lacing Threads.

In the samples of linen threads, there is such varied and general merit, that the Jury found it exceedingly difficult to draw any marked distinction as regards superiority. Those exhibited by Messrs. **MARSHALL** and Co., of **LEEDS**, (No. 26, p. 511) are found to be the most perfect as regards evenness of spinning, particularly in the fine numbers; and the Jury desire to state that the Prize Medal already awarded to this house for examples of China grass, is intended also to mark the high merit of the threads exhibited, which would certainly have received a Prize Medal, if the award had not been already made on another ground.

In shoe threads, those exhibited by Messrs. **W. B. HOLDSWORTH** and Co., Leeds (53, p. 512), are the best; and the samples shown by Messrs. **FINLAYSON, BOUSFIELD**, and Co., Glasgow (48, p. 512), and Messrs. **TITLEY, TATHAM**, and **WALKER**, Leeds (51, p. 512), are of good quality. The two former firms having been awarded Medals on other grounds, it is sufficient to record this opinion of the shoe threads.

Cordage, &c.

The Jury found the collection of ropes for marine and other purposes, with cord, twine, &c., very limited in extent; and from the few goods exhibited it is impossible to have a precise idea of the progress made of late years in these manufactures. They found but one exhibitor worthy of the honour of a Medal.

II. WOVEN FABRICS.

In the second department of flaxen products, namely "woven fabrics" of all kinds, the following countries have contributed:—England, Scotland, and Ireland, France, Belgium, Russia, North Germany, Spain, Portugal, China, and Egypt.

From the British dominions there is about one-half the number of the entire exhibitors and goods.

(*a*) *Canbas, Sailcloth, Sacking, Carpeting, &c.*

Some goods have been exhibited by several manufacturers in conjunction, from the town of Bridport, and the district of Crewkerne, Somersetshire (the latter generally styled Coker canvas), all of excellent quality. The Jury being of opinion, in such cases, that Medals could not be awarded, think that Particular and Honourable Mention is due to them.

In this subdivision the Jury have found great excellence, the exhibition of the various countries being highly creditable to the manufacturers engaged in this branch of industry.

(*b*) *Woven Fabrics, heavy and low-priced Linens; Huckabacks, Crash, Duck, Ticks; Low Sheetings, Brown and Fancy-striped ditto, Dowlas, Holland, Low Brown Linens, Osnaburgs, &c.*

The goods of this subdivision are of very extensive consumption, and their chief characteristic, especially in the Scotch and Irish, is lowness of price; those exhibited by the manufacturers of Barnsley are of very superior quality for family use, and consist of an extensive assortment of ducks and drabbets, ticks, damasks, hucks, &c.; being an exposition of the peculiar manufacture of that town and district. The Jury were much pleased with the general excellence of these goods.

(*c*) *Plain Linen of all widths, bleached or unbleached.*

In this subdivision the exhibition is very extensive and varied, and the goods generally display much care and skill of manufacture, particularly the finer descriptions.

Count Harrach, of Janowitz, Moravia (285, Austria, p. 1020), has exhibited hand-spun bleached linen and bleached yarn of very fair quality. Also fancy damasks for lining carriages and for covering furniture, made in imitation of silk.

These latter the Jury consider worthy of special notice; but Count Harrach, being a member of the Jury (and also Chairman), cannot compete for any Medal. The skill and merit, however, in producing these goods, deserve high commendation.

The Royal Belfast Flax Improvement Society (p. 203*), have exhibited a very interesting series of patterns of the flaxen manufactures, characteristic of that country; comprising sacking, huckabacks, drills, diapers, ticks, linens, lawns, hollands, &c.

Whotune, a merchant of Canton, China (1419), has shown, in the department allotted to that nation, a variety of cloths and handkerchiefs made from China grass. Honourable Mention is due to him, as the only exhibitor of this peculiar article from that country.

Some samples have also been contributed by Marshall and Co., of Leeds (55, Class IV., p. 199*), of cloth from this material. In speaking of yarns, allusion has already been made to the merit they deserve in improving and developing the manufacture of this material.

Wilford, John, & Sons, of Northallerton (42, p. 512), have sent, with their other goods, a piece of sheeting made from China grass, and bleached in Ireland. This is also worthy of notice.

(*d*) *Drills, Damasks, and Twilled Linens of all kinds.*

In this subdivision the Jury have had much difficulty in discriminating, the competition being so close and the excellence of the goods so general.

The town of Barnsley, as before mentioned, exhibits very deserving specimens of its manufacture in this subdivision. And the names of those manufacturers who have contributed to this Exposition will be found duly classified amongst those of whom Honourable Mention has been made.

Charles Tee and Son, of that town (37, p. 512), have exhibited a varied and beautiful assortment of plain and fancy cloths for waistcoats and dresses of excellent quality, and made with great taste in the patterns. The Jury would have awarded a Medal to these goods, but Mr. Tee, senior, being a member of this Jury, cannot enter into competition for such a distinction. Honourable and Special Mention is therefore due.

(*e*) *Cambrics, Lawns, and Printed Linens, for Dresses, &c.*

This subdivision is the last of Class XIV.

Conclusion.—In conclusion, the Jury wish to remark, that the management of flax and its products involves a great amount of skill and labour, from the sowing of the seed till the completion of the manufactured articles; and they have to express their satisfaction at the excellence of the textile fabrics contributed by the various countries,—an excellence so general, as to render their task of selecting the best, in many cases, exceedingly difficult. Bearing in mind the wish of the Royal Commissioners, they have sought to reward *superior merit* wherever such has appeared evident. In cases of very close and doubtful competition, they have given Medals, or Honourable Mention, to each of the parties. The Jury have avoided, as much as possible, invidious comparisons between nations, or individuals, feeling satisfied the public and business-men will discriminate in this respect for themselves. The remarks in this Report, as before mentioned, are confined to subjects brought under their notice, in examining the collection of goods in the Building.

The Jury have decided on not recommending any Council Medals in this Class, as they considered that such a distinction was intended to mark either discovery or invention, or such a new application of known materials as might tend to important results in the department of industry to which it was applied, and not to perfection of manufacture or taste.

It is satisfactory to the Jury to be able to state, that there has been no disagreement amongst the members in making their decisions. This fact not only confirms them in the justice of their awards, but will tend to strengthen the public reliance in their impartiality.

The office of Judge or Juror is at all times one of great responsibility, and on the present occasion more particularly so, as the whole world is waiting their decisions. The members of the Jury are sensible of the confidence placed in them, in being selected for such an honourable task, and they have endeavoured faithfully to discharge the important and onerous duties entrusted to them.

The Jury award Prize Medals to the following exhibitors in the various subdivisions:—

Imperial Alexandrovsk Manufactory, Russia, (19a, Russia, p. 1366), for canvas of superior quality.

Andrews, Michael, Ardoyne, Belfast, Ireland (5, p. 510), for excellence in double damask table-cloths and napkins.

Berthelot and Bonté, of Cambrai, Belgium (216, Belgium, p. 1158), for superior excellence and fineness in hand-spun flax yarn.

Beyer's Widow & Co., Zittau (51, Saxony, p. 1107), for superiority of design in damask cloths and napkins.

Birrell, David, Dunfermline (27, p. 511), for damask table-cloths and napkins of superior quality, fineness, and design.

Bolenius and Nolte, Bielefeld (562, Prussia, p. 1082), for fine linens.

Boniface and Son, of Cambray (32, France, p. 1172), for cambrics of exceedingly fine and beautiful finish.

Clibborn, Hill, & Co., Banbridge, Ireland (20, p. 511), for diapers. An excellent assortment, bleached.

Cooreman, A. J., Rebecq, Belgium (212, Belgium, p. 1158), for the finest and most perfect lace thread made from hand-spun yarns.

Coulson, James, & Co., Lisburn, Ireland (92, p. 516), for an extensive and admirable exhibition of fine, well-made damask table-cloths and napkins.

Cox Brothers, Dundee (63, p. 513), for low-priced striped bedding and hessians.

Cumont-Declercq, Alost, Belgium (235, Belgium, p. 1158), for superiority in the colour of his linen threads.

Dautremer and Co., of Lille (Nord) France (137, France, p. 1178), for excellent quality and evenly-spun flax-yarns, from 100 to 320 leas.

Decock-Wattrelot and Baudouin, Roulers, Belgium (221, Belgium, p. 1158), for fine linens. A good variety.

Eickholt, Anton, Heirs of, Warendorf (549, Prussia, p. 1081), for neatness of design in his exhibition of damasks, and goodness of colour in his linens.

Ferrol, Royal Manufactory of Isabella II. at, Spain (193, Spain, p. 1341), for canvas of superior quality.

Finlayson, Bousfield, & Co., Glasgow (48, p. 512), for the strong threads exhibited in the coarse and dle sizes, and for the great taste and neatness with h they are got up.

ASER, DOUGLAS, Arbroath (79, p. 515), for canvas of rior quality, made by steam-power looms.

ASSOT and Co., Lyons (526, France, p. 1204), for perior style of damasks, and excellence in carrying out he patterns.

HARO, E. F., 18 Rue des Petit Augustins, Paris (866, France, p. 1221), for the extraordinary dimensions and excellence of canvas for historical painting.

HENNING, JOHN, Waringstown, Ireland (16, p. 510), for damask table-cloths of superior patterns and quality, bleached, brown, and mixed colours.

HIVES and **ATKINSON**, of Leeds (45, Class IV., p. 198*), for good quality in mill and spun yarns.

HOLDSWORTH, W. B., and Co., Leeds (53, p. 512), for the superior style and colour of their satin-finish linen threads, being the best examples of threads prepared by that method.

KIRK, WILLIAM, & Son, Armagh, Ireland (10, p. 510), for brown linens, of low description and prices; Hollands, brown, black, and slate-coloured, &c.

KRAMSTA, C. G., and Sons, Freyburg, Silesia (128, Prussia, p. 1055), for a good assortment of bleached platillas of export quality.

KUMS, E., Antwerp (468, Belgium, p. 1166), for variety of low heavy goods, comprising canvas, imitation Russia sheeting, &c.

LAING, J. and A., Dundee (63, p. 513), for ducks, imitation Russian sheetings, striped ditto, &c., of excellent quality.

LAWSON, ALEXANDER, Fifeshire (63, p. 513), for a large and low-priced variety of dowlas, hucks, sheeting, window-blinds, &c.

M'CAY, THOMAS, Dromore, Ireland (19, p. 511), for an exceedingly fine piece of fronting linen, made of mill-spun warp and hand-spun weft, exhibited brown.

MALO-DICKSON and Co., Dunkirk, France (320, France, p. 1192), for canvas of superior quality.

M'MURRAY, THOMAS, and Co., Dromore (25, p. 511), for a superior assortment of fine linens, bleached.

MARSHALL and Co., of Leeds (55, Class IV., p. 199*), for their examples of the preparation of "China grass" for the purposes of manufacture.

MERLIE-LEFEVRE & Co., Havre (926, France, p. 1224), for a varied assortment of cordage of remarkably good character.

MESTIVIER and **HAMOIR**, Valenciennes, France (636 France, p. 1208), for the great excellence and superiority, exceedingly-fine and very beautiful finish, of their assortments of cambrics, plain and bordered.

MILVAIN & HARFORD, Newcastle-on-Tyne (71, p. 514), for canvas of superior quality, made with bands, which add to the strength.

MÖRMAN-VANLAERE, J., Ghent (231, Belgium, p. 1158), for variety of canvas of tow, flax, and hemp, and very broad coverings for railway waggons.

PARMENTIER, P., Isighem, Belgium (222, Belgium, p. 1158), for fine linens of superior quality, exhibited brown, and made from mill-spun yarn of Liege. Also a small assortment of handkerchiefs, very well manufactured.

PELDRIANS' HEIRS, Hohenelbe, Bohemia (288, Austria, p. 1021), for fine linen, of hand-spun yarn.

RICHARDSON, I. N., SONS, & OWDEN, Belfast (7, p. 510), for a superior assortment of light shirting linens for export, bleached.

SADLER, FENTON, and Co., Belfast, Ireland (18, p. 510-11), for a superior assortment of heavy shirting linens, for home trade, bleached.

SCRIVE BROTHERS, Lille, Nord, France (1007, France, p. 1227), for damasks, including their yarns and power-loom goods.

SMIETON, J. and Son, Dundee (63, p. 513), for dowlas, crequillas, creas, &c., of light and low-priced quality for export.

WAENTIG, CHR. DAV., and Sons, Gross-Schonau, near Zittau and Leipsic (53, Saxony, p. 1107), for damask table-cloths and napkins, of superior neatness in design and good quality.

WARNES, JOHN, of Trimingham, Norfolk, for the growth and preparation of the flax exhibited by Messrs. Hives and Atkinson, of Leeds (45, Class IV. p. 198*).

WESTERMANN, A. H., and Co., Bielefeld, Westphalia (543, Prussia, p. 1081), for linens, well bleached.

WILFORD, JOHN, and Sons, Northallerton, Yorkshire (42, p. 512), for plain and fancy drills of very superior quality of styles.

The Jury make Honourable Mention of the following Exhibitors :—

AMEYE-BERTE Ghent (209 Belgium, p. 1158), for waggon-coverings and other heavy goods made by power-looms.

BECK and Sons, and other exhibitors, Switzerland (163, Switzerland, p. 1277), for damasks and drills of fair quality.

BECK and Son, Courtrai, Belgium (324, Belgium, p. 1161), for a very fine piece of linen of hand-spun yarn, bleached. (Prize Medal awarded in Class XIX.)

BELL, T., and Co., Lurgan, Ireland (6, p. 510), for a good assortment of cambric handkerchiefs.

BERNARD and Co., Belfast, Ireland, for good hot-water steeped flax. (203*.)

BEVERIDGE, ERSKINE, of Dunfermline (29, p. 511), for damasks. (He also exhibits a good variety of stair and floor covering, &c.)

BOLENIUS and **NOLTE**, Bielefeld, Germany (562, Prussia, p. 1082), for evenly-spun flax yarns, 480's being the finest.

BRUZGHIN, ALEXANDER, Kaluga (216, Russia, p. 1373), for good canvas.

BURBACH BROTHERS, and Co., Horfelgii, (799, Prussia, p. 1094), for water-pipes of hemp, without seams.

CANTER, J., Barnsley (36, p. 511), for ducks, drabbets, &c.

CARTER BROTHERS, Barnsley (36, p. 511), for ducks, drabbets, &c.

CARTHAGENA, Royal Arsenal, Spain (191, Spain), for excellence of cordage.

CATOR, NELSON, and Co., of Selby (46, Class IV. p. 198*), for the excellence of their flaxen fibre. (Honourable mention awarded in Class IV.)

CORRY, BLAIN, and Co., Belfast (24, p. 511), for good damasks, made with power-looms; and a beautiful and novel design, on paper, for a table-cloth, not yet executed in cloth.

COULSON, WILLIAM, Lisburn, Ireland (93, p. 516), for a very fine damask cloth.

DAUDRÉ, A., St. Quentin (1170, France, p. 1233), for good damasks.

DÉROUBAIX, HENRI, Courtrai (239, Belgium, p. 1158), for good drills and other articles.

DESMEDT and Co., Zele, East Flanders, Belgium (104, Belgium, p. 1154), for specimens of Flemish flax, being the most perfect from Belgium. (Prize Medal awarded in Class IV.)

DOBBELAERE-HULIN, Ghent (208, Belgium, p. 1158), for brown hand-spun sheetings, imitation Russian ditto, of good quality.

DOMMER, T., Alost, Belgium (233, Belgium, p. 1158), for some good cambric handkerchiefs, white and printed, and a variety of other linen articles.

DON, W. & J., and Co., Forfar and Dundee (63, p. 513), for brown sheetings and Osnaburghs of good quality.

DON BROTHERS and Co., Forfar and Dundee (63, p. 513), for brown sheetings and Osnaburghs of good quality.

DOUMORTIER, LOUIS, of Bousbecque, near Lille, Nord, France (177, France, p. 1182), for the best and most perfect specimens of scutched flax, rated and prepared on the Courtrai system. (Prize Medal awarded in Class IV.)

EASSON, ALEXANDER, Dundee (63, p. 513), for sail-cloth and sacking of tow, hemp and jute.

EDINBURGH ROPE AND SAIL-CLOTH COMPANY, Edinburgh (p. 513), for good canvas.

ELMENDORF, E. F., (470, Prussia, p. 1078), for specimens of good middle-sized yarns.

FERIE, WENZEL, Bohemia (284, Austria, p. 1020), for lawns of fine quality and colour.

FLETCHER, H. T Barnsley (36, p. 511), for ducks, drabbets, &c.

GAILEY, D., Coleraine (106, Class IV., p. 203*), for flax steeped upon the cold-water system.

GHENT LINEN COMPANY of Belgium (230, Belgium, p. 1158), for the heavier examples of tow yarns.

GODARD and **BONTEMPS**, Valenciennes and Paris (240, France, p. 1188), for a good variety of white and printed fine cambrics.

GOENS, L. J., Termonde (237, Belgium, p. 1158), for general excellence of cordage.

GUYNET and **BECQUET**, of Cambray and Paris (254, France, p. 1189), for fine cambrics.

HATTERSLEY, PARKINSON, & CO., Barnsley (36, p. 511), for ducks, drabbets, &c.

HAXWORTH and **CARNLEY**, Barnsley (36, p. 511), for ducks, drabbets, &c.

HENNING, JOHN, Waringstown, Ireland (16, p. 510); Honourable Mention is here made, as this exhibitor is awarded a Medal for damasks, which also includes the variety of cambrics and printed goods he has exhibited in this subdivision.

HOLLOWAY, T. J., Salisbury (74, p. 515), for the general excellence of the cordage exhibited by him.

HUNT, W. and SON, of Dunfermline (28, p. 511), for good quality and designs in damasks.

JOUBERT-BONNAIRE, and Co., Angers (552, France, p. 1205), for good canvas, principally made of hemp. (Prize Medal awarded in Class IV.)

JACKSON and **MATTHEWMAN**, Barnsley (36, p. 511), for ducks, drabbets, &c.

KAZALETT, A., St. Petersburgh (102, Russia, p. 1369), for general excellence of cordage.

KIRSTEIN, C., Bielefeld (120, Prussia, p. 1055), for a good assortment of linens.

KROENIG, F. W. and SONS, of Bielefeld (556, Prussia, p. 1081), for a good assortment of linen.

LAINÉ-LAROCHE, and **MAX-RICHARD**, Angrês, Maine et Loire, France (286, France, p. 1190), for dry spun-yarns made of hemp, of good material and quality. (Prize Medal awarded in Class IV.)

LANDERNEAU JOINT STOCK LINEN COMPANY, France (1019, France, p. 1227), for good canvas made from hemp.

LEADBETTER, J., and Co., Dundee (63, p. 513), for a low-priced variety of checked and striped linens.

LEGRAND, DANIEL, Avesne, Nord, France (1313, France, p. 1239), for good and fine cambric handkerchiefs.

LIESKE and **HÄBLER**, Gross-shandle (52, Saxony, 1107), for good damasks.

MALCOLM, J., Lurgan, Ireland (22, p. 511), for bleached lawns and handkerchiefs,—a good variety.

MENGDEN, MICHAEL VON, Russia (222, Russia, p. 1373), for good damasks.

MOORE, W. F., Isle of Man (67, p. 513-14), for good canvas.

PIGOT and **NEWTON**, Barnsley (36, p. 511), for ducks, drabbets, &c.

RENNY, SONS, and Co., Arbroath (81, p. 515), for good canvas.

RICHARDSON, J. and T., and Co., Springfield, Lurgan, Ireland (21, p. 511), for cambric handkerchiefs.

RICHARDSON and Co., Lisburne (23, p. 511), for excellency of bleach, shown in fine linens.

ROYAL BELFAST FLAX IMPROVEMENT SOCIETY (Class IV., 106, p. 203*), for a very interesting series of patterns of the flaxen manufactures, characteristic of that country; comprising sacking, huckabacks, drills, diapers, ticks, linens, lawns, hollands, &c. (Council Medal awarded in Class IV.)

SCHULZE, DANIEL, Bodenteich, Luneburgh, Hanover (6, Hanover, p. 1133), for specimens of good middle-sized yarns.

SEEMANN, C. and H., Stutgard (36, Wurtemburg, p. 1117), for fine white and printed linen.

SIEGL, J., and Co., Moravia (290, Austria, p. 1021), for a good specimen of creas, bleached.

ST. BERNARD, the House of Correction, at Antwerp (226, Belgium, p. 1158), for dowlas, imitation Russia sheeting, ducks, &c.; a good variety.

TITLEY, TATHAM, and **WALKER**, of Leeds (51, p. 512), for excellence in colour of the linen threads.

VAN ACKERE, J. C., Courtrai (215, Belgium, p. 1158), for a very fine piece of linen of hand-spun yarn, double thread, in warp.

VAN DEN HOOGEN, T. Dortrecht, Holland (26, Netherlands, p. 1143), for general excellence of cordage.

VAN DER VOORT, H., Boxtel, Holland (45, Netherlands, p. 1144), for good damasks.

WALTON and Co., Knaresborough (38, p. 512), for sheetings and huckabacks of good quality.

WARDEN, A. J., Dundee (63, p. 513), for carpeting made of jute.

WESSEL, F. W., Beilefeld (542, Prussia, p. 1081), for a good assortment of linens.

WHOYUNE, of Canton, China (p. 1419), for a variety of cloths and handkerchiefs made from China grass.

WILFORD, WILLIAM, Tamise, Belgium (211, Belgium, p. 1158), for good canvas.

WILFORD, JOHN, & SONS, of Northallerton (52, p. 512), have sent, with their other goods, a piece of sheeting made from China grass, and bleached in Ireland. This is also worthy of notice.

WILKS, JONAS, Watling-street, London (31, p. 511), comprising bleached and brown, heavy and fronting linens, huckabacks, and Russia sheetings, all of very excellent quality and style. This gentleman exhibits as a merchant; but the Jury, in accordance with the rules laid down by the Royal Commissioners, cannot award a Medal in such a case, he not being the manufacturer.

The Jury award the sum of 10*l.* each to the following subjects:—

HARVEY, ANN, Belfast, Ireland, for perfection and quality of hand-spun flax yarn. Exhibited by the Royal Flax Society of Ireland (106, Class IV., p. 203*).

HEEPEN SPINNING-SCHOOL, Bielefeld, Germany (546, Prussia, p. 1081), to a little girl 10 years of age, for fine and well-spun flax yarn.

MAGILL, JANE, Belfast, Ireland, for fine hand-spun flax yarn. Exhibited by the Royal Flax Society of Ireland (106, Class IV., p. 203*).

WILLIAM CHARLEY, } JOINT REPORTERS.
GRENIER LEFEVRE, }

London, June 1851.

Google

CLASS XV.

REPORT ON MIXED FABRICS, INCLUDING SHAWLS, BUT EXCLUSIVE OF WORSTED GOODS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

CHARLES VAN HOEGAERDEN, *Chairman*, Belgium; Merchant, Member of Chamber of Commerce, Brussels.
JOHN R. LAVANCHY, *Deputy Chairman*, 6 New Burlington Street; Silk Mercer.
W. CLABBURN, Norwich; Manufacturer.
MAXIME GAUSSEN, France; Member of the Central Jury.
DAVID KEMP, Glasgow; Shawl Merchant.
N. KINGSBURY, United States; Manufacturer.
JOHN MORGAN, Grenlaw, Paisley; Manufacturer.
WILLIAM PRINSEP, *Reporter*, 30 Gloucester Gardens.
TITUS SALT, J. P., Bradford; Manufacturer.
FREDERICK SCHWANN, Huddersfield; Merchant.
JOHN H. SWIFT, United States; Merchant.
Sir GARDNER WILKINSON, Turkey.

Associates.

F. BERNOVILLE, France; Spinner and Manufacturer. (Juror in Class XX.)
GEORGE HAIRS, 31 Milk Street, City; Shawl Manufacturer.

A.—MIXED WOVEN FABRICS, OF VARIOUS MATERIALS, SHOT WITH EITHER COTTON, LINEN, WOOL, SILK, MOHAIR, OR OTHER SUBSTANCES.

THE description given in the "Classification for the use of Juries" of the articles to come under the examination of this Class is so very miscellaneous, namely, "for dresses, damasks, aprons, shoe and boot cloths, linings, cravats, vestings, ponchos, pantaloon cloths, coatings, tweeds, quiltings, plaids, tabinets, poplins, paramattas, chalis, barèges, cashmeres, articles for furniture, shawls," that some necessity was found for drawing a line more definitely between this and Class XII., where, under the head of "Woollen and Worsted," many of the above articles would be better placed.

We have consequently confined our notice to the following articles:—Vestings, coatings, tweeds, linings, pantaloon stuffs, shoe and boot cloths, cravatings, plaids, tabinets, poplins, paramattas, cashmerets, cassinets, chalis, barèges, cashmeres, shawl cloths, and Utrecht velvets.

General Remarks.

It is difficult to give a correct idea of the origin of many of these fabrics. Varieties of them have been made in Yorkshire, Gloucestershire, and Norfolk, from time immemorial, and are of equally ancient date in many parts of Europe. The introduction of spun silk with wool may be dated from 1685, when the revocation of the Edict of Nantes brought over to Spitalfields and to Norwich especially nearly 30,000 artisans from Paris and Lyons, who established these manufactures in England. We find that the importations of silk into Ireland in that year were of 80,000*l.* value. Tabinets or poplins have been produced in Ireland ever since 1771. Novelties are being constantly introduced, both in style and texture, as well as in new combinations of materials, and many most valuable experiments of this character have been adopted, particularly within the last ten years. We may notice two articles in particular, which have become of great importance to this class of manufactures, viz., alpaca and mohair. The former is the wool or hair of an animal of the llama tribe from the region of Peru; the latter, that of a goat peculiar to Asia Minor: and some idea of the rapid development of such novelties may be formed from the following returns of imports, viz.,—Of alpaca wool, from 1836 to 1840, 7000 bales per annum; from 1841 to 1845, 13,000 bales per annum; from 1846 to 1850, 20,000 bales per annum. Of mohair, in 1841, 5,621 bales; in 1850, 12,884 bales.

We believe that to England must be accorded the chief credit of searching for and adopting most of the new and important materials which are every year being introduced into these manufactures, tending naturally to increase the value of the trade: she also takes the lead in the quantity of production. France, ever ready to adopt and improve, produces very largely the same articles, and is peculiarly successful in the finer and richer descriptions, where delicacy of design and colour is most favourably applied; and had she equal facility with England in sending her productions into foreign markets, the development of her medium classes of these goods would have been more complete. Austria has made very great progress within the last ten years in these fabrics; her materials are excellent, and ably put together; and she presents them at low price, for a large internal consumption. Bohemia, in particular, supplies tissues of a quality that bears the stamp of decided progress. Labour in these countries is extremely cheap, and the artisans are intelligent, and if the progress now apparent continues with increased energy for the coming ten years, their productions may vie, particularly in price, with those of all Europe; but we find no originality among them, whether of design or manufacture. Prussia and the States of the Zollverein have given valuable proofs of their powers of copying the productions of France and England. They require but the support of capital, and the encouragement of a natural taste for design, to become the producers of the best articles at low prices; for in many cases they have the raw material at hand, and they are not wanting in either energy or ingenuity to give the fullest development to such advantages. In Belgium we find proofs of a very active commerce in these fabrics, and an increasing desire to take advantage of the demand for exportation of middling and low-priced goods. The ancient excellence of the weavers of that country has not, apparently, prompted the manufacturers to keep the lead in textile fabrics, either in character or quality. Their produce is very extensive, both for the home and foreign demand, and they appear to prefer leading purchasers to their stores by cheapness and goodness of manufacture, rather than by the attraction of superior excellence or novelty. Portugal has exhibited some good copies of French and English fabrics, which give fair promise of excellence. Egypt has contributed some specimens of its early essays in these fabrics; but as they are chiefly the produce of artisans of other countries, they should only be noticed as evidence of her desire to promote the industry of her population in working upon the raw materials at her command.

The peculiar feature of this manufacture is, that in most descriptions the hand-loom alone is made use of, giving employment to a vast number of persons, we may perhaps say millions; who are thus, by the various occupations connected with it, placed entirely above want.

Particular Remarks.

Exhibitors of various articles are in number as follows:—

From England	30
Scotland	3
Ireland	6
France	11
Zollverein States	38
Austria	16
Belgium	13
Holland	1
Portugal	2
Switzerland	2
Total	122

Among whom we proceed to notice those who are most worthy of remark.

Schwann, F., Huddersfield (115, p. 490). All his assortment of embroidered cashmeres and other descriptions are of perfect character, particularly the valentias. The designs are rich, and in good taste; and the execution such as to create regret that the names of the artisans are not recorded.

This contributor being a member of the Jury of this Class, his goods are not under consideration in competition for the reward of merit.

The Jury award Prize Medals to the following Exhibitors in this department:—

Atkinson, R., and Co., 30 College Green, Dublin (256, p. 498), for poplins of excellent quality, rich in colour, and perfect in manipulation. There are some double and triple corded, of admirable execution. The figured pieces are of good design and brilliant effect. The specimen given of their weaving, by the presence of one of their weavers, who works at an elegant loom upon a rich and elaborate design, is highly interesting and instructive.

Bolingbroke, C. and F., Norwich (311, p. 501), for poplins, plain, striped, watered, of superior make and excellent colours; the character of their manufacture is highly meritorious.

Brown and Forster, 5 Vigo Street, Regent Street, London (9, p. 480), for a variety of superior vestings, of cotton warp and weft of wool, worked by Jacquard, in designs of excellent taste; likewise stuffs of other descriptions. Their waistcoatings of plush vegonia will be found remarkable for novelty and excellence, and as being well adapted for a large consumption.

Catteaux Brothers, Brussels (244, Belgium, p. 1159), for pantaloon stuffs of cotton-wool and linen with cotton. They are fabrics of good taste and extensive consumption, and highly deserving of merit for cheapness.

Catteaux-Gauquié, Courtray (245, Belgium, p. 1159), for fabrics of the same description, but chiefly calculated for the lower classes. A Prize Medal is awarded for goodness of texture and cheapness.

Cormaldi, D., Vienna (not in the Catalogue), presents specimens of vestings of spun silk and wool, also in fine Saxon wool, figured on the Jacquard. There are some with corners embroidered on a new principle. These goods are of decided merit.

Croco, F., 163 Rue de Charonne, Paris (809, France, p. 1219), for vestings distinguished for the purity and elegance of their design, and for fineness of execution, particularly in the cashmere descriptions, attention being apparently more given to quality than to cheapness of price: his goods are of high merit.

Day, John, and Son, Mold Green, Huddersfield (113, p. 490), for a pantaloon stuff, warp of cotton with a weft of carded wool, crossed on one side only, of the character of cassinet. The surface of this stuff is soft to the touch, without having been sheared. This fabric is remarkable for excellence and equality of tints, difficult to accomplish.

Echinger Brothers, Vienna (304, Austria, p. 1022), for vestings of a strong and useful character, made with cotton, wool, and silk, of moderate price, worth about 4*s.* per yard; some with combination of colours.

Fassin, —, jun., Rheims (France), for a variety of excellent goods of a similar description, destined for home consumption, and got up with good taste, chiefly waistcoatings of cotton warp shot with wool and silk, also with combed wool, such as cashmere and valentias, figured with spun silk, of good design and quality. These examples are of great merit, both in execution and lowness of price.

Funke, R., Gladbach (587, Prussia, p. 1083), for a variety of superior fabrics, well coloured and of excellent materials, in several combinations of cotton, wool, and silk, for summer cloths and dresses, such as the Victoria cloths and cassinets, which deserve particular notice.

Grafe and Neviandt (591, Prussia, p. 1083), for vestings, made on the Jacquard loom, of cotton warp shot with wool, and figured in various styles; they are of superior merit.

Haas, Philipp, and Sons, Vienna (259, Austria, p. 1019), for woollen velvet shot with cotton, of superior quality, soft in texture, and strong. Medal awarded in Class XII.

Heymann, Charles, and Co., Crefeld (575, Prussia, p. 1082), for vestings, chiefly made on harness looms, of the character of poplin, corded with cotton in weft. Some worked with gold thread have a rich effect, at a moderate price, averaging not more than 3*s.* 7*d.* Their productions are of decided merit.

Kauffmann, H., Berlin (117, Prussia, p. 1055), for specimens of woollen velvets, of plushes of goats' hair of various descriptions, printed, and chiné, and all of high merit, fully deserving the award.

Learoyd, James, Huddersfield (115, p. 490), for cassinets of a very superior quality, exhibited along with the goods of Mr. Schwann: although his name does not appear as an exhibitor, he is entitled to the full credit of excellence.

Learoyd, W., Huddersfield (115, p. 490), for cassinets of a superior quality and novel make, presenting different faces of satin and cloth, where the difference of tint in dying is not perceptible; and other fabrics of superior merit. This manufacturer has exhibited his specimens with those of Mr. Schwann.

Lefébvre-Ducatteau Brothers, Roubaix (1309, France, p. 1239), for vestings of excellent quality, and although chiefly prepared for the middle classes, distinguished for good design and make. We noticed particularly a waistcoating of cotton warp, with weft of combed wool, checked with silk. Also some valentias, figured with silk, of admirable design and fabric. Their tasteful and varied cheap goods are prepared for a very large consumption.

Lemaire, Descamps, and Plissart, Tournay (240, Belgium, p. 1158), for specimens of pantaloon stuff of linen warp and weft of satiné. Those at the price of 6½*d.* are extraordinarily cheap.

Lienart-Chaffaux, Madame, Tournay (242, Belgium, p. 1158), for specimens of pantaloon stuff of linen warp, and weft of cotton satiné, well manufactured, and at the low price of 7*d.* and 8*d.* per yard.

Marx and Weigert, Berlin (113, Prussia, p. 1054), for excellence of manufacture in Utrecht velvet.

Milner and Hale, Huddersfield (not in the Catalogue), for excellent cashmerettes of the kind called kerseymere, warp of cotton and weft of wool (carded merino). This stuff is milled and worked with a fluff, and is remarkable for its softness and perfection. The tints of both cotton and wool are so perfectly equalised as to be scarcely distinguishable. There is another kerseymere warp of organzine silk and weft of carded wool, equally well blended in colours, of which the feel and quality are admirable. Their merit is undoubted.

Morgenroth and **Krugmann**, Elberfeld (532, Prussia, p. 1080), for woollen velvet, plain and figured, of a quality of distinguished merit.

Murley, W. J. C., Bow Churchyard, London (10, p. 486), for vestings of the character of velvet with goats' hair and cotton; cotton warp with silk weft. These are of superior character: but their vestings of linen thread and silk are truly remarkable. Their embroidered waistcoatings by the "*battant brocheur*," merit particular attention for excellence of workmanship. This house presents articles of high merit.

Patriau, Charles, Rheims (1380, France, p. 1242), for great variety and excellent taste in their vestings of cashmere, with cotton warp and weft of silk and wool; those also of woollen plush, plain and figured, are particularly deserving of notice. The poplin vestings are likewise of distinguished perfection. This house has produced at Rheims a new fabric called *piqué*. They employ a great number of artizans, and supply largely for exportation showy and cheap goods as well as those of superior qualities, which are eagerly demanded for home consumption. The superior and pre-eminent character of their manufactures entitles them to the very highest consideration, and in the opinion of the Jury they fully deserved the award of the Council Medal; but this was not confirmed by the Council of Chairmen.

Pferdmenges and **Kleinjung**, Vierzen (573, Prussia, p. 1082), for an excellent description of vestings of cotton warp, with weft of carded and combed wool, worked with silk checks, of varied and good designs.

Pim Brothers and Co., Dublin (255, p. 498), for excellent specimens of poplin got up with great carefulness and evenness of make. There are some on the Jacquard, figured of single colour, worthy of particular notice, and one especially woven with four colours highly deserving of merit for perfection of make and design.

Rockstroh, H., Vienna (306, Austria, p. 1022), for good specimens of waistcoatings of cotton and wool, with the corners of the waistcoats figured by the Jacquard. They are sold at the low price of 1s. 7*d.*, and, in this respect, the merit of the exhibitor entitles him to reward.

Stieff and **Harrass**, Potsdam (161, Prussia, p. 1057), for a variety of superior vestings of silk warp and cotton weft, figured with silk, by the Jacquard loom, with good effect, at very moderate prices. They also show two pictures of Jacquard imitations of engravings. Their productions are of high merit.

Taylor, J., and **Son**, Newsome, Huddersfield (111, p. 490), for vestings of great variety and superior make. The cashmeres are of good taste and high merit. There is among them a novelty of good invention, being a variegated cloth of cotton warp, figured and shot with goats' hair, styled Tigré. The fabrics of this house are of the highest merit, and in the opinion of the Jury entitled to the award of a Council Medal; but this was not confirmed by the Council of Chairmen.

Tee and **Son**, Barnsley (37, Class XIV., p. 512), for a variety of fabrics of excellent quality, distinguished both for design and economy: they present a novelty peculiarly worthy of merit, being the introduction of a new material called China grass, a substance which has lately been spun by Messrs. Marshall, of Leeds. The employment of this new thread in vestings and pantaloon cloths gives a peculiar finish to these goods.

Tolson and **Sons**, Dalton, Huddersfield (116, p. 490), for an excellent assortment of vestings and other articles of superior quality, among which we particularly distinguish some Scotch designs, with silk and wool, brilliant and cheap. There is also a lady's cloth, lightly dressed, of particular merit. Their fabrics generally are of high merit. Medal awarded in Class XII.

Walmesley, H., Failsworth, near Manchester (51, Class XI., p. 482), for poplins of a new and cheap description, with several other fabrics of excellent character, showing great ingenuity.

Weigle, J. J., Ludwigsburg (29, Wurtemburg, p. 1115), for a fabric of vestings of cotton, carded wool, plain, and crossed with silk, an excellent description of valentia well manufactured. Medal awarded in Class XI.

The Jury make Honourable Mention of the following Exhibitors:—

Aked, T., and **Sons**, Halifax (137, p. 491), for pantaloon cloths of cotton and goats' hair, and light coatings, very well manufactured, and of very good colours.

Bachoven and **Vollschwitz**, Zerbst (830, Prussia, p. 1095), for silk and cotton plush, highly esteemed for the linings of caskets. (Awarded in Class XIII.)

Barboza, J. (683, Portugal, p. 1315), for excellent fabrics for pantaloons, of good manufacture, strong, and giving great promise of equality with the productions of other countries.

Bennett and Co., Abingdon Street, Manchester (185, p. 495), for specimens of Utrecht velvet. One design in relief, made in the Jacquard loom, is well worthy of notice; more, however, for the happy idea than for the excellence of its execution. Credit is due to them for the introduction of the article.

Bonte, L., Roubaix (33, France, p. 1172), for pantaloon stuffs of cotton warp, shot with wool, of well-chosen colours and good materials, at prices suited to the working classes.

Bull and **Wilson**, London and Bradford (12, p. 486), for waistcoatings of wool called buckskins, being a kerseymere of very fine texture, embroidered with silk by children of twelve years of age. The work is of remarkable beauty, particularly in its character.

Burkhardt, H. T., Crimmitzschau (109, Saxony, p. 1109), for light cloths, cassinets, the qualities and colours of which are good.

Cocu, A., 58 Faubourg du Temple, Paris (125, France, p. 1177), for vestings of cashmere design, of good quality, and well-assorted colours for general consumption.

Daupiaz and Co. (853, Portugal, p. 1315), for most creditable goods of various kinds. We noticed waistcoatings in the Scotch style, made of wool, cotton, and silk. (Honourable Mention awarded in Class XIX.)

Fry, W., and Co., Dublin (267, p. 499), for furniture pieces, manufactured in a superior manner; also for some fair specimens of dress pieces plain and figured.

Gilson and **Bossut**, Tournay (241, Belgium, p. 1158), for specimens of pantaloon stuffs of linen warp, strong, useful, and cheap.

Hess, G., 6 Rue de la Villière, Paris (263, France, p. 1189), for vestings of considerable excellence of manufacture.

Lehmann, D. J., Berlin (136, Prussia, p. 1055), for specimens of plush and woollen velvets, plain and printed. We also noticed some in two colours made on the Jacquard, after French designs. The manufacture is good and the colours well chosen.

Levin, H., Sons, Berlin (114, Prussia, p. 1054), for vestings of a similar description, also worked with wool and silk on the Jacquard. Their goods are of excellent character.

Max Meyer and Co., Berlin (133, Prussia, p. 1055), for silk and cotton plush, of excellent quality.

Pferdmenges Brothers, Gladbach (574, Prussia, p. 1082), for light cloths, called cassinets, with cotton warp and carded wool weft. The manufacture is good and price moderate.

Repiquet and **Silvent**, Lyons (1432, France, p. 1244), for goods almost entirely composed of silk, and perhaps belonging to Class XIII., but we find some waistcoatings of silk velvet shot with cotton, and some poplins of good quality; the waistcoats being in particularly good taste. (Prize Medal in Class XIII.)

Reynolds, W., 81 Grafton-street, Dublin (266, pp. 498–99), for poplins for furniture, manufactured in a superior manner.

Rurmann and **Meckel**, Elberfeld (590, Prussia, p. 1082), for vestings distinguished for their moderate cost. Cotton warp shot with silk and cotton made on the Jacquard, some of poplin and satined descriptions.

Schofield, J., Rastrick, Huddersfield (125, p. 490), for pantaloon cloths, vestings in wool, silk, and cotton, and kerseymeres called "patent Britannics," all of good quality.

Schulte, J. H., Barmen (675, Prussia, p. 1087), for valentias and cashmere designs of good manufacture.

TRENDEL, jun. (41, Bavaria, p. 1100), for specimens of light pantaloon stuffs of cotton and wool, of excellent make, good taste, and moderate price.

WILLETT, E., NEPHEW, and Co., Norwich (310, p. 501), for paramattas and bombazines of excellent quality.

B.—SHAWLS.

General Remarks.

1. KASHMIR SHAWLS from the East, and Imitations thereof.

From the limited nature of a Report of this kind, a complete history of the shawl manufacture will not be looked for, however interesting it might be; but such is the importance of this beautiful fabric, and of its valuable trade, that a sketch of its origin, and of its rapid European development, may well precede our particular remarks upon its present position, and upon the examples now exhibited. The source from which this article has sprung is well known to be the ancient and beautiful fabric of the Valley of Kashmir, where the excellence of the raw material stands to this day unequalled, although its manufacture has been and is still, carefully prosecuted in many parts of the world. The great beauty of the eastern tissue, considering the rudeness of the means of machinery employed as compared with those which are now available to the European manufacturer, is a marvel in the eyes of the most experienced.

The superiority of the woollen fabrics of Kashmir is to be found recorded in many ancient eastern works. In the Mahábhárath, where narrating the transactions taking place at the palace of Gundeshthira, the eldest of the Panda princes, about the period of two hundred years before Christ, it is stated[*] "that the people of Kanchoja (the northern districts surrounding Kashmir) brought cloths and skins as tribute." The former were made of wool, and embroidered with gold, being, in fact, shawls and brocades.

Again, in the Ayeen Akbery,[†] being the institutes of the Emperor Jilaleddeen Mohamed Akbur, sixth in descent from Timur (Tamerlane the Great), proclaimed emperor in 1556, we find the following interesting account of shawls:—"His Majesty has ordered four kinds of shawls to be made: 1st. Toos affee (grey affee), which is the wool of an animal of this name whose natural colour, in general, is grey, inclining to red, though some are perfectly white; and these shawls are incomparable for lightness, warmth, and softness. Formerly they were made of the wool in its natural state, but his Majesty has had some of them dyed, and it is surprising that they will not take a red colour. 2nd. Sufed alcheh (white alcha), which they also call terehdar. The natural colours of the wool are white or black, and they weave three sorts, white, black, and grey. Formerly, there were not above three or four different colours for shawls, but His Majesty has made them of various hues. 3rd. Zerdozy and others,[‡] which are of His Majesty's inventions. 4th. From being short pieces, he had them made long enough for jamehs (gown-pieces). The shawls are classed according to the day, month, year, price, colour, and weight; and this manner of classing is called missel. The mushrifs, after examination, mark the quality of each upon paper affixed to its corner. All those brought into the palace on the day Ormuzd of the month Ferirdin (10th March) are preferred to those received afterwards, of the same fineness, weight, and colour, and each is written down in order. Every day there are received into store the following kinds,[§] and from this account of one day may be formed an idea of what is done in the course of a year.

"Formerly, shawls were but rarely brought from Kashmir, and those who had them used to wear them over the shoulder in four folds (*vide* ancient sculptures), so that they lasted for a long time. His Majesty has introduced the custom of wearing two shawls, one under the other, which is a considerable addition to their beauty. By the attention of His Majesty the manufacture in Kashmir is in a very flourishing state, and in *Lahore* there are upwards of a thousand manufactories of this commodity. They also make an imitation of shawl with the warp of silk and the woof of wool, and this kind is called *mayan*. Of both kinds are made turbans, &c."

With this account before us, it is reasonable to suppose that varieties of every kind were introduced about this period; and the evident encouragement given to these improvements doubtless tended much to the progress of this trade, while these shawls continued to be a favourite article of dress, during the Mahommedan dynasties in particular. After their decline, it is probable that the troubled state of Upper India, and the general turbulence of the mountain character, had its effect in retarding the progress of a trade involving the labour of so many hands; but its absolute necessity as an article of wearing apparel to every well-dressed native of India, Persia, and parts of Turkey, effectually prevented the manufacture from falling into decay, even at the worst of times. It was once said that there were upwards of 30,000 looms at work; but Strachey, who visited the country in 1809, gives 16,000 as the number at that time. The value of the whole produce was estimated at 35 lacs of rupees, but Moorcroft, who was there in 1822–23, says it had declined to half that sum. A renewed vigour has been instilled into it within the last thirty years by the constantly increasing demands of the European markets; and the present improved state of government, of social rights and intercourse, in that part of India, will of course add greatly to the energies of a persevering and painstaking people, and will most probably give early proof that its resources have never been fully developed. The valley itself is now in the hands of Golab Singh, a chief who fully appreciates the value of the trade; but many of his measures are oppressive to the manufacturer, and some of the best makers are finding it to their advantage to settle in the neighbouring cities, under the British Government, where they are able in perfect freedom to push their trade to any extent. Umritzer and Lahore are already showing rapid progress in this trade, and there is no reason why their productions should not equal in all respects those of Kashmir; while the demand for Europe is actively promoted by European agents residing there, for the express purpose of encouraging perfection in design, colour, and texture. The activity of the present trade may be estimated from the following returns, procured from the firm of Ripley and Brown, the leading brokers in this trade:—

	Imports.	Deliveries.	Exports.
In 1842	2,484	2,740	2,218
1843	2,726	2,992	2,298
1844	4,957	4,127	2,757
1845	7,981	5,411	3,860
1846	3,709	5,429	3,400
1847	3,989	4,354	3,045
1848[*]	2,389	1,904	1,484
1849[*]	1,183	3,311	2,403
1850	6,982	5,753	4,242
1851[†]	4,034	2,898	2,139

We find publications in France, "sur la fabrication des châles," which give the date of about 1800 as the period of the first introduction into France of the taste for this article of dress, and of their first importation from Egypt, where undoubtedly they had found their way from the eastern emporium, chiefly through Persia. In England, however, the fashion had been earlier introduced by those connected with the East India Company's trade, and they were included in the periodical sales of prohibited goods, held at the East India House as early as 1750. In 1787, we find they were admitted by our Custom-house, upon payment of an *ad valorem* duty of 27½ per cent., which duty has since been thus changed, by various acts and regulations:—

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[*] *Vide* vol. ii., p. 140.

[†] *Vide* vol. i., p. 105.

[‡] Zerdozee, gold-leaved; goolabtun, rose body; kesheedeh, worked; kulgha, pine-shaped; Bandhemim, spotted; cheet, like chintz; alcheh (ignor.); perzdar, with a nap.

[§] Toos, grey; sefed, white; lalzereen, red-golden; narenjee, orange; berenjy, rice-coloured; kabzy, straw-coloured; gulpumbeh, rose-cotton; sendely, sandal-wood; badamee, almond; arghuwanee, bright red; anaby, musk-perfumed; assely, pure; gulkasnee, cockscomb-colour; sibeky, light; alifee, marked with alifs or sprigs; festoky, sea-green; pezhgul, a Turkish wood; goolkhear, spotted; nezybereen, spearhead; asmany, sky-colour; goolabee, rose; kulghy, pine-shaped; aby, watered; zytoony, olive-coloured; segevy, liver-coloured; zemroody, emerald; benefsa, violet; fakhtehy, ring-dove colour.

[*] Troubles in Europe and in India.

[†] Up to May.

1812 – – –	£81 2 11	per cent.
1813 – – –	62½	,,
1814 – – –	67½	,,
1825 – – –	30	,,
1842 – – –	7½	,,
1846 – – –	5	,,

The severe restrictions upon their importation, and their consequent costliness, induced the weavers of Norwich to make the first attempt at imitation of the Indian fabric; and we are informed that in 1784 Mr. Barrow and Alderman Watson, of that town, succeeded in weaving the first Indian style of shawl we believe ever made in Europe. The process was too slow and unprofitable to induce them to continue their operations; but Mr. John Harvey, of the same town, followed up the enterprise with Piedmont silk warp and fine worsted shoot, the designs being worked in by a process of darning by the hand. No great progress, however, appears to have been made in this tedious and expensive process, and not till 1805 was an entire shawl produced from the loom in Norwich. In Paisley and in Edinburgh they took up the manufacture about the same time, but the former town has alone retained it, making India imitations now of real Kashmir wool thread, at very low prices, to a large extent.

In 1802 a commencement was made in Paris; and it is related that the enormous expense of 60,000 francs, expended in setting the loom prepared for the purpose, induced the immortal Jacquard to invent his wonderful process of working intricate designs with facility. In 1819 great success had been reached upon looms à la Tire, with Kashmir wool imported for the purpose, and spun with great skill in France. Not earlier, however, than 1834 was the present process, called spouliné, which is the exact imitation of the Kashmirean, so introduced for working intricate designs that one man, with a Jacquard loom, can produce the excellence now attained in Paris. In fact, we find the true Indian shawl there produced, but perfected by the addition of machinery, and sold at about a quarter of the cost in India, their range of prices being, for squares of full size, 25 to 600 francs, and for long shawls of full size 50 to 1500 francs: 4,000,000 francs is given as about the value of the total production of these fabrics in France at the present time; that of Scotland cannot so easily be estimated, but it is very large, though the shawls are chiefly of a cheaper description, ranging from 7*s.* 6*d.* to 5*l.* per square, and 1*l.* to 15*l.* for long shawls. We have dwelt thus at length upon the productions of France and England because of the greater development of the manufactures in these countries, where it had been first introduced; but we find that within the last five years Austria, the States of the Zollverein, and Belgium have been setting their looms upon similar produce; and with such excellent material at command, and such ingenious and industrious artizans, they may soon vie, in cheapness at any rate, with either of their predecessors in the trade. There is a peculiarity in the character of a real Kashmir shawl, as well in originality of design as in solidity and durability, which, notwithstanding the enormous difference of cost, will retain its value in the eyes of those who can afford to pay it. The finer descriptions cannot be purchased in the valley under 300 to 1,500 rupees for square, and 450 to 2,000 rupees for long.

Particular Remarks.

We find the following number of contributors of the descriptions called "woven," "printed," "embroidered," and "tartans:"—

	Woven.	Printed.	Embroidered.	Tartans.
France – – –	15	7	4	6
Algiers – – –	1	–	–	–
Belgium – – –	–	1	–	1
Austria – – –	10	1	3	5
Hamburg – – –	–	1	–	–
Zollverein – – –	7	2	–	2
Russia – – – –	1	3	–	–
Turkey – – – –	–	–	1	–
Geneva – – – –	–	–	–	1
Spain – – – –	–	–	–	–
Portugal – – –	2	1	1	–
India – – – –	5	1	–	–
China – – – –	–	–	2	–
England – – –	12	23	10	29
Egypt – – – –	1	–	–	–
Greece – – – –	–	–	1	–
Barbary – – –	–	–	1	–
Persia – – – –	–	–	1	–
Manilla – – –	–	–	–	–
Novia Scotia – –	–	–	–	1
United States – –	–	–	–	2
Van Diemen's Land –	–	–	–	1

Among whom we proceed to notice those who are most worthy of remark.

1. WOVEN SHAWLS.

The **HONOURABLE THE EAST INDIA COMPANY** has contributed to this Exhibition such a costly and gorgeous display of the very best specimens of every description of manufactures within their dominions, each in its kind so choice and perfect, and of a taste so original, as to afford example to all Europe, that as exhibitors of the most distinguished character we cannot but recommend that their display should be suitably recognised by Her Majesty's Commissioners.

There are many articles which do not strictly come under the cognizance of our Class, but it has been considered preferable to combine as much as possible the Report upon this collection of fabrics, rather than scatter the notices upon each different substance among many Classes.

We proceed to notice particularly,—

From Kashmir, a square shawl of perfect design and tissue; two long, fine white ones, of beautiful texture, and others (p. 915), presented by **MAHARAJAH GOLAB SINGH**; some pieces of superior shawl cloths, called kid cloth, and Purrepuz; this is looped in the weft at the back.

From Indore, shawls and embroideries, and other articles, by **MAHARAJAH RAO SCINDEAH** (pp. 915 and 916).

From Puttealla, shawls, scarfs, and rich tissues, by the **RAJAH OF PUTTEALLA**.

From Loodiana, shawls for cheapness of price.

From Benares, splendid brocaded shawls and scarfs, from **HANOO DEO NARAYN**.

From Ahmedabad, the same description of goods.

From Moorshedabad, the same, with some gold prints.

From Indore, the same.

From Madras and Bengal, beautiful embroidered muslin scarfs and shawls, of remarkable texture and elegant taste.

From Bengal, a very curious white muslin shawl-scarf, worked with gold, in which the turning of the shuttle shows extraordinary skill.

From Dacca, two shawls, embroidered with gold and silver needlework; executed for Her Majesty. Some elegant scarfs, embroidered with coloured silks of Sherry; oriental taste.

From Delhi, some splendid specimens of needlework.

From Ahmedabad, a curious specimen of cloth of gold, worked by hand; exhibited by **MR. CHARLES COPLAND**.

From Kashmir, a splendid shawl, worked in many colours with gold and silver; exhibited by the **PENINSULAR AND ORIENTAL STEAM COMPANY**. A very handsome long shawl, called an Alvandar; exhibited by **MR. JOHN GRAHAM**.

It would be endless to point out all the excellencies which this portion of the Exhibition puts forth. The entire Catalogue of the Indian department may be well called the correct list of them, for all of them are worthy of notice, and will, no doubt, afford to manufacturers of all nations a means of finding that they have still something to learn.

Clabburn and Son, Norwich (284, Classes XII. and XV., p. 500), are exhibitors of the very first-class shawls of a similar style and perfection. They also present poplins, paramattas, and a variety of beautiful fabrics of the highest order. The fabrics of this firm are remarkable for their perfection of manufacture, and good taste in design, for their variety and novelty, and for all those qualities which characterize first-rate manufacturers; but a member of the firm being upon this Jury, their productions are not under our review for particular distinction.

Gaussen and Co., 1 Rue de la Banque, Paris (1242, France, p. 1237), have furnished a selection of very beautiful shawls of Indian wool, got up in the most perfect and classic style. Their manufacture is of the highest class; but the leading member of the firm being upon our Jury, they are out of the pale of competition.

Morgan, John, and Co., Paisley, Scotland (299, Classes XII. and XV., p. 500), have contributed a fine collection of shawls of the highest character for design and manufacture. They are dyers of their own yarn, and dressers of their own produce, and are in all respects manufacturers of the very first repute; but the senior member being upon this Jury, their goods are not under consideration for any Prize distinction.

Webber and Hairs, London (277, Classes XII. and XV., p. 499), have exhibited a great variety of printed shawls of excellent taste. Mr. Hairs being, however, an Associate Juror, their goods do not come under Prize consideration.

Council Medal.

Deneirouse, E., Boisglavy, and Co., 16, Rue des Fossés Montmartre, Paris (1182, France, p. 1234), for a long white shawl, made precisely upon the same principle as those of Kashmir, and distinguished by the character of "spouliné." This shawl is of peculiarly fine texture and design, combining natural flowers, in all their various tints, with the style peculiar to India: it is perfect in all respects. There is also a long white, of a new and original design; it is remarkable for the introduction of a new process, adapted to the Jacquard loom, by which, with the usual colours, a great variety of tints may be made by combinations of different threads in the weft. This is a new and important discovery, which, added to the excellence of their manufacture, in all respects entitles these exhibitors to the recommendation of the Council Medal, and this award was confirmed.

The Jury award Prize Medals to the following Exhibitors:—

Berger, Joseph, and Son, Vienna (309, Austria, p. 1022), for a highly creditable collection of shawls of elaborate style, a long one in particular with various-coloured compartments, and a square of Kashmir wool worked with gold, are deserving of great merit for good taste and colouring; others of entire wool are highly creditable for their moderate cost.

Blakely, E. T., Norwich (285, Classes XII. and XV., p. 500), for a square shawl of purple ground with many compartments, of various colours, in which gold is introduced, perfect of this particular school. The Barége scarfs are of superior quality and novel taste. His goods are of the highest merit.

Bliss, William, Chipping-Norton, Oxfordshire (270, Classes XII. and XV., p. 499), for a variety of shawls, made from different materials, and of great merit for the adaptation of new articles for tissue, such especially as the vicuña, which is here shown to great advantage: he is an enterprising manufacturer of great merit.

Boas, Brothers, Paris (68, France, p. 1174), for shawls of a very particular style, and of extraordinary composition; we notice in particular a long white of curious design and colouring, which possesses much originality, and is well manufactured. Their shawls are of Indian wool yarn, and deserving of a high degree of credit.

Damiron and Co., 6 Rue des Capucins, Lyons (1167, France, p. 1233), for a collection of fine wool shawls of good style and make, and at very moderate prices.

Duché and Co., 1 Rue St. Petits Pères, Paris (1592, France, p. 1263), for great general excellence. This firm manufactures the largest quantity of fine shawls in France, and has exhibited the greatest variety of rich specimens in this Exhibition. They are of superior make and design. We particularly call attention to a long white shawl, of extraordinary manipulation, manufactured entirely of Indian wool yarn, and the finest ever made, having 320 shoots to the inch. Another long white, of new and original aspect: the inner border is formed by double grounds, shaded of different tints, graduating from the darkest to the lightest; the colours, being clear and distinct, show the design in all its perfection. Gold and silver threads are used both in warp and weft, to increase the number and brilliancy of the tints. There is also a square, with different compartments of various colours and ground, of very perfect design. We considered that the Council Medal should be awarded to this Exhibitor; but this recommendation was not confirmed by the Council of Chairmen. The productions of this house are of the very highest order of perfection, combining excellence in material, manufacture, colour, and design, with much originality.

Forbes and Hutchison, Paisley (291, Classes XII. and XV., p. 500), for cheapness of manufacture and general excellence.

Gaussen, Fargeton, and Co., 2 Place des Victoires, Paris (1243, France, p. 1237), for a variety of shawls of India wool, with very elaborate effects, and of superior manufacture. We notice particularly a long white on two grounds, in which there is excellent harmony in colouring and design; again a square white of very rich style and careful manipulation. In all there is great merit.

Grillet and Co., 11 Place Croix-Paquet, Lyons (1259, France, p. 1237), for two long shawls of very elaborate design and excellent manufacture. The striped pattern is worthy of particular notice for novelty and harmony: their known superiority of manipulation gives rise to regret that they have not exhibited a greater variety.

Hébert, F., and Son, 13 Rue du Mail, Paris (1621, France, p. 1255), for shawls woven from Indian wool yarn of the very first class, being a classic and harmonious imitation of the Indian style. There is a long one with ground of four colours, very successful in its colouring; a square amber colour is very true to its Indian origin; and altogether this firm is decidedly worthy of merit for its careful products.

Kerr, Robert, Paisley, Scotland, and of the firm of Kerr and Scott, London (300, Classes XII. and XV., p. 500), for remarkably fine specimens of every description of shawl, in all textures, all of which are stamped with the character of superiority, and the highest degree of skill in manufacture. We considered his goods to be pre-eminent in design, novelty, variety, and texture, and accordingly recommended him for the Council Medal, which the Council of Chairmen did not, however, grant.

Lion Brothers, and Co., 9 Place des Petits Pères, Paris (1327, France, p. 1239), for a handsome collection of shawls, of elaborate design and excellent make; a long white is well worthy of notice. There are two squares of peculiar style, in which the white and yellow effects are produced by gold and silver thread. Their manufacture is of distinguished merit.

Merlin, A. and V., Government of Riasan (281, Russia, p. 1375), for a long white shawl made of fine wool, conspicuous for its beautiful texture, and for a handsome border of modern floral design, quite original, which presents the same effect on each side of the shawl, the centre being sewed in according to the Indian manner. It is a novel and extraordinary production of high merit, and though scarcely to be considered an object of trade, it may lead to one of importance hereafter.

Robertson, J. and J., Paisley (301, Classes XII. and

XV., p. 500), for cheapness of manufacture and general excellence.

Towler, Campin, and Co., Norwich (309, Classes XII. and XV., p. 501), for a very choice collection of long shawls, of different compositions of spun silk and wool. They are of elaborate and original designs, showing superior skill in workmanship, and the highest degree of merit a manufacturer can attain. Every improvement is here adopted without abandoning the distinguished character of the original Norwich style. We find also printed shawls on a grenadine gauze of great merit, and a square with silk worked on cashmere ground, very beautiful. All their productions show great perfection in a school peculiar to this town, and always to be admired, and they are of the highest degree of merit. We therefore recommended a Council Medal to these exhibitors; but it was not conceded by the Council of Chairmen.

Zeisel, J. and J., and C. Blümel, Vienna (320, Austria, p. 1022), for a collection of shawls, among which a long white of woollen warp, and another with four compartments of elaborate French designs in good taste, made of Cashmere wool, are worthy of particular remark for excellence of manufacture. Others of more moderate cost are also deserving of great merit, showing much perfection in the working of their woollen thread.

The Jury make Honourable Mention of the following Exhibitors:—

Bonfils, Souvraz, and Co., 3 Rue des Fossés Montmartre, Paris (1094, France, p. 1230), for specimens of shawls of excellent design and manufacture; we point in particular to a long one with pink ground and orange compartments: a very successful combination, and possessing much novelty.

Chambellan, G., and Co., 8 Rue des Fossés Montmartre, Paris (1140, France, p. 1232), for a collection of shawls of superior manufacture from Indian wool yarn; in particular a long one of excellent design, and a square in four compartments, are well worthy of notice.

Chinard, Charles, 9 Rue de Cléry, Paris (89, France, p. 1175), for a collection of shawls of very good make and careful combination of colours; particularly a new style of square adapted for summer fashion, differing from the ordinary method of weaving.

Haley, John, and Son (58, Classes XII. and XV., p. 488), for some peculiarly soft flannel shawls, made of goats' hair, the produce of stock reared by H.R.H. Prince Albert in Windsor Park.

Haydter, Sebastian, Vienna (311, Austria, p. 1022), for moderate-priced goods, and very creditable specimens of long shawls of good effect, at from 40*s.* to 45*s.*, and a black square at 24*s.*, which are decidedly cheap.

Marx and Weigert, Berlin (113, Prussia, p. 1054), for a collection of long and square shawls on spun silk warp, with wool and mixture weft; of good design and very effective, and of moderate prices.

Oppenhoff and Hartung, Berlin (134, Prussia, p. 1055), for several harness shawls, as well as tartans, of good taste and manufacture; their colours are few but effective, and prices very moderate.

Pin-Bayard, Roubais (682, France, p. 1211), for a collection of damask worsted shawls, of peculiarly soft texture and excellent make: when their moderate cost is considered we cannot but give him much credit. (Prize Medal awarded in Class XII.)

Reinhold, W., Vienna (315, Austria, p. 1022), for a variety of long and square shawls of very good taste in colour and design, and for effective goods at a low price.

Riss, Joseph, Vienna (316, Austria, p. 1022), for shawls of a low quality, presenting them solely for merit as to cheapness.

Roxburgh, John and Andrew, Paisley (296, Classes XII. and XV., p. 500), for specimens of woven shawls, of good designs; also shawls made on spun silk warp, in which an ingenious advantage is taken of short reeding in design, which reduces the expense of production.

Sabin, Rebeyre, Lyons, for a good assortment of cravats, scarfs, square and long shawls, of good colouring and design, chiefly suited to a large consumption at low prices.

2. SHAWLS OF BARÈGE, CRAPE, GAUZE, SILK, AND OTHER DESCRIPTIONS.

General Remarks.

The rapid progress in the manufacture of shawls, and the increasing taste and demand for this style of garment, has led to the introduction of many kinds of lighter fabrics, in either wool, silk, goats' hair, or the various combinations of these with other materials, such as cotton, spun silk, &c.

These descriptions are generally traded in under the following denominations:—

Crapes, made of silk, in imitation of Chinese fabrics; chiefly manufactured at Norwich and Lyons.

Barège, made of wool, an improved imitation of shawls made in the Pyrenees, by the peasantry of a place so named; remarkable for their lightness, elasticity, and strength.

Another sort, with silk warp, and with a check of silk; a new introduction for increasing the effect of printing.

Grenadines, made of silk of a peculiar twist, which gives hardness and durability, but at the expense of brightness.

Levantines and Albanians, made of silk and spun silk, in imitation of the scarfs from various parts of the Mediterranean.

Chenille, a novel application of silk, sometimes with cotton.

Chiné, a printed warp before weaving.

The trade in these articles has already in a few years become most important, giving employment to an immense number of artisans in various branches besides those of spinning and weaving, such as designers, carvers, chemical colourists, and dyers.

In the perfection of these goods, France has taken the lead, and to her early encouragement of schools of design, and well-known national taste, may be attributed the tone and fashion she has given to all Europe; but her work is more expensive than that of England, and large quantities of these goods are brought over to be printed here at the lower cost, which the greater division of labour and the more extended development of the trade has accomplished.

In these printed articles, Austria shows evidences of an active endeavour to produce imitations of the designs of France.

In the exhibition by the States of the Zollverein we also perceive the foundation of a future trade in these fabrics.

Particular Remarks.

The Jury award Prize Medals to the following Exhibitors in this department:—

Chocqueel, Felix, Paris (1148, France, p. 1233), for great excellence in the printing of light shawls. For a long time foreman to his brother, he has acquired much of his perfection. We point especially to a long white shawl of elaborate design, the cutting and printing of which prove him to be a manufacturer of great merit.

Chocqueel, Louis, Labricht, near St. Denis (90, France, p. 1175), for a collection of printed shawls, on barège, cachemire d'écosse, and other fancy goods, of great excellence in design, harmony of colours, and perfection of printing, which is conspicuous in the great clearness of his white grounds, the whole being of the very highest merit. Medal awarded in Class XVIII.

Glen and McIndoe, Glasgow (279, Classes XII. and XV., p. 499), for the economical execution of the printed shawls exhibited by Messrs. Keith, Shoobridge, and Co.

Keith, Shoobridge, and Co., 124, Wood Street, London (279, Classes XII. and XV., p. 499), for a large collection of printed shawls, scarfs, and mufflers, of excellent design and execution. They are deserving of merit for the goods they have made up on their own designs. But to Glen and McIndoe, Glascow, their printers, we consider much credit to be due, for the execution of the detail, which for colour and neatness is very remarkable.

Swaisland, C., Crayford, Kent (283, Classes XII. and XV., p. 500), for goods that prove him to be a printer of the very first class. We point especially to an elaborate design on a barège ground, which has required 550 blocks to complete the pattern. The colouring is bright and clear; the execution perfect. At his extensive works the art of printing on wool has been carried to great excellence.

THIERRY-MIEG, Mulhouse (1506, France, p. 1248), for a large collection of shawls, square and long. The designs are of classic style, clearly and neatly executed, and the sharpness of outline well preserved. The goods are cheap, and of decided merit.

TOWLER, CAMPIN, and Co. (286, p. 500), and E. T. **BLAKELY**, Norwich (285, p. 500), are both manufacturers and exhibitors of first-class printed goods, but have received their awards of merit under the head of woven shawls.

The Jury make Honourable Mention of the following Exhibitors:—

DEPOUILLY BROTHERS, BOIVAUX, and Co., Paris (1586, France, p. 1252), for a good selection of barège shawls, printed with taste and accuracy. The colours and composition do much credit to M. Boivaux, the designer.

GODEFROY, LEON, Purteaux (1252, France, p. 1237), for a few specimens of shawls printed on fancy barège, with dark grounds of great perfection in clearness and precision. He is a printer of the first class; but having a larger collection of dresses than of shawls, he will be more particularly noticed elsewhere.

JAMESON and **BANKS**, Honey-lane Market, Cheapside, London (278, Classes XII. and XV., p. 499), for a large collection of superior shawls on various grounds, some with novel floral designs, executed in the most perfect manner, and printed by the first men in the art; such as Swaisland, Littler, and David Evans and Co.

LAWSON, J., and Co., Caledonia Print Works, Paisley (294, Classes XII. and XV., p. 500), for excellent specimens of printing, of good effective and clear designs, which are moderate in price.

LEWIS and **ALLENBY**, Regent Street, London (276, Classes XII. and XV., p. 499), for a design of their own composition of peculiar Indian style, very classic and effective; printed on several grounds by Swaisland in a superior manner.

LITTLER, MARY ANN, Merton Abbey, Surrey (282, Classes XII. and XV., p. 500), for shawls of Indian style, designed and executed by herself, showing great excellence in the art of printing. Medal awarded in Class XVIII.

3. SHAWLS, EMBROIDERED WITH WOOL, SILK, THREAD, GOLD, SILVER, &c.

General Remarks.

There is no doubt of the origin of this description of manufacture being traceable to eastern nations, where, in truth, we still find the most perfect workmanship and the greatest variety of design, with perfection of colouring. There, unquestionably, all uses of the embroidery-needle have been learned. The web of Penelope was no new thing in her time to the nations farther east. The Israelites were enjoined to have the door of the tent of their first tabernacle a "hanging of blue and purple, and scarlet and fine twined linen, wrought with needlework."[*] Deborah, in her song of triumph, 1296 years B.C., sings of the "prey of divers colours of needlework, of divers colours of needlework on *both sides*."[†] No better evidence can be needed of the antiquity of embroidery.

We have from China some specimens of the most exquisite work of this kind, unsurpassed by that of any other nation. We regret that nothing has been sent from Japan, where it is understood that embroidery is carried to great perfection. It is most probably from Tartary that Russia has derived her excellence: the specimens produced on this occasion not being shawls, will, we trust, be noticed in their proper Class. India stands pre-eminent in the exhibition of embroidered shawls, whether in coloured wool or silk, upon Kashmirs, cloths, or in gold and silver brocades; in short, in almost every variety of form or description.

Persia is not fairly represented on this occasion, for she has artisans of the highest merit; witness the beauty of her carpets, a species of embroidery in the manner of their manipulation; and she could have sent some excellent shawls, scarfs, and roomals.

Turkey has given a very handsome display of the excellence of her manufactures, and of the richness of her taste in embroidery of every kind; but her shawls do not evince equal talent or originality, being mostly copies of Indian designs.

Greece exhibits only some gauze scarfs, worked with tinsel. She does not appear to maintain the character she formerly held for this kind of work.

Egypt shows no originality in this fabric; her silk and gold scarfs are not of a fine character, and are of the same description as those of Turkey.

In Paris, Paisley, and Vienna the embroidery of shawls and scarfs on various materials is carried to great perfection; but the demand for such goods is not very great, the process being naturally expensive.

Particular Remarks.

Turkey.—The Government of Constantinople have placed on view a valuable collection of embroidered scarfs and roomals (handkerchiefs), of superior taste and fabrication, fully maintaining the renown of Levantine manufactures. The shawls are scarcely equal in character for excellence. There are some kumcabs, made at Damascus, worthy of remark; also some Albanian scarfs, of cotton cloth mixed with silk and tinsel, made at the Imperial factory; not without merit, considering the difficulties attending the introduction of machinery into that country. Altogether, the collection is a valuable exhibition of the progress of manufactures in Turkey, and worthy of the most Honourable Mention.

India.—The East India Company's collection has already had special notice. We however point particularly to the gorgeously-brocaded square shawls, and the long red shawls embroidered with gold and pearls; to the muslin scarfs embroidered with gold thread and beetles' wings. It would be tedious to mention the various excellencies, as all are of the very highest order of merit.

The Jury award Prize Medals to the following Exhibitors:—

FOULQUIÉ and Co., Paris (1603, France, p. 1253), for net shawls embroidered with silk, rich, elegant in design, of novel character, well executed, and quite worthy of the Prize Medal. (Medal awarded in Class XIX.)

GRAHAM, JOHN, Ludgate Street, London, embroidered crape shawls of peculiar excellence in texture, colour, and design. They are probably the finest specimens ever brought from China, and of the highest possible merit. We hold the Exhibitor to be worthy of the Prize Medal as the importer.

LAPORTA, H. F., Vienna (387, Austria, p. 1029), for embroideries on several textures, most of which show great skill in that art, and a perfect adaptation of material to colour and design.

WHITEHILL, M., and Co., Paisley (287, Classes XII. and XV., p. 500), for superior merino shawls embroidered with silk, of which the taste and execution are conspicuous, proving them to be manufacturers of high merit.

The Jury make Honourable Mention of the following Exhibitors:—

HENRY, EBENEZER, and **SONS**, Glasgow (13, Class XI., p. 480), for a good selection of embroidered merinos, of good taste and execution.

MAIR, JOHN, SON, and Co., Glasgow (59, Class XI., p. 482), for a good selection of embroidered merinos of good taste and execution. (Medal awarded in Class XIX.)

SIEBERT, FREDERICK, Vienna (271, Austria, p. 1020), for well-executed embroideries.

4. TARTAN PLAIDS, SHAWLS, SCARFS.

General Remarks.

This peculiar manufacture is of very ancient date, and many learned researches have been made to endeavour to trace its introduction into the British isles, and into Scotland in particular, where it has so long remained the well-known national costume, giving a name to its peculiar style that is universally adopted in every part of the world where the manufacture is produced or traded in. Great difficulty has been found in the derivation of the word Tartan: it does not appear in Gaelic, nor was it used in the Highlands, where the word Breachan was its equivalent, until the sixteenth century. The ancient bards invariably used the word Breach or Breachan in Scotland, Brycan in Wales, and Breacan in Ireland, where the dress prevailed from very early times. A woollen fabric of this description appears to be clearly traced from the northern tribes of Europe, very far east. In Russia, and among the Calmucks, it is common to this day; in Burmah, the chequered design, although mostly in silk, is the common dress of the country. There are strong evidences of its having been of Scythian wear; it may be fanciful to trace Tartan to Tartaric origin, but it is curious to find the Arabic word *Berkan* meaning "party-coloured." Livy describes the party-coloured woollen cloths of the Gauls, Germans, and Goths. Pliny, again, states that the dress of the Gauls was woven in squares of party-coloured fine wool. Dio, writing in the third century, describes the Britons in cloths of divers colours, which were called by their bards "Breach," or "Breachan." There is no record of their having been the distinctive dress of the clans of Scotland before the sixteenth century; but in a chartulary of Aberdeen, in 1269, the canons of the Church forbid the clergy to wear the party-coloured garments under the name of *Tyretains*. This word was brought into use from Normandy in the eleventh century, and may very probably be the origin of the word Tartan, for it is frequently used in reference to these woollen cloths of many colours. In the fifteenth century the records of the Royal Wardrobe give an item of expenditure, describing the colours of these Tyretaines. In 1570 an ancient Scottish manuscript gives a list of the colours of the plaids of the different clans. In 1747 the wearing of this distinctive dress was prohibited by Act of Parliament, and the grey shepherds' mauds were made instead. This Act was, however, repealed in 1782, but the fashion was not actively revived until very lately. The visit of George IV. to Scotland, in 1822, gave the first impulse to this revival, and in the neighbourhood of Stirling fancy plaid shawls began to be made. In 1828 clan Tartan shawls, long and square, became very popular. The Galashiels weavers took up the trade very actively, and from that period the consumption has each year been greatly on the increase. Paisley opened extensive manufactories about eight years ago, which now throw off a vast quantity. The example of that town was quickly followed by France, Belgium, many parts of Germany, Austria, and Bohemia; and in 1849 a very extensive concern was opened in Massachusetts, North America, for the production of this fabric from native wool, which has given evidence of excellence that will compare with any other country. We find also a specimen from Canada; but in this article it will probably be long before Scotland can be surpassed in design, fabric, or cheapness.

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[*] Exodus, chap. xxvi., v. 36.

[†] Judges, chap. v., v. 30.

Particular Remarks.

Morgan, John, and Co., Paisley (299, Classes XII. and XV., p. 500), have a very handsome collection of tartans of very superior make; but, as already stated, they are not under consideration for distinction in consequence of Mr. Morgan being a member of the Jury.

The Jury award Prize Medals to the following Exhibitors in this department:—

Cross, William, 62 Queen Street, Glasgow (202, Classes XII. and XV., p. 500), for tartans of fine Indian wool, of superior make, the colours excellent, and the tissue perfect.

Kerr and **Scott,** 31 and 32 St. Paul's Churchyard, London (275, Classes XII. and XV., p. 499), for a variety of tartans of the very best description, manufactured by Robert Kerr, the beauty of whose fabrics has already been fully appreciated by this Jury.

Lawrence, Stone, and Co., Boston, United States (464, United States, p. 1464), for a few tartans of excellent manufacture, fine in texture and bright in colours. They are made from native wool, and show much excellence as the produce of a manufactory only three years at work, but estimated to turn out this year 5,000,000 pieces. This concern, from its rising importance, is considered to be of decided merit.

Lees, R. and G., Galashiels, Scotland (192, Classes XII. and XV., p. 495), present such perfect specimens of their manufacture that we cannot but consider them as makers of the highest merit, and fully entitled to the Prize Medal.

Paton, J. and D., Tillicoultry, Scotland (466, Classes XII. and XV., p. 501), for a collection of tartans remarkable for their fineness and softness of texture, for the excellence and variety of their colours, and perfection of make.

Sanderson, R. and A., and Co., Galashiels, Scotland (196, Classes XII. and XV., p. 495), for an excellent collection of tartans; their mauds, or shepherds' checks, are particularly worthy of notice.

Van der Beeck, J. C., Dusseldorf (Prussia, 494, p. 1079), for a collection of fancy tartans, with ends brocaded, of peculiar style. The taste and execution are both superior; and, with reference to moderate price, this manufacture is considered to possess a decided merit.

The Jury make Honourable Mention of the following Exhibitors:—

Haarhaus, J. C., **Sons,** Elberfeld (567, Prussia, p. 1082), for a good collection of medium-priced tartans, well made and of good colours. They are extensive manufacturers.

Holms, William, and **Brothers,** 7 St. Mirren's Street, Paisley (288, Casses XII. and XV., p. 500), for a complete collection of clan tartans, sixty-two in number, got up with great care, of excellent colours.

Wilson and **Son,** Bannockburn (468, Classes XII. and XV., p. 501), for a collection of clan tartans, fifty-eight in number, of good colours and strong manufacture. They well merit Honourable Mention.

In presenting this our Report upon Class XV., we have, in the faithful execution of our trust, unanimously decided that among the beautiful and elaborately-made textures which have come under our examination such perfection of various kinds of merit has been found, that according to our interpretation of the instructions of the Council of Chairmen we could not do otherwise than recommend those Exhibitors who have presented a combination of such different merits as are unquestionably pre-eminent in their class, and therefore entitled to the Council Medal, which we trust will be confirmed.

WILLIAM PRINSEP, Reporter.

London, July 1851.

CLASS XVI.

REPORT ON LEATHER, INCLUDING SADDLERY AND HARNESS, SKINS, FURS, FEATHERS, AND HAIR.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Col. the Hon. George Anson, *Chairman*; 25 Hill Street, Berkeley Square.
Charles Nottbeck, *Deputy Chairman*, Russia; attached to the Ministry of Imperial Domains.
J. A. Nicholay, *Joint Reporter*, 82 Oxford Street; Furrier.
James B. Bevington, *Joint Reporter*, Neckinger Mills, Bermondsey; Leather Manufacturer.
J. S. Cunningham, United States.
Jacques Fredéric Fauler, France; Member of the Chamber of Commerce.
John Foster, 16 Wigmore Street, Cavendish Square; Florist and Feather Manufacturer.
J. W. Newman, Walsall; Saddler and Harness Manufacturer.
Hector Roessler, Zollverein; Counsellor of Commerce.
Edward Zohrab, Turkey; Turkish Commissioner.

Associate.

George Kidd, 257 Oxford Street; Saddler and Harness Maker.

The Jury, for convenience and certainty in examination, have distributed the articles exhibited in this Class under the following heads:—

Skins and manufactured furs.
Feathers for ornamental purposes.
Artificial hair.
Woven hair for furniture.
Rough, tanned, and sole leather.
Curried leather.
Varnished leather.
Morocco and dyed sheepskin leather.
Alum and gloving leather.
Oil or chamois leather.
Dyed sheepskins for rugs.
Vellum and parchment.
Saddlery and harness.
Portmanteaus.

The manufacture of the skins of animals into the various useful articles to which they are applicable, has been at all times an important branch of industry, and is estimated to hold the fourth place among the manufactures of England in respect to the value of the produce and the number of persons employed.

The hides, skins, and furs upon which this labour is employed, are mostly the produce of our own country, but besides the home supply, immense quantities are imported from North and South America, Europe, and the East Indies. The estimated number imported into Great Britain annually is about 11,000,000, of which 5,000,000 are applicable for furs, and 6,000,000 are adapted for various descriptions of leather.

The following statement shows the number of unmanufactured hides and skins annually imported into Great Britain for tanning and leather dressing, a large portion of which are re-exported in the raw state:—

Hides and kips	2,550,000
Calf skins	270,000
Horse hides	228,000
Seal skins	593,000
Goat skins	464,000
Sheep skins	210,000
Lamb skins	1,430,000
Kid skins	48,000
Deer skins	90,000
Total	5,883,000

Subjoined is a table of the imports and exports of skins adapted for furs.

——	Total Importation into England.	Exported.	Consumed in England.
Racoon	525,000	525,000	None.
Beaver	60,000	12,000	48,000
Chinchilla	85,000	30,000	55,000
Bear	9,500	8,000	1,500
Fisher	11,000	11,000	None.
Fox, Red	50,000	50,000	None.
„ Cross	4,500	4,500	None.
„ Silver	1,000	1,000	None.
„ White	1,500	500	1,000
„ Grey	20,000	18,000	2,000
Lynx	55,000	50,000	5,000
Martin	120,000	15,000	105,000
Mink	245,000	75,000	170,000
Musquash	1,000,000	150,000	850,000
Otter	17,500	17,500	None.
Fur, Seal	15,000	12,500	2,500
Wolf	15,000	15,000	None.
Martin, Stone and Baum	120,000	5,000	115,000
Squirrel	3,000,000	100,000	2,900,000
Fitch	65,091	28,276	36,815
Kolinski	53,410	200	53,210
Ermine	187,104	None.	187,104
Rabbit	120,000	None.	120,000
Wolverine	1,200	1,200	None.
Skunk	1,200	1,200	None.
Sea Otter	100	100	None.

The temperate and tropical countries supply the peculiar descriptions of hides and skins which are best adapted for leather, while the northern and arctic regions abound in races of beautiful animals which are thickly covered with fine hair or fur, whose skins are extremely valuable as articles of clothing.

To prepare the skins from the raw state, and render them fit for ornamental dress, is the first process of the fur dresser. In this country it is the usual practice to trample them in closed tubs with a little salt butter, turning them over and over for several hours; by this means the skins are made into soft and pliable leather. The next operation is to rub them on the flesh side over a blunt iron to remove loose pieces of integuments, and to reduce the substance, after which it is necessary to cleanse the fur and skin completely from the grease: for this purpose, it is again trampled with sawdust (usually from mahogany), which being beaten out, and repeated several times, conduces to make the fur glossy and clean, and to fit it for the cutter to fashion into any shape that may be required.

The fur of most animals is in its greatest perfection at the approach of winter, and before the animal has attained its greatest age. It is the object of the furrier, by dyeing the inferior skins, to imitate the more perfect specimens. Some difficulty has attended this process, as the nature of the skin will admit of the dyes being used only in a cold state, but the method which has been practised in Paris and London has been so far successful, that the permanence of the colour in the dyed sable is frequently found of equal durability to that of skins of the natural colour. Considerable excellence has been attained also in dyeing rabbit and inferior furs of those colours which are more suitable to the prevailing taste.

The several contributions of furs in the Exhibition, taken as a whole, form a complete collection of all the skins known to be used for ornament or dress; those of the Hudson's Bay Company, and the Central Committee of Nova Scotia, are adorned with some of the choicest skins known to commerce; but our notice would be very incomplete if we omitted to mention the remarkably beautiful and extensive collection of skins, and specimens of taxidermy, furnished to the Exhibition by several members of the nobility and other gentlemen, under the superintendence of Messrs. Nicholay & Son, of Oxford Street. We have also to notice the valuable articles exhibited by the same firm, on which the Jury made the following minute, 9th July, 1851:—

[The Jury having closely examined the extensive and interesting collection of furs exhibited by Messrs. Nicholay and Son, Her Majesty's furriers (301), as well as the large assortment of manufactured articles, of excellent design and workmanship, resolve;—that they consider them worthy of especial notice, and have pleasure in recording their judgment that the collection would fully entitle Messrs. Nicholay and Son to a Prize Medal, which they are precluded from awarding them, in consequence of one of the firm being a member of this Jury.]

We proceed to give a brief account of the animals that are captured for their fur, the skins of which are exhibited in various parts of the Building, commencing with—

The Russian Sable (*Mustela zibellina*).—This rich and beautiful skin has long been esteemed one of the most valuable and useful furs that have been brought to our country. About 25,000 are annually collected in the Russian territories, of which only a small number is imported into England. The fur is brown, with some grey spots on the head. The darker varieties are the most highly valued, a single skin being frequently sold for 9*l*., though the average value does not exceed 2*l*. or 3*l*. Naturalists are not agreed whether to consider the animal from which the skin is procured as a distinct species. Some are of opinion that the Russian sable, the stone and pine martens, as well as the Hudson's Bay sable, are but one species, on which the differences of food and climate have produced some slight variations in form and colour. To the furrier, however, the Russian sable is easily distinguishable, from the length and fulness, as well as the darker colour of the fur. The use of this choice variety is necessarily limited to the wealthy, on account of its high value. In the reign of Henry VIII., by a law which sought to regulate the expenses of the different classes, and to distinguish them by peculiarity of costume, the use of the sable was confined to the nobility above the rank of viscount.

Hudson's Bay Sable (*Mustela Canadensis*).—The sable skins next in repute to the Russian are those imported by the Hudson's Bay Company, of which no less than 120,000 are annually brought into this country. As the natural colour of the skins is much lighter than the prevailing taste, it is the practice to dye many of them a darker colour, and the furs thus treated are scarcely inferior to the natural sable.

Baum or Pine Marten (*Mustela abietum*).—The sables imported under this name are the produce of Europe. The animal is found in extensive forests remote from the habitations of man, and preying on birds and the smaller animals. They are distinguished from the stone marten by the yellow colour of the throat; other parts of the skin are brown. When dyed, they have a similar appearance to the best sable.

Stone Marten (*Mustela saxorum*).—This marten is generally found in mountainous and stony places, though a frequent visitor to farm-yards and homesteads. It is generally distributed through most European countries. The under fur is a bluish white, with the top hairs a dark brown. The throat of this variety is usually of a pure white, by which character it is generally distinguished. The French manufacturers excel in dyeing this fur, from which circumstance it is frequently called French sable. It is also dyed in this country, the excellent qualities of the skin adapting it to a great variety of purposes to which furs are applied.

Fisher.—There are about 11,000 of these skins annually brought to this country from North America; they are larger than the sables, and the fur is longer and fuller. The tail is long, round, and full, gradually tapering to a point, and quite black; a few years since it formed the common ornament to a national cap worn by the Jew merchants of Poland, and at that time was worth from 6*s*. to 9*s*., but its present value does not exceed 6*d*. to 9*d*.

Mink (*Mustela vison*).—There were 245,000 skins of this little animal brought to this country last year from the possessions of the Hudson's Bay Company and North America. The fur resembles the sable in colour, but is considerably shorter and more glossy. It is a very durable and useful fur, and is exported in large quantities to the Continent.

Ermine (*Mustela erminea*).—This animal is similar in form and habit to the common weasel of this country; but in Siberia, Russia, and Norway, from whence the skins are imported, the little animal, during winter, becomes as white as the snowy regions it inhabits, and is esteemed as the whitest fur known, though its summer dress is a dingy brown. The tail of the skin, of which the lower half is jet black, is generally introduced as an ornament to the purely white fur. It is worn on state occasions, and in the reign of Edward III., its use was restricted to the royal family.

Fitch or Polecat (*Mustela putorius*).—These skins are produced throughout Europe, and in no place of better quality than in our own country. The ground of the fur is a rich yellow, while the top hair is a jet black. This fur is at present very little used in this country, but is much worn in America. It is very durable, but the natural smell of the fur, which is rather unpleasant, is difficult to counteract.

North American Skunk (*Mephitis Americana*).—The skins known under this name are imported by the Hudson's Bay Company. The animal from which they are taken is allied to the polecat of Europe, and, from the fœtor it emits when attacked, which has been known to affect persons with sickness at 100 yards distance, has received the soubriquet of "Enfant du Diable." It has a soft black fur, with two white stripes running from the head to the tail, which is short and bushy. The skins, though imported into England in small numbers, are usually re-exported to the continent of Europe.

Kolinsky (*Mustela Siberica*).—The Kolinski or Tartar sable is of a bright yellow colour, and is sometimes used for ladies' dress in its natural state, but it is more frequently dyed brown to imitate other sable, to which it bears a strong resemblance. It is remarkable for the uniformity of its colour, having no spot or difference of shade in any part of the body. The tail, which is of the same colour, is exclusively used for the best artists' pencils.

Musquash, or Musk Rat (*Fiber zibethicus*).—The animal known under this name is found in great numbers in North America, frequenting swamps and rivers, and, like the beaver, building its habitations of mud with great ingenuity. Dr. Richardson states, that it has three litters of young in the course of the summer, producing from three to seven at a litter. The animal has a peculiar smell, similar to that of musk; but it must not be mistaken for the animal from which the musk of commerce is procured, which is a native of Tibet. About one million skins are brought to this country annually; the fur resembles that of the beaver, and is used by hat manufacturers. The skins are also dyed by the furrier, and manufactured into many cheap and useful articles.

Nutria, or Coypou (*Myopotamus coypus*).—This rodent quadruped is an expert swimmer, and frequents the neighbourhood of water, where it lives in burrows; it is smaller than the beaver, and considerably larger than the musquash, but has a resemblance to both these animals in its natural habits, and in the qualities of the fur.

Until lately this fur was very much used by hat manufacturers, and as many as 600,000 skins have been annually imported from Buenos Ayres and Chili, in which countries the animal abounds. Owing to the wars that continue to be carried on between the different states of Buenos Ayres, and the consequent withdrawal of the trappers from their accustomed occupations, the importations have fallen to 3,000 skins, which are dressed and dyed as a substitute for the costly fur seal.

Hamster (*Cricetus vulgaris*).—About 100,000 of the skins of the hamster are annually collected in central Germany, where the animal abounds; it has a poor, short, and coarse fur, and is almost exclusively used for cloak linings by the Greeks; the colour of the back is a reddish-brown, the belly black, with a few light spots. The animal is about 9 inches in length, and lives under ground, forming several apartments for storing grain separate from its own hybernaculum. It is so industrious and provident, that when the peasants go "hamster nesting" in the winter, they possess themselves not only of the skin but of the valuable store of good grain, which is said frequently to exceed two bushels.

Perwitzky.—The skin of this animal is beautifully marked like tortoiseshell, and is brought from the southeastern territories of Asiatic Russia; the fur is short, giving little warmth, and is chiefly made into cloak-linings, and used by the Russians.

Beaver (*Castor Americanus*).—Beaver skins are imported by the Hudson's Bay Company in less quantities than formerly; the use of the fur in our hat manufactories has greatly diminished since the introduction of silk hats, and a considerable depreciation has taken place in their value. This beautiful fur is sometimes used for articles of dress. In order to prepare the skin for this appropriation the coarse hairs are removed, and the surface is very evenly cut by an ingenious machine, somewhat similar to that used in dressing cloth. The fur thus prepared has a beautiful appearance, not unlike the costly South Sea otter, and has the advantage of lightness, with durability and cheapness.

The white wool from the under part of the beaver still obtains a high price, and is largely exported to France, where it is manufactured into ladies' bonnets. There is no doubt that the beaver was formerly an inhabitant of the British Isles, and Pennant remarks that two or three waters in the principality of Wales still bear the name of Llyn yr afange, or the Beaver's Lake.

Otter (*Lutra vulgaris, Lutra Canadensis*).—The large supply of otter skins used by the Russians and Chinese is derived principally from North America. The quality of the fur is in most respects similar to the otter of the British Isles, of which there are about 500 skins collected annually. This animal has frequently been tamed, and from its extreme agility in the water, has been rendered serviceable in catching fish for the use of its owner.

The American otter is much larger in size than the European, being about 5 feet from the nose to the tip of the tail; a smaller variety abounds in the East Indies, the fur of which is very short.

Sea Otter (*Enhydra marina*).—The sea otter has a very thick, soft, woolly fur, and is most highly prized by the Russians and Chinese, to whom most of the skins are exported. In its habits it is allied to the seal, but has never been met with in large numbers. It is found in the North Pacific, from Kamschatka to the Yellow Sea on the Asiatic coasts, and from Alaska to California, on the American coast.

The annual production is about 1,000 skins, of which 100 are imported into this country by the Hudson's Bay Company.

Seal (*Phoca*).—There are numerous varieties of these animals, some of which are found on the western coasts of Scotland, Ireland, and Wales. They frequent, in immense numbers, the coasts of Newfoundland, Greenland, and Labrador, and the importations into this country frequently exceed 500,000 in one season. The young seals of some species increase in size with great rapidity, and it is asserted by the seal fishers that they double their bulk in eight days. The greater portion are tanned and enamelled with black varnish for ladies' shoes; other descriptions are well adapted for fur, especially the seal of the South Seas and the north-west coast of America. Before they can be used as a fur, it is necessary to remove the very coarse hairs which cover a beautifully fine and silky fur. The roots of these hairs are deeply seated in the substance of the thick pelt, while the fur is strongly attached to the upper surface of the skin. By shaving the pelt to half its natural substance the roots of the coarse hairs are cut through, and they easily fall out; but the same effect is produced by a natural process of fermentation, which ensues when the skins are properly prepared and allowed to remain together. The soft curly fur of the seal is now rarely used in its natural state, but is dyed a deep Vandyke brown, and has the appearance of the richest velvet.

Fox.—Of foxes' skins brought to this country there are many varieties; the black and silver foxes (*Vulpes fulvus*, var. *argentatus*) from the arctic regions are the most valuable. Many of the skins in the Exhibition are worth from 10 guineas to 40 guineas. They are purchased for the Russian market, being highly prized in that country. The cross and red foxes (*Vulpes fulvus*) are used by the Russians, Turks, and Greeks for cloak-linings and collars. The blue and white foxes are used in this and other countries for ladies' dresses. The white foxes (*Vulpes lagopus*) are represented by arctic voyagers as exceedingly numerous, and migrating in troops over the frozen seas at the approach of the rigorous season. They are easily caught, fifteen having been taken from one trap in four hours.

Wolverine (*Gulo luscus*).—This animal, which is only met with in North America, Norway, and Sweden, is now generally considered by zoologists as identical with the glutton of old writers. It is extremely mischievous to the fur-trader, and will follow the marten-hunter's path round a line of traps extending forty or fifty miles, merely to come at the baits. The fur is generally dark nut-brown, passing, in the depth of winter, almost into black, and is chiefly used in Germany and other northern countries for cloak-linings.

Bear (*Ursus*).—There are several descriptions of bear-skins used by the furrier. The skin of the black bear of North America (*Ursus Americanus*) is used in this country for military purposes, for rugs, and carriage hammer-cloths. In Russia it is frequently manufactured for sleigh coverings, and the skin of the cub bear is highly valued for trimmings and coat-linings. That of the grey bear (*Ursus ferox*) is applied to similar uses. That of the white polar bear, of which the supply is very limited, is frequently made into rugs, bordered with the black and grey bear skins. The fur of the brown or Isabella bear (*Ursus Isabellinus*) has frequently been very fashionable in this country, when its value has been tenfold the present price. It is still considerably used in America for various articles of ladies' dress.

Hare.—The wool or under fur of the European grey hare (*Lepus timidus*) is extensively used for manufacturing felt hats, both in Europe and America. A few of these are dressed for the purpose of being worn as a protection to the chest.

The white hare of Russia and the polar regions (*Lepus glacialis*) was formerly much worn in its pure white state as a lining for ladies' cloaks, and as a substitute for the white fox, but the skin being exceedingly tender, its use for this purpose has been discontinued. The white hare is also frequently dyed; it looks exceedingly rich, but is not very durable.

Rabbit (*Lepus cuniculus*).—The English rabbit, both in its wild and domestic state, affords a very plentiful supply of useful fur. When dressed and dyed in imitation of other skins, it is manufactured into a great variety of cheap and useful articles for the middle classes. The wool has recently been manufactured into a peculiar cloth adapted for ladies' use, but by far the greater number of skins are still used for hatters' purposes. The English silver-grey rabbit was originally a breed peculiar to Lincolnshire, where great attention was paid to it; but warrens have since been formed in various parts of the country. Skins of this variety are continually exported to China and Russia, where they are much esteemed, and command a comparatively high price. The Hudson's Bay rabbit is beautiful in the length and texture of its fur, but the skin is so fragile, and the fur so liable to fall off with slight wear, that it has little value as an article of dress. The white Polish rabbit is a breed peculiar to that country; its skin is often made into linings for ladies' cloaks, and being the cheapest and most useful fur for that purpose, the animal is imported in great numbers.

Squirrel (*Sciurus vulgaris*).—This attractive little animal abounds in most countries, especially in Siberia and the north of Europe. It is from the Russian dominions that we derive our principal supply of the skins of this agile creature, which exceeds in number that of any of the fur-producing animals. It is said that 15,000,000 are every year captured in Russia, our supply from thence exceeding 3,000,000 annually. The fur of the squirrel, of which there are several varieties, is light, warm, and durable; some of the lighter colours are dyed in imitation of sable. The colour of the Siberian squirrels varies from a pearl grey to a dark blue grey: the under parts, which are white, are frequently cut out and made into cloak-linings, remarkable for their lightness: the tails are manufactured into boas for foreign markets; they are also extensively used in the manufacture of artists' pencils.

Chinchilla (*Chinchilla lanigera*).—There are two chief varieties of chinchilla, the produce of South America: those from Lima are short in the fur, and inferior in quality to those from Buenos Ayres and Arica; the colour is a silvery grey, Arica producing the darkest and best-coloured skins. The general appearance of the animal places it between the squirrel and the rabbit: in its natural abodes it has the agility of the former, and resembles the rabbit in living in holes and burrows. The extreme softness and delicacy of the fur adapt it only for ladies' use. Though much admired and frequently worn in this country, it is more extensively consumed in France, Germany, and Russia.

Racoon (*Procyon lotor*).—The racoon is an inhabitant of North America: the skins are imported into this country in immense numbers; but meeting with no demand for our home trade, are re-exported by merchants who purchase them at the periodical sales. They are used throughout Germany and Russia for lining shubes and coats, and, being of a durable nature and moderate in price, are esteemed as one of the most useful furs.

Common Badger (*Meles vulgaris*); American Badger (*Meles Labradorica*).—The skin of the European badger, from the wiry nature of its hair, is generally used for the manufacture of superior kinds of shaving brushes; but the skins exported from North America have a soft, fine fur, which renders them suitable for many purposes for which the larger furs are used.

Cat.—In Holland the cat (*Felis domesticus*) is bred for its fur; it is fed on fish, and carefully tended until the fur arrives at its greatest perfection; large numbers are also collected in England and many other countries. The wild cat (*Felis catus*) is much larger and longer in its fur, and is met with in extensive forests, particularly in Hungary; the colour is brownish grey, mottled, and spotted with black. The softness and durability of the fur render it very suitable for cloak-linings, and it is also made into wrappers for open carriages and railway travelling.

Canada Lynx (*Felis Canadensis*); Lynx Cat (*Felis Rufa*).—The fur of the lynx is long, soft, and of a greyish colour, sometimes, as in the Norway lynx, covered with brown spots; the belly is white, silky, and not unfrequently spotted with black. The change of fashion has for some time discarded it from this country; but it is dyed, prepared, and exported in considerable quantities for the American market, where it is much valued and admired. It is generally used for cloaks, linings, and facings, for which purposes it is very appropriate, being exceedingly soft and light.

Furs are subject to injury by several species of moths, whose instincts lead them to deposit their eggs at the roots of the fine hair of animals.

Linnæus mentions five species that prey upon cloth and furs, of which *Tinea pellionella*, *T. vestionella*, and *T. tapetzella* are the most destructive. No sooner is the worm hatched than it eats its path through the fur, and continues increasingly destructive until it arrives at its full growth, and forms itself a silken covering, from which in a short time it again emerges a perfect moth.

Another cause of the decay of furs is the moisture to which they are frequently exposed; the delicate structure of the fine under-fur cannot be preserved when any dampness is allowed to remain in the skin. This fact is well known to the leather manufacturer, who, having wetted his skins, allows them to remain in a damp cellar for a few days for the purpose of removing the hair, which is pulled out with the greatest facility after remaining only one week in a moist condition. It follows from these observations that to preserve furs it is necessary to keep them dry, and to protect them from moths; if exposed to damp or rain, they must be dried at a moderate distance from the fire; and when put by for the summer should be combed and beaten with a small cane, and very carefully secured in a dry brown paper or box into which moths cannot enter. During the summer they should be examined once a month to be again beaten and aired, if the situation in which they have been placed be at all damp. With these precautions, the most valuable furs may be preserved uninjured for many years.

The Jury award Prize Medals to the following Exhibitors in this department:—

Bevingtons and Morris, King William Street, London (332, p. 535), for a collection of good and well-manufactured furs and skins, both natural and dyed, of stone marten, baum marten, Kolinsky, sable, and ermine.

Clarke, Robert, and Sons, Cheapside, London (307, p. 534), for a well-assorted collection of manufactured furs in ermine, mink, musquash, grebe, and seal.

Central Committee, Nova Scotia (2, p. 970), for a choice collection of skins, the produce of Nova Scotia, fully described in Illustrated Catalogue, with the names attached to the specimens.

Drake, R., Piccadilly, London (306, p. 534), for three very beautiful muffs made from the choicest skins of the Russian sable, the grebe, and miniver.

Eggers, F., Moscow, Russia (not in Catalogue), for a fur carpet, well designed, and of good workmanship.

Geyer, J., Pesth, Hungary (346, Austria, p. 1024), for a national cloak called the Bunda, made from Hungarian lamb skins; the tanned leather, which is richly embroidered, forms the exterior of the cloak.

Hudson's Bay Company, Fenchurch Street, London (301, pp. 529-534), for a choice collection of fur skins, the produce of their possessions in North America, consisting of twenty-seven groups, which are fully described in the Illustrated Catalogue, with their scientific names.

Keilich, Henry, 9, Butterland Street, Hoxton, London (not in Catalogue), for models of a miniature tigress and cubs, displaying great ingenuity and excellence in design and workmanship, each hair of which is said to have been separately fixed by the hand.

König, L., Berlin (139, Prussia, p. 1056), for a camaille of superior workmanship, made entirely from the tails of the mink.

Meyer, M. and S., Bow Lane, London (304, p. 534), for a variety of manufactured articles made from the skins of the rabbit, and dyed in imitation of more costly furs, by which a cheap, warm, and ornamental clothing is brought within the means of the working classes.

Russian Imperial Cabinet, St. Petersburgh (not in Catalogue), for a pelisse lining made from the necks of the silver fox, for a Russian sable lining, and for skins of the same animal, from Kamschatka.

Smith, George, and Sons, Watling Street, London (310a, p. 534), for an assortment of good and well-manufactured furs made from Russian sable, North American sable, chinchilla, ermine, and squirrel.

Turkey, His Highness the Sultan of (1, Turkey, p. 1387), for a large and interesting collection of skins, the produce of Turkey.

Warming, E., Copenhagen (7, Denmark, p. 1356), for a fur carpet, with stuffed foxes serving as footstools, in which the design and workmanship are in good taste.

Weinknecht, T., Brussels (259, Belgium, p. 1159), for two carpets made of fox skins and other furs, beautifully designed; also for a choice collection of other furs.

Zeitz, J. F., Berlin (841, Prussia, p. 1096), for a coat-lining made entirely from mink tails, and for a similar article made from the paws of the fisher (*Mustela Canadensis*). Both specimens show great skill in manufacture.

The Jury make Honourable Mention of the following Exhibitors:—

Boldner, S. (not in Catalogue), for a fur hearth-rug representing the Royal Arms of England.

Dick, A., 35 George Street, Edinburgh (311, p. 534), for a well-manufactured hearth-rug of many pieces of fur neatly and artistically arranged.

Henderson, J., Montreal (107, Canada, p. 965), for sleigh robes and other furs, the produce of the colony.

Liverpool Local Committee, per T. C. Archer (270, Class XXIX., p. 803), for specimens of the various skins imported into Liverpool, methodically arranged, and with their scientific names attached. (Awarded a Prize Medal by Jury of Class XXIX.)

Feathers.

The beautiful colouring and graceful forms of these ornaments have always attracted general admiration, which the closest inspection tends only to increase. Whether our attention is drawn to the soft delicacy of the down of birds, or to the mechanical structure of the pinion feathers, which combine the greater strength with lightness, they are equally interesting and instructive.

The kinds which are used for dress are those of the ostrich, the marabout stork, the rhea or American ostrich, the emu, the osprey, the egrette, the heron, the autrenga, the birds of Paradise, the swan, turkey, peacock, argus pheasant, ibis, eagle, grebe, &c.

The feathers of the ostrich, of which there are several varieties, all varying in texture and quality according to climate and food, are imported into this country from Mogador, Aleppo, Alexandria, and the Cape of Good Hope, and have been used in all ages as ornaments of the head. They formed the plumes of knights' helmets, and were much used by our nobility in the reign of Henry VIII., who himself wore one on state occasions. The black ostrich feathers have been used for many years by the Highland regiments, and at funerals. The feathers in their natural state are still worn by the natives of the Cape of Good Hope, where it is not uncommon to see a waggoner's hat ornamented with them. The perfection to which the art of dyeing has been brought in this country and in France, and the great improvement in their manufacture in other respects, has brought them extensively into wear for bonnets and head-dresses.

Next in request to the feathers of the ostrich are those of the marabout stork, which are of two kinds, white and grey. These are imported into this country from Calcutta in great quantities. They are very much admired for their beautiful texture and extreme lightness, and are used for head-dresses, muffs, and boas. The white kind have at times been so scarce as to be worth their weight in gold.

The feathers of the rhea, or American ostrich, are usually imported from Buenos Ayres. They are used for a variety of purposes by the natives, who dye them of different colours, and form head-dresses and coverings for the body. The flossy kinds are used for military plumes in South America and in Europe, and the long brown feathers of the wing are made into brooms and dusting brushes.

A very graceful plume is made from the feathers of the emu, which are much prized on the Continent, and worn there both of their natural colour and dyed. The feathers of the osprey and the egrette, which are found in various parts of the globe, are chiefly used for military costumes by hussar regiments: those of the smaller egrette, which are the most graceful, are worn by ladies.

The feathers of the Indian heron and the autrenga are much prized on account of their scarcity, and are frequently worn by eastern princes.

Birds of Paradise, which are imported from the Manillas, have in all ages been in great request as ornaments both for men and women, and were formerly very rare. They are favourite decorations for the Turkish turban, and it will be remembered that they were worn by the Nepaulese princes when in this country.

The feathers of the common cock are also used for ladies' riding hats and for military plumes. The greater part are imported from Hamburg. The down of the turkey, the swan, and the goose, is made into plumes, muffs, and tippets; and from the feathers of the ibis, wreaths and trimmings are formed, which are much admired for the brilliancy of their colours.

The manufacture of feathers gives employment to a great number of females, and is principally confined to England and France, although of late manufactories have been established at New York for goods suitable for that country.

The Jury award a Prize Medal to the undermentioned firm:—

Adcock and Co., 3 Princes Street, Cavendish Square, London (323a, p. 534), for an admirable collection of the most beautiful kinds of feathers, manufactured and dyed for ornamental purposes.

The Jury desire to make Honourable Mention of the following Exhibitors:—

Booth, J. P., Cork, and 80 Hatton Garden, London (112, p. 533), for various articles of ladies' dress made from turkey-down and feathers.

Foster, Son, and Duncum, 16 Wigmore Street London (74, Class XXIX., p. 795), for a handsome muff and boa of marabout feathers.

Henoc, 1 Rue St. Sauveur, Paris (261, France, p. 1189), for screens and feather-brooms made of ostrich, peacock, and other feathers.

L'Huillier, E., 86 Rue St. Martin, Paris (1325, France, p. 1239), for various kinds of feathers for ornamental purposes, head-dresses, cloaks, screens, &c.

Lodde, A. A., 50 Rue Bourg L'Abbé, Paris (1329, France, p. 1240), for plumes of feathers and screens of various kinds.

Perrot, Petit, and Co., Rue de la Bourse, Paris (852, France, p. 1225), for two rare and magnificent Persian heron plumes and other fancy feathers for dress. (Awarded a Prize Medal by Jury of Class XXIX.)

Tollet, George, Betley Hall, Staffordshire (154, Class XX., p. 586), for tippets, cloaks, victorines, and muffs made from goose-down and feathers: a manufacture established with the view of giving a new employment to needle-women.

Artificial Hair.

The material for this trade, which gives occupation to a large number of manufacturers and workmen, is procured from the north of France, Belgium, and Germany, and some of good quality is occasionally brought from Ireland. The lighter-coloured hair, which bears the highest value, is the production of Germany; the darker shades are imported from France. The wholesale price varies from 30*s.* to 60*s.* per lb., and occasional rare specimens are of much higher value. A head of hair, such as is bought of the peasant girls in the districts before named, weighs from 1¼ to ¾ of a lb., and is usually exchanged for trinkets or articles of dress.

The Jury, after carefully examining all the specimens contributed by various Exhibitors, have selected the following, of which to make Honourable Mention, as the most suitable recognition of the general equality in style and excellence displayed in these productions:—

Bouchet, C., 74a New Bond Street (246, p. 527), for specimens of the new crochet-work in wig making, on skin and on net.

Browne, F., 47 Fenchurch Street, London (245, p. 527), for head-dresses of ornamental hair.

Carles, H. R., 45 New Bond Street, London (251, p. 528), for wigs and head-dresses.

Causse, D. A., 267 Regent Street, London (259, p. 528), for perukes and head-dresses.

Croisat, J., 76 Rue de Richelieu (1574, France, p. 1252), for perukes without toupées, produced by machinery.

Isodore and Brandt, 217, Regent Street, London (253, p. 528), for wigs, perukes, and other works in hair.

Robey, W., Richmond, Surrey (262, p. 528), for ladies' head-dresses.

Thibierge, 4 Rue Vide Gousset, Paris (695, France, p. 1212), for perukes and ladies' fronts.

Tyzack, W. V., Norwich (264, p. 528), for specimens of manufacture in false hair.

Winter, W., 205 Oxford Street, London (249, p. 528), for wigs and head-dresses.

The Jury are much indebted to Mr. Nesbitt, Wigmore Street, to Mr. Jennings, Quadrant, and to Mr. Dalling, Old Bond Street, for their valuable assistance in the examination of the various manufactures in artificial hair.

Woven Hair for Furniture and other purposes.

Hair used for weaving consists of the long hair from horses' tails. It is procured principally from South America and from Russia. All the black and grey hair is dyed for the manufacture of black hair-cloth for covering furniture. White only can be dyed so as to produce what are called fancy colours, such as green, claret, crimson, scarlet, &c., and great care is required in the process, which, however, when well managed, produces good permanent colours.

The quality of the cloth, as well as the brilliancy and permanency of the colours, depend also in a great degree on the nature of the warp, which may be either of cotton, linen, or worsted. Coloured hair-cloth (principally manufactured at Worcester, Sheffield, and Paris) has been extensively used in the fitting up of steam-vessels, and for covering chairs, sofas, railway carriages, &c. Some of the lighter colours have also been used for boys' caps, slippers, &c.

In the manufacture of hair-cloth, the weaver uses a sort of hook-shuttle, which he passes between the threads of the warp, or shed, towards his left hand; the assistant, or "server," places a single hair over the end of the hook, and the weaver draws it through the warp. This operation is a tedious one, and the hairs being necessarily placed in singly, prevents the application of machinery, which is so advantageously used in fabrics where the shoot or weft consists of a continuous thread.

In this department, the Jury award Prize Medals to the following Exhibitors:—

Delacour, H. P., 47 Rue Vieille du Temple, Paris (472, France, p. 1200), for horsehair and "vegetable silk" damask.

Forrer, A., 136 Regent Street, London (99, Class XXIII., pp.689-90), for ornaments worked in hair and gold.

Haussens-Hap, B., Velvorde, Brussels (257, Belgium, p. 1159), for horse-hair fibre stuffing for furniture, and other manufactures in hair.

Laycock and Sons, Sheffield (330, p. 535), for horse-hair damask, &c., of superior manufacture.

Lemonier and Co., 1 Rue du Coq St. Honoré, Paris (909, France, p. 1223), for ornamental hair-work.

Webb, E., Worcester (243, p. 527), for coloured hair-cloth and cloth composed of silk and hair; also for horse-hair carpets, woven in the same manner as Brussels carpets. In all these articles great excellence of manufacture has been attained.

Wisdom, Russell, and Whitman, Cleveland, Ohio, America (205, United States, p. 1450), for superior specimens of curled hair for furniture.

Leather.

An exhibition of the various descriptions of leather brought from every country, affords an opportunity of comparing the peculiar qualities and excellencies of each, which must be highly instructive both to manufacturers and artizans. Many of the improvements in this branch of trade have been introduced from other countries, where they have originated in causes purely local: thus, Russian leather, so much esteemed for its scent, is tanned with the cheapest bark of the country, and softened with an oil extracted from the bark of the birch tree, also abundantly produced; the combination of these materials gives the scent and qualities so highly valued in Russian leather. The peculiar softness in French curried leather is in part attributable to using the bark of the evergreen oak, with which the better descriptions are tanned; and the sole leather of England, which is not surpassed by any of its class, is dependent, to some extent, upon the superior oak bark that abounds in our island.

The bark of the oak tends to give firmness and solidity, while other sorts are remarkable for the softness they impart to the leather; and each material used in tanning gives some distinct quality in respect to colour, scent, toughness, or capability of resisting moisture and decay.

Experience shows that the tanning principle in different combinations is found in the bark and leaves of many trees; and it is to be expected that an extended comparison of the various descriptions of leather, for the first time brought together, will be the means of suggesting many improvements.

Chemistry has hitherto done less in this branch of manufacture than might have been expected. Though numerous experiments have been tried, and many patents granted for new processes, there has been no decided improvement, no marked progress, to show that better results have been obtained than by the old methods of tanning.

Very much has, however, been effected by mechanical means during the last 50 years. The steam-engine has been generally introduced into the manufactories of the leather-dressers and tanners. It is used in grinding bark, for softening foreign hides, and in giving motion to many machines for washing, glazing, and finishing leather. But the most important results have arisen from the invention of very ingenious machinery for splitting hides and skins. These machines completely separate the upper from the under surface, leaving each part of the same superficial dimensions as the original hide. This is effected by means of a long sharp knife, kept in rapid motion about the sixteenth of an inch from the edge of a smooth bar of iron, over which the skin is drawn by a revolving cylinder. By another machine the skin is pressed between two revolving rollers, and presented, as it emerges, to the edge of a long straight knife, which is nicely adjusted between the upper and under surface of the skin, and kept in motion backward and forward to facilitate the operation of splitting. These machines are now common in most of the leather manufactories of England, and in some of the most important establishments on the Continent.

The hydraulic press is found to be a very useful auxiliary for expressing the grease from sheep skins; it enables the leather manufacturer to dye more brilliant colours, which cannot be well done while any grease remains in the pores of the skin. By these appliances the tanners and leather-dressers are enabled to produce a more perfect and a cheaper article. The improved facilities of transport, the abolition of excise duties, and the greater freedom of our commercial relations with other countries, have all tended to the same desirable result.

We proceed to give a short account of several descriptions of skins used for tanning and leather-dressing; specimens of which are met with both in the English and Foreign sections of the Exhibition.

Horse Hides.

Horse hides are brought into this country in large numbers; the principal supply is from South America, from whence 180,000 were imported last year. The horse was unknown in South America previous to the occupation of the country by the Spaniards; it now runs wild over the flat plains of that country, and is caught for the value of its hide and hair. These skins are usually appropriated for ladies' shoes, either as cordovan or enamelled leather; for the latter purpose, the hide is split by a machine described in another part of this Report. The price of these hides varies considerably; at the present time the value is very low, not exceeding 4*s.* 6*d.* each.

Ox and Cow Hides, and Calf Skins.

Ox and cow hides are produced in very large numbers in the British Isles; they are usually tanned in oak bark, and appropriated for sole-leather, as well as for harness, machinery, and coachmakers' use. Foreign hides, which are imported largely from the East Indies, South America, and the Cape of Good Hope, are similarly appropriated. The latter description, like most of the skins from that fertile colony, are large, thick, and well grown. A remarkable specimen of the horns of the Cape ox, measuring more than 8 feet across, is exhibited in the department appropriated to Cape produce. The calf skins of England are very generally tanned in oak bark, and used for the upper part of boots and shoes. Foreign calf skins are imported from the Baltic, where they are killed much younger than in this country, and are used for bookbinding, for gloves, and ladies' shoes.

Hippopotamus Hides.

About 100 of these hides have been annually imported into London from South Africa; they have been tanned in oak bark, in which state they make exceedingly thick and compact leather: no very suitable application has yet been found for them.

Deer Skins.

Deer skins produced in this country are manufactured into oil or chamois leather, and appropriated for gloves, breeches, boots, and braces. A very large number are annually collected in North America, and manufactured in the United States. A small portion of these skins are used in this country and in Germany. The hair of the deer is said to be the best material for stuffing saddles.

Hog Skins.

Hog skins are collected and tanned almost exclusively in Scotland, where it has long been the custom to strip the skin from the carcase of the animal, contrary to the practice in this country and in Ireland. The leather is porous and light, but extremely tough and strong on the grain or outer surface. When tanned and curried, it is sold to harness-makers for covering saddles, for which purpose it is peculiarly adapted. The wild boar is remarkable for the extreme thickness of its hide on the back and mane, which enables it to break through the thorny brushwood of the forests with facility. A specimen of this part of the skin is exhibited by Mr. Geo. Edwards, which is more than two inches in thickness, and took seven years to complete the process of tanning.

English Sheep and Lamb Skins.

The immense supply of English sheep skins affords occupation to many large establishments, in which they are manufactured and variously coloured similar to morocco leather. They are tanned in bark for bazils, in alum and salt for white leather, and are also largely appropriated for parchment and chamois leather. The principal places where the skins are dressed and dyed are Bermondsey, Leeds, and Manchester, whence they are exported to Germany, South America, and our own colonies. A considerable quantity are also sent to the United States, after being partially prepared and salted. The value of an English sheep pelt varies from two to ten pence, when the wool of the same skin may be estimated from two to ten shillings; hence the attention which is paid to the latter, while the former is entirely neglected. In proportion to the fineness of the wool, the compactness and value of the pelt are depreciated. The supply of sheep and lamb skins annually produced in London and its vicinity exceed a million and a half; a large portion of these are split; the upper surface is tanned with sumach; the lower half is manufactured into parchment and chamois leather. Of lamb skins, the grain or upper surface is frequently made into white leather for tying over the stoppers of chemical bottles; the flesh, or lower surface, is dressed into thin chamois leather for lining gloves.

Cape of Good Hope Sheep Skins.

A very distinct variety of sheep skin is imported from the Cape of Good Hope; the wool is short and coarse, and rarely produces more than 1 lb. per fleece. This sheep has a tail of extraordinary thickness, frequently as large as the neck of the animal, and loaded with fat. Though the wool is of no value to the Cape farmer, this animal is still preferred by some flock-masters in consequence of the superior quality of the meat, the large quantity of fat produced, and the hardy constitution of the sheep, which appears to be particularly adapted to the climate. A similar sheep skin with broad tail is also imported from Smyrna; but on this the wool is of finer quality. When manufactured into leather, the quality of the Cape sheep skin is found to be nearly equal to morocco leather: it is frequently dressed for tan driving gloves, and produces a very serviceable and durable article.

Foreign and English Lamb Skins for Gloves.

In Italy, Spain, and the south of France, it is the custom to kill the lamb at a much earlier period of its growth than is usual in England; the skin is in consequence small, fine, and thin, and is used as a substitute for kid: the leather, however, is neither so strong nor so glossy on the surface, but sufficiently soft and elastic, and largely manufactured into gloves in the counties of Somerset and Worcester. About 1,400,000 lamb skins are annually imported for this purpose. Those of the highest value are brought from the vale of the Arno, in Italy; they are also imported from Turkey, Austria, Spain, and France. Small English skins, which are taken by the shepherds from the lambs that die within a few days of their birth, are frequently dressed with the wool, and appropriated for lining gloves and shoes. About 400,000 of this description are annually collected, and a portion of them are manufactured into coloured leather gloves.

Swiss Goat Skins.

The goat is reared in considerable numbers in Switzerland, Italy, and the south of France, for the valuable milk which it supplies. The skins are preserved with great care, and exported to this country for the purpose of making into morocco leather. Those from Switzerland bear the highest value, on account of the perfect nature of the grain of the skins, which enables the morocco manufacturer to dye them very brilliant and permanent colours. The texture of goat-skins is very strong, and more durable than the sheep; from which circumstance they are well adapted for covering chair-seats and lining carriages. About 96,000 are annually imported from Switzerland and the valley of the Rhine.

Cape Goat Skins.

Skins of the Cape goat are much thicker than any other kind, and are applied to purposes where great strength and substance are required. The body of the animal is as large as the fallow deer. Many of the skins are exported to Germany, where they are manufactured into leather for the common dresses of the peasantry.

Mogadore and East Indian Goat Skins.

Mogadore goat skins are distinguished by the great length of the hair, which, when shorn from the skin, is curled and manufactured for stuffing chair-seats and mattresses. The skin is rather inferior in quality, and usually made into black morocco, which, from the circumstance of our first supplies having been derived from Spain, still retains the name of black Spanish leather.

East India goat skins are small in size and extremely short in the hair: they are appropriated for ladies' shoes, and occasionally dyed for covering chair-seats.

Kid Skins.

Kid skins are collected in the south of France, Germany, Switzerland, Italy, and Ireland. French skins are the most perfect, and of the finest quality; those from Ireland, of which there are 60,000 skins annually exported, are also highly valued. East Indian kid skins are adapted for light shoes, but are occasionally made into gloves. As soon as the kid begins to feed on herbage, the fineness and delicacy of the skin are injured, and the skin becomes unsuited for the best gloves; it is then used for shoes, braces, and binding-leather, for which purposes it is well adapted on account of its great strength and elasticity.

Seal Skins.

The seal has been already mentioned among the fur-producing animals; the particular species whose skins are manufactured into leather are found in great numbers on the shores of North America, from Newfoundland to the Arctic Ocean. As many as 600,000 have been caught in one season, and a large fleet of vessels is employed in this trade. The oil which the animal produces is the principal inducement to its capture; but the skin, which is worth from 3*s.* to 4*s.*, forms no inconsiderable sum when estimated upon the large numbers that are brought to this country. The seal, when young, has long, white, silky hair, which it sheds in a few weeks, and becomes covered with hair of a coarser and darker colour. In the latter state it is best adapted to the purposes of the leather-dresser. When carefully manufactured, the skin has greater strength in proportion to its substance than any leather that is usually worn. It is generally made into black enamelled leather for ladies' shoes, and is much used for shoe-binding, where great strength is necessary. From experiments tried on seal, porpoise, and whale leather, that are exhibited in the Canada department, it appears probable that the skins of the marine mammalia have greater strength than those of land-animals.

Skins and furs in the undressed state are liable to be eaten through by the grub of a small beetle (*Dermestes vulpinus*). The eggs are generally deposited in some crevice about the head of the skin. These produce a swarm of hairy grubs, which feed upon the pelt, and grow to the size of small caterpillars. Instances have been known where the entire value of a foreign package of skins has been destroyed by these insects, and the annual loss occasioned by them in this country is computed to be from 2000*l.* to 5000*l.* They are found to be most destructive when skins are packed in midsummer or autumn, at which season the insect flies abroad and deposits its eggs unperceived as the skins are drying in the air. The collections of skins packed in spring and winter are not liable to this injury. Camphor and tobacco-leaves have been tried against the depredations of this insect, and each has been attended with some success, but not so entirely as to recommend either of them as a complete preventive.

Rough Tanned and Sole Leather.

The number of exhibitors in this subdivision is 53, of whom 15 are in the English department, 9 in the French, and 29 in other sections of the building.

The sole leather in the English department has for the most part been tanned with oak bark, but we notice some varieties in the collection of Messrs. Boutcher, Mortimer, and Co., and in the Australian division, in both of which there are specimens that have been tanned with mimosa bark. The Hon. Z. Pratt, of Prattsville, New York (102, United States, p. 1440), exhibits leather tanned with the bark of the hemlock tree: several exhibitors have employed valonia as a principal ingredient. In the New Zealand collection there are some remarkable varieties; and in the Russian department we find specimens said to be cured with rye.

Although many vegetable extracts have been discovered which are useful in tanning, inasmuch as they shorten the process and economize the cost of production, yet no material has yet been found which combines so many valuable qualities as oak bark for tanning sole leather; it fills more completely the pores of the hide, and prevents the great absorption of water to which leather tanned with other material is liable.

The simplest method of tanning sole leather, still practised in some of our colonies, is, to shave the hair from the hide with a sharp knife, and to steep the pelt in bark liquors for a year; by which time the gelatine of the hide has chemically united with the tannin, and the process is complete. In England it is customary to remove the hair by immersion in lime-water; if this process is carried beyond the proper point it dissolves too much the soluble gelatine, and renders the leather porous.

Since the abolition of duties on tanned hides and skins, a considerable increase has taken place in the importations from foreign countries, with obvious advantages to the foreign manufacturer and English consumer. Both curried and varnished calf leather of excellent quality are brought from France, Germany, and Switzerland, and large numbers of curried boot-fronts. From Australia and the East Indies arrivals of tanned leather are more frequent, and supply at moderate prices the increasing wants of the community. In many cases the economy of tanning on the site of produce is considerable: the labour and tanning materials are both procurable at less cost; much is saved by the diminished freight of the manufactured article; and the leather is less liable to damage by moth and worm, to which untanned skins are exposed in their passage to this country.

As many beautiful and well-manufactured leathers have come under the notice of the Jury, which have been exhibited by proprietors, or by those who have only to a small extent superintended the manufacture, the Jury have recognized the merit of these productions by including the exhibitors with those manufacturers whom they consider entitled to Honourable Mention.

The Jury award Prize Medals to the following Exhibitors:—

Cox, W. H. and Co., Russell Street, Bermondsey, London (293, p. 529), for two foreign butts very well tanned.

Crawford, H. M., Philadelphia (51, United States, p. 1436), for calf skins tanned in oak bark.

Draper, R. and H., Kenilworth (293, p. 529), for a remarkably heavy and well-tanned English hide, weighing 90 lbs.

Duport, V., 16 Rue des Francs Bourgeois St. Marcel, Paris (182, France, p. 1182-3), for three split hides of twice the usual length. The increase of surface is ingeniously obtained by a peculiar mode of splitting. A machine divides the hide into two surfaces, commencing at the neck and continuing nearly to the opposite extremity; where the splitting terminates the hide is neatly cut to preserve a uniform thickness, and when opened out extends from 17 to 18 feet.

Fieux and Co., Toulouse (210, France, p. 1183), for well-manufactured sole and harness leather.

Hepburn, John and Thomas, Long Lane, Bermondsey (293, p. 529), for an English crop butt, of good substance and texture, and well tanned in every respect.

Landron Brothers, Meung-sur-Loire (1639, France, p. 1255), for well-tanned sole leather.

Peltereau, Auguste, Chateau Regnault, Indre-et-Loire (677, France, p. 1211), for sole leather of excellent quality, tanned by two methods.

Peltereau, F., jun., Chateau Regnault, Indre-et-Loire (949, France, p. 1225), for sole leather of excellent quality, tanned in oak bark; some of the specimens have been tanned without the usual application of lime.

The Jury make Honourable Mention of the following Exhibitors:—

Beauchau de Baré, A., Namur (262, Belgium, p. 1159), for tanned hides, applicable for soles and pump-buckets.

Boutcher, Mortimore, and Co. (293, p. 529), for tanned sole leather.

Bucknall, George (293, p. 293), for tanned hippopotamus hides of remarkable thickness.

Buschmann, J. W., St. Vith (386, Prussia, p. 1072), for well-manufactured sole leather.

Estivant Brothers, Givet, Ardennes (1214, France, p. 1235), for a Buenos Ayres hide, tanned in oak bark.

Evershed, Sussex (293, p. 529), for well-tanned light sole leather.

Hauser, J. de J., Waedenschwyl, Canton Zurich (172, Switzerland, p. 1277), for a specimen of sole leather, tanned in oak bark.

Holmes, T., Hull (16, p. 518), for specimens of the tanned hide of the walrus, and polishing wheels covered with the same; also for stuffed heads of the male and female walrus, taken at the Davis' Straits fisheries.

Kelsey, J. T., Lingfield, Sussex (266, p. 528), for a well-tanned crop hide, weighing 82 lbs. The process of tanning occupied two years.

Masson, Charles, Huy (267, Belgium, p. 1152), for tanned sole leather of good quality.

Curried Leather.

Leather, having been first tanned and dried, requires to be reduced to an even substance, to be well extended, and made supple with fat or oil, before it is fit for the upper part of boots. In the latter operations consists the art of the currier; and although much of the strength of the leather depends upon the previous treatment, still great attention and judgment are required to conduct this process perfectly. No article enters more generally into the consumption of the affluent and labouring classes; and it is evidently a subject of some importance to adopt those methods of currying which secure the greatest suppleness of leather, combined with durability.

The manufacturers of France have for many years excelled in their mode of tanning and currying the finest descriptions of calf leather: those from the south of France (Bordeaux calf), which are reported to have been tanned with the bark of the evergreen oak, are extremely soft and pliable, and their merits are obvious from the extensive sale they meet with in this country. The mode of tanning and currying pursued by the English exhibitors is adapted to bear exposure to wet, and great improvement has taken place in the method of rendering the leather soft and easy to the wearer. The Swiss exhibitors have shown some very excellent leather of this class, for the upper parts of boots and shoes.

There are upwards of 70 exhibitors of curried leather, of whom 20 are in the French division, 13 in the English, and the remaining 44 are distributed through every section of the Building.

The Jury award Prize Medals to the following Exhibitors:—

Bossard, I., Church Street, Bermondsey, London (294, p. 529), for curried calf leather of superior qualities, combining great strength with softness and pliability.

Courtepée-Duchesney, 11 Rue du Renard, St. Sauveur, Paris (806, France, p. 1219), for boot-fronts, very pliable, and of good quality, principally manufactured from the calf skins of Paris.

Cozens and Greatrex, Walsall, Staffordshire (283, p. 528), for tanned and curried leather, adapted for bridles, and for well-manufactured hog skins.

Dezaux-Lacour, Guise, France (167, France, p. 1181), for curried calf skins and well-tanned sole leather.

Guillot, J. A., 17 Rue du Boulai, Paris (534, France, p. 1204), boot-fronts of various kinds, very well manufactured.

Hemsworth and Linley, West Smithfield, London (20, p. 519), for boot-fronts, and cordovan of excellent quality and workmanship.

Herrenschmidt, G. F. Strasbourg (538, France, p. 1204), for boot-fronts, and curried calf-skins, soft in texture.

Jetu, C. A., Quebec (109, Canada, p. 965), for curried porpoise leather, and samples of leather from the skin of the whale; the porpoise leather is of fine texture and considerable toughness, and is remarkable as the first of the kind exhibited in this country.

Lambert and Son, Bermondsey New Road, London (63, p. 521), for waxed calf skin boot-fronts, and cordovan, of good qualities and workmanship.

Prin, A., Jun., Nantes (1411, France, p. 1243), for russet and black curried calf leather, well manufactured.

Mercier, J. J., Lausanne (175, Switzerland, p. 1277), for curried calf leather, boot-fronts, and chamois leather, well manufactured for the purposes to which they are applicable.

Merklinghaus and Wex, Barmen (672, Prussia, p. 1087), for dressed hides manufactured for saddlery and harness.

Skvorsoff, M., Moscow (232, Russia, p. 1374), for curried calf leather of good quality, and a few calf skins tanned and curried, with the hair attached as an inside lining for the boot; extremely soft and pliable.

Stockil, W., 33 Long Lane, Bermondsey, London (17, p. 518), for specimens of boot-fronts, very well curried from the English leather.

Suser, H., Nantes, France (1022, France, p. 1227), for a good assortment of curried calf leather and foot-fronts.

Ventujol and Chassang, 21 Rue des Gobelins (1384, France, p. 1242), for boot-fronts manufactured from Bordeaux calf skins, remarkable for peculiar softness, fineness of texture, and the great toughness of the material.

The Jury make Honourable Mention of the following Exhibitors:—

Budin, R. A., Rue du Fer à Moulin, Paris (77, France, p. 1175), for curried horse hides, suited to the upper part of boots and shoes.

Buse, N., Swansea, Wales (4, p. 518), for curried calf leather, well manufactured.

Fortier Beaulieu, Rue de la Lunette (510, France, p. 1203), for curried leather suitable for harness and saddlery.

Ghislain-Dubois, Binche (469, Belgium, p. 1166), for cow hide curried for strap leather.

Hogarty Brothers, Cork, Ireland (13, p. 518), for curried calf leather and boot-fronts, very well manufactured.

Massemin, C. L., Rue de la Reyne, Paris (1345, France, p. 1240), for calf leather adapted for boot-fronts.

Oberconz, H., Trèves (383, Prussia, p. 1072), for curried leather, and for a well-tanned hide, a perfect imitation of Russian leather.

Paillart Brothers, Rue du Grand St. Michel, Paris (338, France, p. 1193), for calf and sheep leather manufactured for straps and rollers.

Reulos, A. J., 13 Rue Geoffroy St. Hilaire, Paris (1434, France, p. 1244), for curried horse leather, adapted for boots and shoes.

Southey and Co., Lincoln's-Inn Fields, London (51, p. 520), for an extensive assortment of good leather, manufactured for coach and harness makers.

Taillet, V., Brussels (254, Belgium, p. 1159), for boot and shoe leather, well manufactured.

Wood, W. and S., 32 Bow Street, London (25, p. 519), for a well-manufactured assortment of calf skins, curried and dyed in imitation of Morocco leather.

Varnished Leather.

Varnished and enamelled leather has been brought to great perfection during the last 25 years, and increases in general demand as the improvements in its manufacture become generally known. Though the difficulty of making a bright varnish adhere to leather which is required to bend freely, and retain an unbroken surface, is considerable, it has been successfully overcome by the use of boiled linseed oil, mixed with vegetable black and Prussian blue to deepen the colour. This composition (the consistence of a thick paste) is rubbed on to the surface of the leather by hand, and dried in a stove heated to 150 and 170 degrees Fahᵗ. The operation is repeated from three to seven times, according to the nature of the leather, and when the varnish is thoroughly dry, it is found to adhere very firmly, and to bear considerable tension without fracture.

Many coloured pigments are mixed with the varnish, without materially altering its tenacity: by this means the most brilliant colours are produced, and the leather is rendered more applicable for ornamental purposes.

The number of Exhibitors in this branch of the leather trade is thirty-three, of whom nine are Germans, seven French, four English, and thirteen from other countries.

Prize Medals are awarded to—

Courtois, E., 12 Faubourg Montmartre (1571, France, p. 1252), for black and coloured varnished calf hides, brilliant on the surface, and well manufactured.

Deadde, J., 18 Boulevard de Charonne (813, France, p. 1219), for a large assortment of well-manufactured calf and cow hides, adapted for shoemakers and coach-manufacturers.

Dixon and Whiting, Bermondsey, London (290, p. 529), for an assortment of varnished and enamelled hides and splits, adapted for coachmakers, &c. In this collection the practicability of splitting three surfaces from one hide, is shown by the exhibition of the three parts separately tanned and varnished.

Doerr and Reinhard, Worms (33, Hesse, p. 1128), for a good assortment of varnished calf leather for shoemakers.

Gautier, J., 4 Faubourg Montmartre, Paris (1244, France, p. 1237), for black and coloured varnished calf leather, on which the enamel is brilliant, and the leather sufficiently pliable.

Heintz and Freudenberg, Baden (382, Prussia, p. 1072), for black varnished calf leather, on which the enamel is strong and brilliant.

Heyl, C., Worms (32, Hesse, p. 1127), for varnished calf leather of excellent quality.

Houette, A. and Co., 46 Rue du Fer à Moulin, Paris (1271, France, p. 1238), for a superior assortment of black and coloured varnished calf leather.

Jorez, jun., Brussels (306, Belgium, p. 1160), for a white varnished hide of superior quality, and for well-manufactured curried leather.

Mayer, Michel, and Deninger, Mayence (36, Hesse, p. 1128), for japanned and varnished hides, and calf leather, and for moroccos, roans, and skivers, dyed in great variety of colour. These Exhibitors also show curried leather for harness, and other purposes. Each description of leather has been well manufactured.

Nyset and Co., 132 Faubourg du Temple, Paris (1373, France, p. 1242), for black varnished calf leather, manufactured very perfectly for boots and shoes. The varnish is brilliant, and sufficiently strong and elastic to bear the bend and strain to which it is liable.

Oastler and Palmer, Bermondsey, London (286, p. 529), for a large assortment of enamelled and varnished leather for coachmakers, and for a very well tanned crop butt.

The Jury make Honourable Mention of the following Exhibitors:—

Hall, Sydney, New South Wales (not in Catalogue), for enamelled kangaroo skins, manufactured for boots and shoes.

Mayer, Ignaz Munich (46, Bavaria, p. 1100), for varnished calf and very good enamelled coach hides.

Minoprio and Hohwiesner (37, Hesse, p. 1128), for varnished calf and coloured japanned hide.

Roth, C. W., Frankfort (9, p. 1122), for varnished calf leather.

Vignaux, L. J., Barcelona (249a, Spain, p. 1344–45), for varnished calf leather, suitably manufactured for boots and shoes.

Morocco and Dyed Sheep-skin Leather, &c.

Morocco and dyed sheep-skin leathers are represented by thirty-one Exhibitors from Paris, London, Leeds, Mayence, Barcelona, Tunis, and Turkey. This description of leather is tanned with the leaves of the sumach tree (*Rhus coriaria*), imported into this country from the island of Sicily. Great excellence has been attained in the manufacture, both in the brilliancy and variety of colours, especially when it is considered that neither strong acid, nor great heat, can be applied without danger of destroying the fibre of the leather.

The specimens of morocco from Turkey, Tunis, and Egypt, show the manufacture in its origin; and no alteration appears to have taken place in the mode of dyeing, &c., since the period when western Europe was indebted to them for this manufacture. The red morocco of Turkey and Egypt is brilliant and permanent, and though well suited for their particular use, is not adapted for general consumption.

Bevingtons and Sons, Neckinger Mills, London (1, p. 518), exhibit an assortment of morocco leather, enamelled seal skins, Cape sheep, kid, and gloving leather, and a series of the materials used in tanning and leather-dressing, to illustrate the several modes of curing and tanning practised in this country. They also exhibit skins in the unmanufactured state, and a Macedonian lamb skin divided to show the natural laminations by which the epidermis, the rete mucosum, and cutis, are easily distinguished.

The Jury award Prize Medals to the following Exhibitors:—

Bayvet Brothers and Co., 16 Rue Mauconseil, Paris (415, France, p. 518), for an assortment of morocco, roan, and calf leather, finished with great regularity, and in a variety of beautiful colours. The cochineal red and the various shades of green morocco, are remarkable for the fulness of colour. The black morocco is also of good quality.

Emmerich and Goerger, Strasbourg (1212, France, p. 1235), for a good assortment of coloured and black morocco, well dyed and manufactured.

Wilson, Walker, and Co., Leeds (11, p. 518), for a very large assortment of coloured sheep, morocco, and calf leather, well manufactured, and adapted, from their price, for general consumption.

The Jury make Honourable Mention of the following Exhibitors:—

David, C., 12 Rue Mauconseil (812, France, p. 1219), for a beautiful collection of dyed morocco, for bookbinding.

Delisle and Co., Grenoble (1181, France, p. 1234), for specimens of sheep and morocco leather, printed in permanent colours, for furniture, &c.

Deed, J. S., Little Newport Street, London (10, p. 518), for a good assortment of morocco leather, for furniture and bookbinding.

East and Son, Bermondsey, London (34, p. 519), for dyed and embossed sheep leather, in imitation of Utrecht velvet. This appears to be a good appropriation of leather which is imperfect in the grain, and is manufactured with skill and good taste.

George Clement, 102 Dean Street, Westminster (32, p. 519), for good specimens of morocco and Russian leather, adapted for furniture and bookbinding.

George, Joseph, 81 Dean Street, Westminster (289, p. 529), for specimens of leather, beautifully gilded, embossed, and painted.

Giraud Brothers, Paris (850, France, p. 1220), for dyed morocco and sheep leather, in brilliant and permanent colours.

Lutwyche and George, Skinner Street, London (53, p. 520), for well-manufactured morocco leather and dyed sheep-skin rugs.

Roeg, Salvador, Barcelona (249b, Spain, p. 1345), for an assortment of morocco leather, dyed in a variety of colours, for shoes; and for well-manufactured black morocco.

Alum and Gloving Leather.

Alum, or white, leather is manufactured principally for the purposes of the glove-maker, and is represented in the Exhibition by twenty contributors.

The common method of making this description of leather is to immerse the prepared skin in a solution of alum and salt, in equal proportions; but where elasticity and softness are required, as for kid gloves, very much care and attention are necessary. The skin, having been first softened in lime-water, has to be many times washed, and worked in pure water, and afterwards in fermented bran-liquor. Yolks of eggs, flour, alum, and salt, are the materials with which the skin is made into soft leather: and it is then dried, worked over a round blunt knife, and, after a second washing and softening with yolks of eggs, it is ready to receive from the dyer the beautiful colours, so well known to the public, in the manufactured article of gloves. It has been estimated that 6,000,000 of eggs are annually consumed in the glove-leather manufactories of France and England.

A few specimens of the excellent kid leather of France are exhibited by M. Jouvin, of Paris: these skins are manufactured at Annonay, a town about fifty miles south of Lyons. The great superiority of the manufacture of this place is very remarkable, and a very large portion of the kid skins from every quarter of the globe are sent thither to be converted into gloving leather. Though the supply is derived principally from the adjacent provinces of France, from Italy, Switzerland, and Germany, yet Ireland and the East Indies have of late years contributed no inconsiderable quantity. The total number annually manufactured there is not less than 4,000,000 skins.

It is worthy of remark also, that a very large portion of the lamb skins, suitable for gloving leather, are sent from many countries to be manufactured at Yeovil, in Somersetshire, and the adjacent neighbourhood. It is not unusual to see in that place the lambs' skins of Italy, Austria, Spain, Turkey, Denmark, Bordeaux, Buenos Ayres, and the Cape of Good Hope. The climate and the peculiarities of water, which are so admirably adapted for kid leather-dressing in France, are unsuited to the proper manufacture of lamb skins, which require a more temperate climate, and other facilities of manufacture, which are met with in England.

The following Exhibitors have been awarded Prize Medals:—

Barrande, J. P., Rue du Fer à Moulin, Paris (756, France), for an assortment of dyed goat, sheep, calf, and kid leather, in variety of colours. The bronze colour of this manufacturer is excellent and durable; and the softness of the alumed calf leather renders it admirably adapted for the upper part of boots.

Corry, J. and J., Queen's Camel, Somersetshire (314), for Italian lamb skins, dressed and dyed in a variety of colours, for gloves.

Lolagnier, —, 6 Rue St. Hippolite, Paris (1330, France), for specimens of kid, lamb, calf, and sheep leather, suitably manufactured for gloves.

The Jury make Honourable Mention of the following Exhibitors:—

Boulogne, P., Prague (334, Austria, p. 1023), for kid and lamb-skin leather, dressed for gloves, in which the smoothness and strength of the grain have been well preserved.

Luxemburg Glove Manufactory (4, p. 1130), for bronze and black kid leather, and for specimens of dyed kid and lamb leather, for gloves.

Mattat and Sons, Randers (10, Denmark, p. 1356), for very well-dressed leather, both for white and tan-coloured gloves.

Rassiger, J. L. and Son, Altenburg (741, Prussia, p. 1091), for an assortment of lamb leather, dyed a variety of colours, for gloves.

Oil or Chamois Leather.

There are fourteen Exhibitors of chamois leather, of whom four are English manufacturers, two French, and eight of other countries.

The peculiar quality given to leather by the process of the oil or chamois leather manufacturer is extreme softness, which renders it a suitable article for gloves, and many other uses where this quality is required.

It is manufactured by the continued application of cod-oil to the skin, alternately with a process of beating in fulling mills, and exposing to the air for partial drying. In about ten repetitions of the oiling and drying process the skins are sufficiently saturated, and are allowed to remain in tubs until they become hot by natural fermentation, after which they are washed in a strong alkali, and a most perfect and useful kind of leather is formed.

So recently as the commencement of the present century sheep skins manufactured in this mode were extensively employed as clothing; but woollen cloth has gradually superseded their use, and the trade has considerably declined in consequence.

The Jury award Prize Medals to the following Exhibitors:—

Pullman, R. W. and J., 17 Greek Street, Soho, London (285, p. 529), for an assortment of buck, doe, and chamois leathers of every description, very perfectly manufactured, for a variety of purposes.

Texier, junior, Niort (1033, France, p. 1228), for specimens of buck, doe, and fawn leather, and for some well-dressed chamois sheep leather, stained in a variety of colours for gloves.

The Jury make Honourable Mention of the following Exhibitors:—

Laydet and Co., glove manufacturers, Paris (296 France, p. 1191), for specimens of chamois leather, dyed in suitable colours for gloves. (Awarded a Prize Medal by the Jury of Class XX.)

Randall and Dicks, Greek Street, Westminster (284, p. 539), for a well-manufactured assortment of buck, doe, and chamois and gaiter leather. These Exhibitors show the application of chamois leather in the pianoforte, where it is used to stop the prolonged vibration of the wires.

Dyed Sheep-skin Rugs, &c.

There are thirteen Exhibitors of dyed rugs manufactured from English sheep and Angora goat skins. Though the manufacture is of recent origin in this country, it appears to have been known to the Eastern nations in the most remote times. In the Old Testament, the "ram skins dyed red" are mentioned, Exod. xxvi. 14, as ornaments for the tent of the Holy Tabernacle. The sheep skins of England, especially the coarse wool skins of Lincoln and Leicestershire, are more adapted for this purpose than those of any other country, on account of the peculiar lustre of the wool. These rugs are extensively used in Great Britain for door-mats, and are exported to America and the continent of Europe. The excellence of the manufacture consists in the perfect extraction of the natural grease, in making them complete leather with alum and sumach, and in dyeing the wool permanent and bright colours.

The Jury award Prize Medals to the following Exhibitors:—

Bevingtons and Morris, 67 King William Street, London (332, p. 535), for an assortment of sheep-skin rugs, in great variety of colours. These Exhibitors show bordered rugs of several designs, in good taste; and Angora goat skins, manufactured in a similar manner.

Clarke, C. and J., Glastonbury (48, p. 520), for sheep and lamb skin rugs, dyed and manufactured into a variety of useful articles.

Deed, J. S., Little Newport Street, Westminster (10, p. 518), for Angora goat and English sheep skin rugs dyed in many beautiful colours.

The Jury make Honourable Mention of the following Exhibitors:—

Rood, G. and Co., Bolton Borough, Glastonbury (49, p. 520), for hearth rugs made from dyed Angora goat skins, and for varieties of door-mats manufactured from English sheep and lamb skins.

Winsor and Son, Bermondsey, London (14, p. 518), for a good assortment of dyed sheep skin rugs, skins for cavalry saddles, and several manufactured articles.

Vellum and Parchment.

Parchment is prepared from sheep skins by the simplest process. After the skin has been steeped in lime and water it is stretched in a frame, and by repeated working with hot water, and several applications of whiting which are dried in the sun, the skin is entirely cleansed from the grease. It is brought to a fine surface by skilful labour with a round sharp knife, and when dry is fit for use.

Vellum is made from calf skins prepared in a similar manner.

This manufacture is represented by seven Exhibitors.

The Jury award Prize Medals to the following Exhibitors:—

Berthault, Issodun (56, France, p. 1174), for a very complete and extensive assortment of parchment and vellum, applicable for deeds, bookbinding, tambourines, and for the machinery of spinning-mills.

Lever, J. and J., 13 Size Lane, London (24, p. 519), for specimens of vellum and parchment, manufactured for bookbinding, deeds, and tambourines. These Exhibitors show some well-dyed vellum, and other samples adapted for paintings.

The Jury make Honourable Mention of the following Exhibitors:—

Evans and Son, 10 Silver Street, London (18, p. 518), for specimens of well-manufactured parchment, and for direction-labels, very completely made from the same material.

Sondermann, W., Erfurt (743, Prussia, p. 1091), for vellum and parchment of extreme whiteness, prepared for deeds, drum-heads, and for machine or cylinder parchment.

Saddlery, Harness, and Portmanteaus.

In reporting on saddlery, harness, and portmanteaus, the Jury remark, that the general character of the articles is highly creditable to the Exhibitors, and show that considerable skill and ingenuity are devoted to this department of industry. There are upwards of 120 Exhibitors in this subdivision.

From the nature of the manufacture it is less concentrated in particular localities than most others. There is no town of note in England where one or more of the trade does not find ample occupation; and as the manufactured article continually falls into the hands of distant makers for repair, the knowledge and inventions of one manufacturer are quickly circulated through a wide district. Hence we find considerable uniformity and excellence of manufacture in this department.

The chief endeavour of the saddler and harness-manufacturer is to obtain strength, with lightness and convenience of form; for which purpose the strongest kinds of leather are used in combination with iron, wood, and other materials. Walsall, in Staffordshire, is the principal seat of the wholesale trade, where considerable quantities of saddlery and harness are prepared for exportation. Great ingenuity and invention have been displayed in the numerous varieties of bits, of which there are very many sorts known to the trade.

The necessity of judging of the saddlery of other countries by a very different standard from our own is evident; the form of saddle, for instance, that is well designed for our smooth roads and well-trained horses, would be very inefficient in the mountainous districts of Spain and South America.

The Jury have had their attention called to some portmanteaus, of very ingenious and clever construction, which, from the facilities they afford the traveller of rapid arrangement and convenience of access, will promote the comfort of a very numerous class of the community.

The Jury award Prize Medals to the following Exhibitors:—

Baker, B. J., Boston (498, United States, p. 1465), for a light harness of superior materials and workmanship.

Blackwell, S. and R., 256 Oxford Street (78, p. 521-2), for phaeton harness of patent black leather. The mountings are in good taste; the materials and workmanship are also of good quality.

Blyth, R., 4 Park Lane, Westminster (90, p. 522), for a lady's saddle, well manufactured; and a hunting or park saddle, with improved elastic seat.

Brace, H., Walsall, Staffordshire (58, p. 520), for two cases of bits, stirrups, and spurs, for the South American market.

Brown and Son, Birmingham (65, p. 521), for specimens of saddle-trees, with whalebone springs, galvanized plates, &c., to prevent corrosion.

Caister, A. B., 7 Baker Street, Westminster (77, p. 521), for well-manufactured hussar and hunting saddles, with pair of harness pads.

Cooper, M., York (50, p. 520), for a case of saddlery, containing articles of very superior workmanship: the racing saddle, in particular, weighing only two pounds, is remarkable for its neat manufacture.

Cuff, R. 18 Cockspur Street, London (96, p. 523), for an embroidered velvet saddle, riding bridle, and harness, manufactured with much taste and elegance.

Earnshaw, H., 91 Wimpole Street, London (107, p. 523), for a case of harness, containing blue morocco and other bridles, well manufactured.

Hickey and Tull, Philadelphia (58, United States, p. 1437), for two portmanteaus, well arranged and strongly constructed.

Kane, G., Dublin (62, p. 521), for portmanteaus and camp furniture, so ingeniously contrived, that most of the articles required to furnish an officer's apartment are contained in a travelling chest.

Lacey and Phillips, Philadelphia (41, United States, p. 1435), for a case of harness, in which the mountings are of solid silver; the materials are of excellent quality, and the workmanship very elaborate.

Ladourée Le Jeune C., Brussels (256, Belgium, p. 1159), for saddlery and harness manufactured in excellent style, with good materials and workmanship.

Langdon, W., junior, 9 Duke Street, London (89, p. 522), for a light phaeton harness, constructed of the best materials, and well adapted for its intended use.

Last, S., 256 Oxford Street, London (38, p. 519), for a well-contrived railway portmanteau, divided into four compartments, to facilitate the access to any articles contained in it.

Middlemore, W., 31 Holloway Head, Birmingham (67, p. 521), for a lady's embroidered saddle, and another with elastic seat; also for a new mouthing rein for unbroken horses, &c., the whole well manufactured.

Morris, R., Montreal (113, Canada, p. 965), for a set of double sleigh harness, of excellent material and workmanship.

Passmore, W., 27 Little Windmill Street, Westminster (79, p. 523), for a set of single horse harness: the style and workmanship are in every respect superior.

Pollock, J., Glasgow (279, p. 528), for a very perfect set of Scotch harness.

Prax and Lambin, Paris (688, France, p. 1211), for a large and varied collection of saddlery and harness; many of the articles are elegantly designed, and the materials have been well selected.

Swaine and Adeney, 185 Piccadilly, London (92, p. 522), for a large assortment of whips and canes, showing much taste in the manufacture, and superiority of workmanship.

White, J. C., 29 Liverpool Street, London (86, p. 522), for silver-mounted harness with improved registered tug. A very useful and ingenious invention.

The Jury desire to make Honourable Mention of the following Exhibitors:—

Adams, H., New York (476, United States, p. 1465), for a portable saddle ingeniously contrived.

Ashford, W. and G., Birmingham (64, p. 521), for specimens of whips of various designs, well manufactured.

Banton, E., Walsall (56, p. 520), for a case of bridles of good workmanship and superior quality.

BELL, C., 34 Wigmore Street, London (93, p. 523), for a lady's saddle and single harness.

BYWATER, W. M., 99 Piccadilly, London (94, p. 523), for harness and improved Russian cavalry bridles.

COWAN, L., Barrhead, New Paisley (273, p. 528), for a very good set of Scotch cart harness of patent leather.

HUDSON, S., Dublin (60, p. 520), for a hunting-saddle with elastic seat, and a side-saddle with safety stirrups.

HUGHES, R., Clifden Street, Finsbury, London (106, p. 523), for heraldic mountings for harness.

MAXWELL and Co., 161 Piccadilly, London (52, p. 520), for socket spurs in various stages of manufacture.

PENNY, J., 37 Union Street, Middlesex Hospital, London (91, p. 522), for a state pony bridle, designed by W. H. Rogers, made by W. Langdon.

STEWART, W., Toronto (134, Canada, p. 966), for a set of single sleigh harness, made of varnished leather.

The Jury desire to record their great obligations to the undernamed gentlemen:—

Mr. Thomas Powell, leather factor, Lime-street.
Mr. William Hackblock, Rood lane.
Mr. Frederick Dandleker, Hambectikon, Lake of Zurich.
Mr. Martin Blackmore, Bread Street, London.
Mr. E. W. Roberts, Page's Walk, Bermondsey.
Mr. Alfred Rymer, Nassau Street, Westminster.
Mr. M. Nicholls, Little Windmill Street, Westminster.
Mr. George Kent, Mornington Crescent, Westminster.
Mr. George Kidd, Associate Juror, 257 Oxford-street.

All of whom have very freely given their valuable services in the examination of many of the Exhibitors' goods, on the merits of which they were peculiarly qualified to assist the Jury in forming a correct judgment.

J. A. NICHOLAY, } REPORTERS.
J. B. BEVINGTON, }

London, December, 1851.

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CLASS XVII.

REPORT ON PAPER AND STATIONERY, PRINTING AND BOOKBINDING.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Sylvain Van de Weyer, *Chairman*, Belgium; Envoy Extraordinary and Minister Plenipotentiary from H. M. the King of the Belgians.
Thomas De La Rue, *Deputy Chairman*, 84 Westbourne Terrace, Hyde Park: Ornamental Stationery Manufacturer.
Charles Whittingham, *Reporter*, Chiswick, and Took's Court, Chancery Lane; Printer.
A. Firmin Didot, *Joint Reporter*, France; Member of Central Jury, &c.*
Professor Hulse, Zollverein; Director of the Royal Polytechnical Academy at Dresden.
Viscount Mahon, F.R.S., 41 Grosvenor Place.
Henry Stevens, Barnet, Vermont, United States; residing at Morley's Hotel, London.
Charles Venables, Plomer Hill House, High Wycombe; retired Paper Manufacturer.

The articles which the Jury had to examine were classified in the following manner:—

A. Paper in the Raw State as it leaves the mill.
B. Articles of Stationery.
C. Pasteboards, Cards, &c.
D. Paper and Scaleboard Boxes (cartonnerie).
E. Printing (*not including Fine Art Printing*).
F. Bookbinding.

The Jury met on the 17th of May, and continued their labours till the 28th of July, when their awards were finally settled and transmitted to the proper authorities.

They did not think it necessary to divide themselves into sub-committees; but in adjudicating upon the specimens of printing intended for the use of the blind, they requested the assistance of George Sumner, Esq., of the United States, and William Hughes, Esq., of Henshaw's Blind Asylum, Manchester, to which request these gentlemen kindly acceded.

The first duty of the Jury was to refer to the "Decisions regarding Juries," and afterwards to the "Instructions from the Council of Chairmen," in which, among other conditions, it is stated that "a classified list of the subjects under the province of each Jury is prepared, and forms the *limitation* of each class;" and that "those articles will be rewarded which fulfil in the highest degree the conditions specified in the Sectional List," namely:—

> "Increased usefulness, improved form, superior quality, or superior skill in workmanship, new use of known materials, use of new materials, new combination of materials, beauty of design in form or colour, or both with reference to utility, the cheapness with reference to production, and that the Report should describe the state of industry as shown in this Exhibition."

The Jury, in accordance with the foregoing instructions, proceeded to the examination of the different articles. The classified list of subjects was found to be very defective, the classification only extending to English Exhibitors, and many articles were found to be misplaced in the classes to which they had been assigned. The Jury had thus to refer several articles to their proper classes, and to decide that maps did not come under their consideration, though several had, in the Official Catalogue, been inserted in Class XVII.; that the lithographic colour press, as well as all other machinery, came under the jurisdiction of Class VI., the Jury offering at the same time to give their assistance and opinions individually or collectively, should any such assistance or opinions be desired; that they could take cognizance neither of literary merit, as had been required of them, nor of different philological systems of printing, as phonetic printing, phonotypy, phonography, &c. &c.; and lastly, that several specimens of caligraphy and penmanship had erroneously been sent to them.

With regard to the Foreign Department the Catalogue was still more imperfect; and the Jury had to search out the articles which appertained to their Class. It is greatly to be feared that, notwithstanding all the care taken by the Jury, there may be articles which have escaped their observation.

It will be observed that the Jury, in strict conformity with the principles laid down by the Royal Commission, have only recommended one Council Medal, and that for typography; not that they did not recognize the excellence and beauty of many of the specimens exhibited, and the skill and perfection which, in many points, the art of printing displayed, but because there did not appear to be any production so clearly bearing the character of *novelty of invention or new application of a known principle* as to justify such a recommendation, with the exception of the products of the Imperial Court and Government Printing Office of Vienna, which presented both novelty of invention and a number of new combinations in the art of typography.

No prize was awarded to publishers, as such, notwithstanding the merit of their publications.

Until recently, bookselling had not been represented at the Exhibitions of Industry: the instructions given to the Jury of the Great Industrial Exhibition of all Nations did not assign to it any distinct position; and, therefore, in the different countries the booksellers have refrained from sending their publications, not deeming that their trade, connected more or less closely as it is with the sciences and with letters, could be looked upon as a branch of industry.

Several booksellers of France, Germany, and Belgium, have, however, thought that the creation of a book being the result of a combination of different industrial branches—such as wood-engraving, metal-engraving, colouring, the choice of types, and of the various kinds of paper, &c.,—the bookseller ought to be looked upon as the partial creator of these industrial products, the first idea of which he had in many instances conceived.

In awarding the Prize Medal, the Jury have, in each branch, observed the general principle of acknowledging the various kinds of excellence to be met with in each article under consideration, without entering into the question of relative merit.

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* M. Didot, a Greek scholar, and an eminent typographer, engraver and typefounder, printer to the Institute of France, and paper-manufacturer, having been appointed member of the Jury, his firm (of which he is the head partner) was excluded from competition. The Jury cannot, however, abstain from expressing their high appreciation of the important services, zeal, impartiality, and talent displayed by M. Didot, both as Joint Reporter and Juryman.

Some articles, though having no claims either to a Prize Medal or an Honourable Mention, contained, nevertheless, some merit, which justified the Jury in noticing them in their Report. They do not profess to express an opinion upon every article exhibited, notwithstanding the care they have taken in making a critical examination of the whole; thus their Report has reference to the general merits of the goods exhibited, as illustrative of the present state of the Paper Manufacture, Printing, and Bookbinding, as pursued in various countries, and the contributions of any individual Exhibitor are neither commented upon, nor is any allusion made to them, except in illustration of the Report.

In the appreciation of the articles of this Class, the products of which deeply interest all grades of society—contribute to their moral, intellectual, and social civilization, and give activity and employment to so many minds and hands—it would have been gratifying to the Jury, had they been able to draw a faithful picture of the actual state of all those branches of industry which have occupied the most ingenious inventors, to trace their gradual development, and to indicate their probable future growth. The Jury feel how imperfectly they have succeeded in attaining this end; they have, however, given a rapid historical sketch of the origin and progress of Printing, of Paper Manufacturing, &c., in order to facilitate a comparison between the past and the present, and to enable the reader in some degree to judge of the real extent of those branches of industry, in various countries, as represented at the Great Exhibition.

The Reporters express their thanks to their Chairman, M. VAN DE WEYER, for his assistance and contributions in the drawing up of the Report; also to their colleague, Mr. HENRY STEVENS, for the information he has given on the state of Type-founding and Paper Manufacture in the United States, as well as for his article on "Printing for the Use of the Blind."

The number of exhibitors of all nations in this Class is 559, of which 212 belong to Great Britain; 124 to France; 1 to Algiers; 24 to the Zollverein States, including Prussia, Baden, and the United States of Northern Germany; 23 to the Grand Duchy of Baden, and the West Provinces of Prussia and Electoral Hesse; 19 to Bavaria; 10 to Saxony; 7 to Wurtemburg; 8 to Frankfort-upon-the-Maine; 18 to the Grand Duchy of Hesse; 1 to Nassau; 3 to Hamburgh; 1 to Hanover; 6 to the Netherlands; 1 to Persia; 1 to Smyrna; 2 to Portugal; 2 to Rome; 5 to Russia; 2 to Sardinia; 1 to Spain; 5 to Switzerland; 2 to Tuscany; 3 to India; 2 to Malta; 5 to Canada; 1 to New South Wales; 1 to Van Diemen's Land; 23 to America; 19 to Austria; 17 to Belgium; 3 to China; 2 to Denmark; 2 to Sweden; and 3 to Egypt.

The Jury, in conclusion, express their hope that the union of all nations, evidenced by the Exhibition of 1851, may hasten the peaceful solution of a question which concerns at once the rights of justice, of literature, of the sciences, and of typography. Property, the unalterable basis of society, can never be less sacred in works of genius than in material concerns. Printers and booksellers, whose complaints unite with those of artists and literary men, have shown that the unrestrained reprinting of works, without regard to moral considerations, is generally attended, in every quarter, with greater inconvenience than advantage. The recognition of literary property within proper limits will give more intellectual life, and more creative imagination to countries in which the reprinting of foreign works now stifles the development of native literature and science.

The Custom-houses, now obliged to establish a search, frequently hostile, will relinquish the impediments to commerce and literature, and works will no longer be reprinted in haste, replete with errors, or mutilated according to the will of speculators, and in emulation of each other.

Lastly, the certainty of a wider market will be an encouragement to writers of talent, and to publishers, who are frequently prevented from commencing great undertakings by the fear of seeing their work immediately pirated. Universal co-operation is indispensably necessary to insure the success of great literary and scientific enterprises, which could not fail to flourish in a higher degree if the rights in literary property were recognized.

I. PRINTING.*

After an interval of four centuries, the date of the Great Exhibition of the world's industry is coincident with the anniversary of that of the invention of printing. It seems as if all nations were assembled in the capital of England to celebrate the centennial birthday of the Press—the most powerful instrument of their civilization. It is by the aid of printing that different nations have imparted to each other their thoughts and their feelings, and have received in some degree a combined existence. Without this marvellous bond, they would have been left to the ignorance and prejudices which foster national warfare, and could never have presented this admirable display of universal harmony and of generous emulation.

When we consider the great costliness of manuscripts at a former period, the difficulty of procuring them, and all the benefits of which society was devoid before the discovery of printing, every friend of study and of exalted intellectual speculations should deem himself fortunate in living at a period when so many stores of instruction are placed within the reach of all.

In every age, and in all countries, printing denotes the state of civilization, of which books are the reflex, and the history of the human mind is written in the progress of bibliography. Thus the first printed books of Germany were almost all devoted to theology and scholastic philosophy, while at Paris ancient literature occupied an equal rank with theology; thus also at Rome, where the remembrance of ancient literature maintained a still stronger empire, printing under the guidance of the Bishops of Aleria and Teramo, principally reproduced the master-pieces of classic times. In France, however, under the influence of the chivalrous reign of Francis I., a great number of works upon chivalry soon appeared, and the desire of becoming acquainted with narratives so much in conformity with the prevailing taste, was one cause of the introduction of printing into England. Of the sixty-two works printed in London by Caxton, those upon theology do not amount to ten, the remainder being devoted to chivalry, to history more or less romantic, to literature, and to manners and customs. Without expatiating upon this subject, we will confine ourselves to observing that at the period when the Pope founded at Rome the celebrated printing-office for the "Propagation of the Faith," there was no corresponding activity on the subject in London; and that at the present day, whilst the great printing establishment of the "Propaganda" remains inactive, England every year sends forth to the world a million of Bibles and New Testaments.

Soon after its first origin, the art of printing had attained a great degree of perfection, and it was not till the second half of the last century, that owing to the efforts of Ibarra, in Spain; of Baskerville and of Bulmer, in England; of the Foulises and the Ruddimans, in Scotland; of Bodoni, in Italy; and of the Didot family, in Paris, any real progress can be pointed out. The types were better cut and better cast, the ink as good as that of the earliest printers, the paper was improved in its make, and the press-work more uniform.

At that time the greatest admiration and astonishment were created by the rapidity with which at each action of the lever, moved by the hand of the workman, all the pages which a whole sheet of paper was capable of containing, were imprinted at a single stroke; but this rapidity, which enabled a workman to produce in one day more than a thousand transcribers could write, could not long suffice to supply the constantly-increasing demands caused by the march of intellect.

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* "I participate in the encomiums bestowed by all former eulogists on this transcendant art, which may justly be considered as the nurse and preserver of every species of knowledge; and while I look into history for an examination of the benefit which mankind has already derived from it, I feel equal, or even still more pleasure in anticipating that which it is yet capable of effecting, when, by being perfectly unfettered all over the globe, it will give rise to and promote a system of universal education, and when, as a certain consequence of that education, all societies will direct their strenuous efforts towards bringing into complete operation that divine morality which has for its basis this simple but sublime maxim, 'Do unto another that which you would wish another should do unto you.'" —*On the Art of Printing, by the late Charles, third Earl Stanhope.*

About the beginning of the present century, Charles, the third Earl Stanhope,[*] by the invention of the press which bears his name, and of a new process of stereotyping, more simple and more economical, had made a great improvement in the typographical art. Subsequently Messrs. Bauer and Kœnig, aided by the genius and knowledge of English engineers, and by the intelligence and perseverance of Messrs. Bensley and Walter, applied steam power to a new system, which created a revolution in the art of printing. In lieu of the platten, which the workman's arm slowly brought down upon the types, two cylinders printed with rapidity both sides of the sheet, whatever its size might be. In November 1814, by means of this machine, which was subsequently much simplified, the "Times" newspaper was printed with a rapidity which surpassed Guttemberg's press even more than the latter did the hand of the transcribers. It might have seemed that the rapidity of production in printing could proceed no further; but after having been repeatedly altered in its form, the printing machine appears before us now in an entirely novel shape, and we might believe on seeing the "Times" newspaper printed by Applegath's new system, that the highest degree of speed had been attained, did not experience prevent mankind from assigning a limit to the perfectibility of human inventions, and to the inscrutable designs of Providence.

Mr. Kœnig's machines, patented in 1814, were far too complicated and expensive, and the inking too imperfect, for general adoption. They were superseded by Mr. Edward Cowper's machine, which he invented and patented in 1816. Almost all the large editions of modern works are printed by Cowper's machines, and the influence they have had on the publication of books of all kinds is far beyond any expectation entertained at the time the machine was invented. After it had been in use some time, it was stated in Court, by an eminent lawyer (now a noble Lord), that, "if it had not been for Mr. Cowper's machine, it would have been impossible to supply the demand for books:" this is not correct, for at that time the hand-press *did* supply the demand: but the striking and important fact is, that the *machine* created a demand, and called into existence books which, but for it, would scarcely have been thought of. As the machine-work from type and wood-cuts was far better than the ordinary printing of the day, booksellers were induced to print extensive editions, because they saw the machine could accomplish all they required. One of the first booksellers who availed himself of this power was Mr. Charles Knight, who projected the "Penny Magazine," on a hint from Mr. M. D. Hill, Queen's Counsel. Each number, published weekly, consisted of eight pages of letterpress, illustrated with good wood-engravings. The public was astonished at the cheapness and good quality of the work, but it was its immense sale which rendered it profitable; for some years it amounted to 180,000 copies weekly. Mr. Knight, whose services in the cause of educational literature entitle him to the highest praise, expended 5,000*l.* a-year in woodcuts for this work. The Cowper machine has been the cause of the many pictorial illustrations which characterize so large a portion of modern publications. The "Saturday Magazine," "Chambers' Journal," the "Magasin Pittoresque," in France, and numerous others, owe their existence to this printing machine. The principal of *cheap editions and large sales* soon extended to establish works of a higher value. A remarkable instance of this was the edition of Sir Walter Scott's works, with notes, edited by himself: instead of the old price of 10*s.*, they were sold at 5*s.* a volume, and the demand created by this reduction of price was so great that, although the printer had a strong prejudice against machines, he was compelled to have them, the presses of his large establishment proving totally unable to perform the work, which amounted to upwards of 1,000 volumes per day for about two years. The Universities of Cambridge and Oxford have adopted Mr. Cowper's machines for printing vast numbers of Bibles, Prayer-books, &c. &c. A Bible, which formerly cost 3*s.*, may now be had for 1*s.* Mr. Cowper recommended the Religious Tract Society to put aside their coarse woodcuts, to have superior wood engravings, and to print them with his machine. The Society adopted these suggestions, and the result is, that by sending forth well-printed books, it could now support itself by their sale, without any aid from subscriptions.

As to newspapers, "The Times," for instance, prints about *Thirty-five thousand* copies every day, and as this newspaper is of a very large size, often with a supplement, the aggregate amount is more than thirty acres of printed surface per day—a quantity that could not possibly have been effected by hand-presses. At the "Times" office there are four machines, invented by Cowper and Applegath, printing from 4,500 to 5,000 impressions per hour; and two machines, lately invented by Mr. Applegath, printing *Ten thousand copies* per hour—a hand-press producing only 300 impressions per hour. The great point obtained in these machines is the perfect distribution of the ink, and the power of causing the type to pass under the inking-rollers twice for newspaper work, or from four to eight times for book-work, thus insuring the type being well inked. The effect was so striking, as to induce Mr. Cowper to apply the inking-roller[*] and table to the common press, and this method has entirely superseded the old printing balls, and completely abolished the imperfect inking, technically called "*monks and friars*," so frequently seen in books printed by the old system. The effect of Mr. Cowper's ingenious invention is, that books are well, cheaply, and quickly printed, an abundance of illustrations introduced, and the quality of printing improved all over the world; thus rendering literature accessible to millions.

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[*] Mr. Stower remarks, "That the common press is constructed on the true principles of mechanism. It does not, however (he allows), produce an adequate impression from heavy works in small letter without great labour and attention. It was, therefore, a great acquisition to gain an accession of power with, at the same time, a diminution of labour.

"This valuable acquisition in the art of printing owes its invention to that enlightened and patriotic statesman, Earl Stanhope. The iron press, invented by this nobleman, is capable of ten times the force of the common press, with, perhaps, a tenth of the labour. In working upon this press nothing is left to the judgment of the pressman but the beating."

The Stanhope principle has been applied in all succeeding improvements of the common press, whether of iron or wood.

Mr. Tilloch having given up the prosecution of the art of stereotyping, Mr. Wilson, a printer of respectability in London, engaged with Earl Stanhope for the purpose of bringing it to perfection, and eventually to establish it in this country. His Lordship, it is said, received his instructions from Mr. Tilloch, and had afterwards the personal attendance of Mr. Foulis for many months, at his seat at Chevening, where his Lordship was initiated in the practical part of the operation.

After two years' application, Mr. Wilson announced to the public, that the genius and perseverance of Earl Stanhope, whom he styles "the Right Honourable Inventor," had overcome every difficulty, and that, accordingly, the various processes of the stereotype art had been so admirably contrived, combining the most beautiful simplicity with the most desirable economy, the *ne plus ultra* of perfection with that of cheapness, as to yield the best encouragement to the public for looking forward to the happy period when an application of this valuable art to the manufacture of books would be the means of reducing the prices of all standard works at least thirty, and, in many cases, fifty per cent.

In January, 1804, the stereotype art (with the approbation of Lord Stanhope) was offered by Mr. Wilson to the University of Cambridge, for their adoption and use in the printing of Bibles, Testaments, and Prayer-Books, upon certain terms and conditions highly advantageous to Mr. Wilson; for, with his Lordship's characteristic generosity, Earl Stanhope uniformly declined to accept even the reimbursement of any part of the moneys by him expended in the prosecution of this ingenious art. Some differences, however, arising between Mr. Wilson and the officials of the University, the contract was dissolved, and Mr. Wilson published his case in a stereotyped pamphlet, entitled, "Arbitration between the University of Cambridge and Andrew Wilson."

Printing—Austria.

Printing, invented at Strasburg and at Mayence, and patronized by the Emperor Maximilian, who obtained masterpieces[†] from it at its very commencement, appears in this Exhibition with a degree of splendour which has caused general surprise. No less encouraged in our day by its present sovereign, the Imperial Printing-office of Austria has proved itself equal to its duties, and has accelerated the progress of the art by numerous experiments of all kinds. Xylography, engraving, type-founding, stereotyping whether by plaster moulds or by means of gutta percha and the galvano-plastic process, electro-metallurgy, by which fossil fishes and animals buried in the antediluvian era are reproduced upon paper; galvanography, galvanotype, chymitype, all those new applications of art and science which dimly foreshadow an unknown future, are represented here; and lithography, that new sister of typography, also appears, with the new adjuncts of chromotypy and chromo-lithography.

The beautiful and rich collection of Oriental types, of which we have counted more than a hundred different sorts, as well engraved as they are well cast, proves that in Austria learning is not less encouraged than the arts.

By the side of so many objects relating to typography, we must admire the typographic plates, each measuring 540 square inches, formed by the galvanic process, and producing, in copper, letters of all languages, from which many millions of copies may be printed without any appearance of wear and tear.

M. Haas, of Prague (367, p. 1028), has distinguished himself by various efforts towards sustaining the long-established reputation of his house.

After the admirable display made by Austria, of numerous specimens of well-executed typography in all languages, the Jury hardly feel themselves authorized to express a wish that, among the great and increasing number of printers in that empire, a few had sent their productions, to show how far the art has advanced without the support of the Government. The only Exhibitor in letter-press, besides M. Haas, was M. Battagia, of Venice (366, p. 1028), who sent fair specimens of typography, in simple and convenient binding. As publishers, MM. Muller (372, p. 1028), and Neuman (373, p. 1028), of Vienna, exhibited books and albums got up with much care.

Printing—Prussia.

Next to the Imperial Printing-office of Austria we notice that of M. Decker, the printer to the Royal Academy of Berlin (148, p. 1056). The large folio New Testament, the German translation by Luther, is a masterpiece of typographic art. The printing of it is perfect, the types are well cut and cast, the ink is black and brilliant, and the paper excellent. Great praise must also be accorded to the edition of the complete works of Frederick the Great, a literary and typographic monument of great beauty, raised by Prussia to its hero. The five volumes in large quarto, already published, are worthy in every respect, by their typographic execution, of the importance of such a work.

M. Decker exhibited, amongst the specimens of types from his foundry, some beautiful Oriental types, engraved in part with the co-operation of the Academy of Berlin, and also specimens of brass rules, of great depth in the engraving, and of very superior execution.

M. Liepmann's ingenious invention (147, p. 1056) for printing in oil from a mass of solid colours, as a substitute for semifluid printing inks, has attracted the notice of the Jury, and they hope that when it has been sufficiently improved, this may be a valuable adjunct to ornamental printing.

M. G. Westermann, of Brunswick (749, p. 1091), has shown a specimen of good printing in the work entitled "European Gallery," printed upon German paper.

From Elberfeld, M. Baedeker's "German Bible," in folio (832, p. 1095), is a specimen of small and neat type printing. M. Haenel, of Berlin (284, p. 1065), exhibited bank-notes, and labels in gold and colours, possessing some merit.

Printing—Saxony.

M. Hirschfeld's, of Leipzic (180, p. 1113), and some other typographic establishments, maintain printing in an honourable position in Germany.

The considerable number of publications printed in a single year by M. Brockhaus (178, p. 1112), who is at the same time a printer, a type-founder, a bookseller, and publisher, at Leipzic, has attracted the notice of the Jury. All these publications are directed towards literary and scientific purposes, and each edition is very large. Although his printing aims less at the perfection of the art than at cheapness and correctness, we have nevertheless remarked a charming little volume entitled *Die Bezauberte Rose*, by Schultze.

The books printed and published by MM. Vieweg, of Brunswick (822, p. 1095), who are also type-founders and paper-makers, are not less worthy of remark for their aim at scientific usefulness. The execution of them is without any attempt at fine printing, but is such as suits this description of books.

M. Barth's work, "Minstrels of Germany" (179, p. 1112), printed at Leipzic, on parchment, and the publications of M. Schmerber, of Frankfort (30, p. 1124), should also be mentioned.

In general, the Jury have observed, in all the books exhibited in the German Department, great improvements in the paper, in the clearness and neatness of the type, and the quality of the ink.

Printing—Italy.

Printing, soon after its discovery, was carried to Rome by some German printers. The Popes Sixtus V., Leo X., and Clement XIV., founded the celebrated printing-office of the Vatican, for the purpose of printing the works of the Holy Fathers and the Holy Scriptures, and of propagating the Catholic Faith. Their beautiful Oriental types give this printing-office an honourable standing, but its publications are few, and do not keep pace with the progress of the times.

The Vendelins of Spires, and the Jensons, were early established in Venice. They introduced some happy modifications into the types by making them approach nearer to the beautiful letters of Roman inscriptions. The Aldi still further improved them, and invented the sloping types called *italic*. Their beautiful and erudite publications are remarkable even in the present day for their typographic execution.

At the end of the last century, and at the commencement of the present, Bodoni, a typographer of consummate skill, who was at the same time the engraver and founder of the types which he so carefully printed, published his beautiful editions—true masterpieces—which have earned for him the highest renown, but in which he perhaps sacrificed too much to typographic luxury.

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[*] Earl Stanhope, when he invented the Printing Press which will bear his name to posterity, coupled with his object an idea of inking the form on the press by means of a revolving cylinder, and in pursuit of this plan spared no expense in endeavouring to find a substance with which to cover his rollers. He had the skins of every animal which he thought likely to answer the purpose, dressed by every possible process, and tried many other substances, as cloth, silk, &c., without success. The unnecessary seam down the whole length of the roller was the first impediment, and next the impossibility of keeping any skin or substance then known always so soft and pliable as to receive the ink with an even coat, and communicate the same to the form with the regularity required. All the presses of his early construction had at each end of the table a raised flanch, type high, for the purpose of applying his rollers; but the obstacles interposed by nature herself totally baffled and defeated his Lordship's plans in this respect.

[†] This may be judged of at the British Museum, by the unique copy upon vellum, printed by Schœnsperger about 1514. It is a magnificent "livre d'heures," the execution of which is even superior to that of the celebrated book of the Adventures of Teurdanck.

Italy has sent but few typographic productions to this Exhibition; nevertheless the Jury have remarked with interest the large folio volume of "The History of the Abbey of Altacomba," skilfully printed at Turin, by MM. Chirio and Mina (89, p. 1305). The type is very beautiful, and each page is surrounded by a border imitated from one of the exquisite manuscripts of the 15th century. The wood engravings have been multiplied by the galvanoplastic process.

Printing—Switzerland.

Notwithstanding its flourishing trade in books, and the great number of printers established in the Cantons, Switzerland has not given the Jury an opportunity for judging of its progress in typography.

Printing—England.

The first book printed by Caxton, after a long residence in the Low Countries, appeared in London in 1474; and it is worthy of note, that the first book in the English language was printed by him, not in England, but on the Continent, in 1471. Almost all those which he printed, and which he translated himself, to please the Princess Margaret, sister of King Edward the Fourth, and at the solicitation of the great lords and ladies of that time, were devoted to chivalry. His types, and those of his successors, Wynkyn de Worde and Pynson, are a not very elegant imitation of the writing then used in England. Up to the time of Buckley, in 1733, the art of printing made little progress in this country. It was Baskerville who, in 1750, turning his thoughts from japanning to type-founding and printing, first gave to the art a real impulse. He spent several years and much of his fortune before he was able to produce types to his own satisfaction. In 1757 he issued his first book—a Virgil, in quarto. Between this date and 1763, he printed those charming editions of Milton, Addison, The Common Prayer, The Bible, Juvenal and Persius, Horace, &c., which are still celebrated for their typographical beauty, and cause the name of Baskerville to be ranked among the most eminent men who have contributed to the improvement of the Art of Printing. The paper which he caused to be made was superior, and all his apparatus for printing, including his ink, presses, chases, punches, matrices, moulds, and types, were produced by himself, and were all great improvements. His process of drying and glazing his paper and ink, as soon as printed, by means of hot plates of copper, was expensive, and had some other faults; but the taste of the period was not then ripe for luxury in printing, and notwithstanding that he offered to print for the London booksellers within five per cent. as low as the printers they employed, he complained that he was unable to get work from them. Accordingly, in 1767, we find him writing to his old friend Franklin:—"After having obtained the reputation of excelling in the most useful art known to mankind, of which I have your testimony, is it not to the last degree provoking that I cannot get even bread by it?" Then, as now, many persons would encourage bad printing, because it was cheaper. His types, though rather lean for large books, were held in much estimation, and in 1779, four years after his death, were sold to a literary society in Paris for 3,700*l.*, and were, in 1784, first employed in printing Beaumarchais' celebrated edition of Voltaire, in seventy volumes, a work at that day unsurpassed in typographic luxury. Thus ended the first real attempt at improvement in England.

At the end of the last century, Mr. William Bulmer and Mr. Thomas Bensley made a fresh progress in the art of printing. Their beautiful publications rivalled the most remarkable productions of France, Spain, and Italy; and the magnificent edition of the works of Shakspeare, in nine folio volumes, embellished with engravings after the most able artists of England, and printed by Bulmer with great skill, excited the zeal of MM. Didot, who wished to raise in France a like monument to Racine, and printed a folio edition, unequalled for its typographical perfection.

At the commencement of the present century, the late Mr. Charles Whittingham brought out the elegant editions which have rendered the Chiswick Press so celebrated. Until that time no one had printed wood engravings so perfectly, by the application of *overlays** necessary for obtaining gradations in the tints. This success encouraged the engravers to give to woodcuts a fineness unknown in the times of Albert Durer, Wolgemuth, and other engravers, who were obliged to employ broad lines, the unevenness of the paper and the imperfections of the presses rendering the printing of fine lines impossible.†

At the present day, when speed is imperatively demanded by the public, the means of satisfying this demand are everywhere numerous and powerful. This fact may be judged of in London by the printing-office of Messrs. Clowes (printers of the Official Catalogues, and of the Reports by the Juries), in which two steam-engines put in motion twenty-six printing-machines; by that of Mr. Spottiswoode, the printer to the Queen, &c.; and by the printing-offices of "The Times," and other large London newspapers, which publish in the morning the long debates in Parliament, so often continued until late in the night. This rapidity of execution would have appeared fabulous in the last century; and it ought to be remarked that the speed does not, in England, in any way prevent the correctness of the work, which is in general remarkable, even in the immense daily newspapers. This advantage must be attributed, in a great measure, to the maintenance of the ancient custom of the printers in England. Here it is required that there should be seven entire years' apprenticeship of every working printer, whether he is destined to be a compositor or a pressman. This beneficial custom, by means of which the workman becomes more skilful and more attached to his profession, is gradually re-establishing itself in all the countries in which, by reason of political commotions, it had fallen into disuse, to the great detriment of the art.

While in most other countries of Europe the patronage of the Government appears indispensable to the creation or the development of a great number of branches of industry more or less intimately connected with the fine arts and science, England affords a striking instance of how they are capable of being nurtured and developed without this support. The strength of its institutions, its spirit of association, the immensity of its capital, and its indomitable perseverance, enable the typographic art to develop itself solely by its own resources. The Tract and Bible Societies, which have printed the Holy Scriptures in all languages, are a remarkable proof of the power of association animated by a religious spirit.‡

The numerous and voluminous encyclopædias, of which the Encyclopædia Britannica alone, in 26 large quarto volumes, has reached its seventh edition, and the large number of important popular publications, also prove the immense resources of this country.

Although neither of the great Universities of Oxford and Cambridge has taken any part in this Exhibition, the Jury must commemorate the high merit of the Clarendon Press in the one, and of the Pitt Press in the other. During a long series of years Oxford has been remarkable for the well-sustained beauty of its Greek and Latin publications, as well as of those in the English tongue.

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* It is also possible that the system of lowering woodcuts was one of the means adopted by the engravers who were employed for the Chiswick Press, in order to facilitate good work. In 1844, the Trustees of the British Museum permitted casts to be taken of the original wood blocks engraved by Albert Durer, in 1510, of his *Passio Christi*, and an edition was printed in English, edited by Henry Cole, Esq. These cuts are very much lowered.

† The term *engraving* is misapplied as to the works of Albert Durer and his cotemporaries, for it was not the *graver* but the *knife* that was used to produce the blocks from which impressions were then taken, after the manner of block cutting for calico printers of the present day.

‡ The statement published in May 1851, by one single institution, the British and Foreign Bible Society, founded in 1804, shows the production of 24,247,667 copies of the Old and New Testament, in one hundred and forty different languages, which have been distributed over the whole surface of the globe by the exertions of the Protestant missionaries. The expenditure, exclusive of the annual engagements, has amounted to £3,751,555.

Mr. **PARKER** (120, p. 544), the bookseller of the University of Oxford, has exhibited as a publisher, several works on mediæval architecture, remarkable for their correctness, the beautiful execution of the wood engravings, and the goodness of the paper.

The Jury have strongly regretted, and this regret has been recorded on their minutes, that almost the whole of the printers of England have refrained from exhibiting the beautiful productions of their presses, owing to the instructions given to the Local Commissioners, which stated that printed books were inadmissible. However, some fine specimens of good printing seem to have crept in by mere chance, such as Messrs. **BRADBURY** and **EVANS**'s beautiful work (136, p. 545), of Mr. Marryat, "Collections towards a History of Pottery and Porcelain," neatly executed; Mr. **PICKERING**'s "Victoria Book of Common Prayer," (140, p. 545) in large Old English type, the Rubrics in red. This book has been carefully collated with the sealed book in the Tower of London. It is on super-royal paper, made by Mr. T. H. **SAUNDERS**, of Dartford, Kent (36, p. 539): it is hand-made, hard tub-sized, from fine strong rags, without any artificial colour; the moulds were made expressly, the wires finer and closer placed, to imitate the old moulds. This is a Supplemental Volume to Pickering's Series of the Common Prayer, which shows all the changes made in the Ritual from the Reformation to the Savoy Conference. "The Booke of Common Prayer, noted by John Merbecke." This is a verbatim reprint, showing what parts of the service were chanted in the reign of Edward VI.; the notes are black on red ledger lines; the paper the same quality and make as the Victoria Prayer-Book, but in water-leaf, that is, without size. Also the first six books of Euclid, with the diagrams and symbols printed in colours, which are used instead of letters, for the greater ease of learners: all these are from the press of Mr. **WHITTINGHAM**. Mr. **BAGSTER**'s (87, p. 543) well-printed and useful "Polyglot Bibles;" Mr. **MACKENZIE**'s (of Glasgow) (94, pp. 543, 544) good specimens of Church Text, illuminated with red capitals; Messrs. **REED** and **PARDON**'s neatly executed specimen of their founts; Mr. **SMITH**'s specimens of Hercules Ellis's Poetry; Major **BELL**'s (203, p. 552) well got-up Tables of Universal History, &c. &c. Two other works must be mentioned, as being connected with the Great Exhibition—Mr. **BRETTELL**'s (169, p. 547) Hymn for all Nations, by Mr. Tupper, translated into thirty languages, and Mr. **OWEN**'s (180, p. 549) reprint of the speech of H. R. H. Prince Albert, at the Mansion House Banquet, also translated into several European and Oriental languages.

The same principle which prevented the English printers from exhibiting their works has deprived the publishers of the opportunity of taking, at the Great Exhibition of all Nations, that high position to which their beautiful and carefully edited works would have justly entitled them. The names of Longman, Murray, Moxon, Bohn, Pickering, and of a great many others, are for ever inseparable from the history of English literature; and thousands would again have seen with satisfaction, and shown with pride to foreigners, the numerous, cheap, neatly printed, and beautifully illustrated productions of Mr. Charles Knight, who in ministering to the intellectual wants and pleasures of the people, has given in the right direction an impetus which is still felt in all branches of art and manufacture connected with this Class.

The following statistical Tables by Mr. Edward Edwards, Secretary of the London Society of Compositors, cannot but prove interesting:—

TABLE showing the RATE of WAGES per WEEK, and NUMBER of JOURNEYMEN and APPRENTICES in 79 TOWNS in the UNITED KINGDOM.

ENGLAND AND WALES.

Name of Town.	Rate of Wages.	Number of Journeymen.	Number of Apprentices.
	Shillings.		
Aylesbury	24	9	9
Banbury	24	9	5
Bath	25	64	49
Bedford	21 to 24	12	20
Berwick-on-Tweed	18 to 20	10	15
Bradford	24 to 26	18	26
Brecon	23	5	4
Brighton	29	30	50
Bristol	24 to 25	20	100
Bolton	27	12	22
Blackburn	24	7	12
Canterbury	20 to 24	10	18
Chichester	21 to 30	3	2
Cardiff	21 to 24	116	11
Chester	27	31	17
Cheltenham	24	24	33
Cambridge	27 to 40	67	50
Durham	21	23	35
Darlington	18 to 24	11	24
Doncaster	22 to 24	20	11
Dover	21	7	14
Exeter	18 to 19	30	14
Hereford	21 to 24	17	50
Halifax	24	24	12
Hertford	28	10	18
Huddersfield	24	10	7
Isle of Man	12 to 20	10	16
Kendal	24	12	58
London	33 to 48	3,000	1,500
Liverpool and Birkenhead	30	280	500
Leeds	26	118	100
Lancaster	24	10	10

ENGLAND AND WALES—*continued.*

Name of Town.	Rate of Wages.	Number of Journeymen.	Number of Apprentices.
	Shillings.		
Leigh	24	2	2
Leicester	24	30	30
Lewes	29	18	20
Maidstone	24 to 25	13	17
Manchester	30	300	80
Macclesfield	18 to 24	11	7
Nottingham	27	55	60
Newport (Monmouthshire)	21 to 24	12	10
Northampton	24	11	22
Oxford	30 to 33	58	46
Preston	27	36	28
Portsmouth and Portsea	21 to 28	20	20
Rochdale	24	6	8
Scarborough	21	11	6
Sheffield	28	62	32
Southampton	20 to 25	21	22
South Shields	21 to 24	15	8
Stafford	24	11	7
Shrewsbury	24	22	23
Stamford	27	22	13
Ulverstone	21	6	14
Warwick and Leamington	21 to 25	29	12
Wakefield	24	14	24
Worcester	24	31	19
Warrington	24	4	7
Woking	27	8	6
Wolverhampton	24	25	22
Wigan	27	11	7
Yeovil	21	4	15
York	24 to 26	40	30
		4,937	3,429

Table showing the Rate of Wages per Week and Number of Journeymen, &c.—*continued.*

SCOTLAND.

Name of Town.	Rate of Wages.	Number of Journeymen.	Number of Apprentices.
	Shillings.		
Dundee	20 to 21	40	35
Edinburgh	25	598	329
Glasgow	25	280	150
Kilmarnock	20	6	6
Perth	20	21	18
Stirling	20	9	12
		954	550

IRELAND.

Name of Town.	Rate of Wages.	Number of Journeymen.	Number of Apprentices.
Belfast	25	63	100
Cork	20 to 26	58	32
Dublin	30 to 32*s*. 6*d*.	380	270
Galway	15	9	5
Kilkenny	20 to 21	10	8
Londonderry	18 to 21	12	24
Omagh and Armagh	15	12	22
Sligo	12 to 15	4	14
		548	475

RECAPITULATION.

	Rate of Wages.	Number of Journeymen.	Number of Apprentices.
London	33 to 48	3,000	1,500
England and Wales	12 to 30	1,937	1,929
Scotland	20 to 25	954	550
Ireland	12*s*. to 32*s*. 6*d*.	548	475
Total	— — —	6,439	4,454

	Journeymen.	Apprentices.
London	3,000	1,500
Provinces of England and Wales	2,500	2,000
Scotland	1,500	1,200
Ireland	1,500	1,300
	8,500	6,000
Total of persons	14,500	

In London there are, besides the numbers stated, 800 men and 350 boys who work exclusively at press.

There are printed in London, 50 weekly, 294 monthly, and 55 quarterly publications. The majority of the weeklies, and about 100 of the monthlies, are chiefly composed by boys; but the quarterlies are mostly done by journeymen. In the United Kingdom there are 14 daily papers, 18 tri-weekly ones, 41 bi-weekly ones, and 403 weekly journals. Total, 476. Of these, 84 are printed in London, 238 in the provinces of England and Wales, 70 in Scotland, and 84 in Ireland. The ratio of employment afforded for the 14,500 persons in the trade may be stated to be as follows:—

	Newspaper Department.		Jobbing, Bookwork, Publications, &c.	
	Journeymen.	Boys.	Journeymen.	Boys.
London (daily press excepted)	600	300	1,940	1,200
England and Wales	1,430	1,200	1,070	800
Scotland	500	350	1,000	850
Ireland	600	450	900	850
	3,130	2,300	4,910	3,700

On the London daily press 460 men are employed; boy-labour is not countenanced on this work.

	Shillings per week.
1. London average wages of 2,350 members	25
2. The South Eastern District (8 towns), average wages of 165 members — from	18 to 24
3. The South Western District (14 towns), 320 members	18
4. The Midland District (26 towns), 939 members — from	18 to 22
5. The Western District, Ireland (13 towns), 694 members — from	13 to 22
6. The Northern District, Scotland (10 towns), 953 members — from	12 to 19

	£.	s.
London, 3,000 members at 25*s*. per week	3,750	0
Provinces of England, 2,500 members, at 20*s*. per week	2,500	0
Provinces of Ireland, 1,500 members, at 17*s*. 6*d*. per week	1,312	10
Provinces of Scotland, 1,500 members, at 15*s*. 6*d*. per week	1,162	10
Total Amount	£8,725	0

The following list, extracted from "The Times," of March 1, 1852, shows the Statistics of the London Daily Newspapers:—

	1845	1846	1847	1848	1849	1850
The Times	8,100,000	8,950,000	9,025,230	11,021,500	11,300,000	11,900,000
Morning Advertiser	1,440,000	1,480,000	1,500,000	1,538,957	1,528,220	1,549,143
Daily News	— —	3,520,500	3,477,009	3,053,638	1,357,000	1,152,000
Morning Herald	2,018,025	1,752,500	1,510,000	1,335,000	1,147,000	1,131,000
Morning Chronicle	1,554,000	1,356,000	1,233,000	1,151,304	937,500	912,547
Morning Post	1,002,500	1,045,500	990,100	964,500	905,000	829,000
Sun	1,098,500	1,104,000	909,000	893,312	873,000	834,500
Express	— —	160,000	778,714	888,018	964,000	776,950
Globe	852,000	764,000	690,000	720,000	630,000	585,000
Standard	846,000	780,000	659,500	652,500	539,000	492,000

In London, the centre of the book trade, nearly 3,000 works (including new editions), are published yearly, of the value of 450,000*l*.; two hundred and thirty monthly and quarterly magazines produce 500,000*l*. yearly. The stamp-duty on newspapers in 1845 was 327,682*l*.; in 1850, sixty-five millions and three-quarters of penny stamps, and eleven millions and three-quarters of half-penny stamps, were used by 159 London and 222 English provincial newspapers. Seven millions and three-quarters of penny stamps, and half a million of halfpenny stamps, by 110 Scottish papers. Six millions and three-quarters of penny, and half a million of halfpenny stamps, by 102 Irish papers.—Vide "*Sharp's Gazetteer*," edition 1852, page 977.

Chromotypy, or Printing in Colours.

Hugo di Carpi is said to be the original projector of printing chiaro-oscuro, by surface block printing. In 1754, "Jackson's Essays on the Invention of Engraving and Printing in chiaro-oscuro," as practised by Albert Durer, Carpi, &c., was published. The editor in his preface states, that "besides the superiority of taste," there is "yet a very essential advantage belonging to this mode, which is, that being done in oil, the colour will never fly off. By this means the same beauty continues as long as the paper can hold together." Unfortunately for this speculative opinion, after the lapse of one hundred years the colour of the ink did "fly off," for the specimens of the wood-cuts in oil scarcely retain any of the colours which were supposed to be imperishable as long as the paper lasted. The paper, on the contrary, continues good and strong to this day.

M. J. M. Pupillon, in his *Traité Historique et Pratique de la Gravure sur Bois*, 1766, gives directions for making the varnish, and for the choice and mixing of colours for printing in chiaro-oscuro; and shows specimens of the different states of the impressions in the progress of the printing. Mr. Savage, in "Hints for Decorative Printing," also gives *practical* directions for ornamental colour printing. His recipes for making coloured inks are, however, incorrect; and although merit is due to him for again calling the attention of printers to the subject, it is perhaps owing to the imperfection of his inks, as he describes them, that this beautiful branch of printing remained so long neglected after his book was published.

The greatest impulse given to colour surface printing in this country, was during the existence of the state lotteries, about 35 years ago. The late Robert Branston, wood-engraver, and the late James Vizetelly, then employed at Messrs. Gye and Balne's printing establishment, greatly promoted the demand for coloured and ornamental printing, the one by his skill as an artist, and the other by his constant endeavours to produce striking effects by means of colour printing; a great emulation for ornamental work being created by the lottery contractors, who vied with each other to render their lottery schemes more and more attractive. Mr. James Whiting, sen., who was one of the principal printers for the Government contractors, also produced great novelties, and subsequently, in conjunction with the late Sir William Congreve and Mr. Branston, established the extensive printing-office of Beaufort House for all descriptions of ornamental printing, and particularly for protection against forgery. The case No. 123, Class XXX., exhibited by his son, Mr. Charles Whiting (p. 829), contained some beautiful specimens of relief engravings rendered more difficult to imitate by the aid of the rose engine; cameo embossing,* in which the surface of the die is inked; and compound plate printing,† at one impression, in two or several colours, by plates constructed to combine with wonderful accuracy at the moment of taking the impression, by cylinder steam machinery: these plates are similar to those so long in use at the Excise and Stamp Offices, and which are of such great durability, that the medicine label plates now in use have produced millions of impressions during the last 25 years, and are still in daily use at the Stamp Office. It was by the aid of this machinery that Mr. Norman, of Frankfort, and Mr. Henel, of Magdeburgh, were both enabled to introduce these principles of printing into their respective countries, the dies and plates being furnished by Mr. Whiting; those gentlemen were not only greatly remunerated for their exertions, but also encouraged by their Governments for the introduction of what was then a new art to those countries. It would be difficult to find any other concern so well adapted in every way as Beaufort House for what it was intended to be at its establishment by Mr. Whiting, sen., Sir William Congreve, and Mr. Branston; and the case exhibited sufficiently demonstrates that Mr. Charles Whiting, who continues the business, fully maintains its well-earned reputation.

When the English state lotteries were abolished, ornamental printing fell greatly into disuse, and it was not until 1832, when Mr. De La Rue took out a patent for printing playing cards, that there was any revival, great facilities being given by the improved coloured inks which he introduced, and which are described in his specification. Since this period rapid and successive improvements have taken place here and on the Continent, and coloured surface printing has arrived at a degree of excellence greatly surpassing that of any former period.

Nothing can be more beautiful and more perfect in execution than the charming plates printed in colours by Mr. Baxter's process (172, p. 548); but the articles having been placed in the Class more especially relating to the Fine Arts, it is in that Class that an account of their merit must be sought for.

M. Silbermann (374, pp. 1194, 1195), of Strasburg, has exhibited productions, some of which are remarkable for the beauty of their execution, such as the painted windows of the Strasburg Cathedral, and some imitations of manuscripts, enriched with coloured vignettes by surface printing. Others, again, are to be noticed for their cheapness, such as those little coloured soldiers, of which a hundred and twenty thousand sheets are annually issued, and find a sale in France, Germany, and England.

A geological map, coloured with nine distinct tints; a table representing the effects of the contrast of colours, the employment of which has found a felicitous application in the work of M. Chevreul, Member of the Institute, and other prints executed by this process, prove that science, as well as the arts and commerce, will profit by this branch of industry.

In addition to the Printers already mentioned, who, in Class XVII., exhibited printing in colours, the following had specimens, in which no special merit was observed beyond that of fair and careful workmanship:—*England*—Mr. J. W. Folkard (p. 544); Mr. J. S. Hodson (p. 547); Mr. Silverlock, London (p. 539); Mr. Evans, of Oldham (p. 544); Mr. Ramsay, of Edinburgh (p. 549); Mr. Gill, of Dublin (p. 547). *Paris*—M. Guesnu (p. 1188); M. Meyer (p. 1208); M. G. Battenberg (p. 1229); and M. Chardon and Sons (p. 1177). *Netherlands*—M. P. H. Noordendorp, of the Hague (p. 1149). *Leipzic*—M. Hirschfeld (p. 1113). *Dresden*—M. Meinhold and Sons (p. 1124). *Frankfort*—M. Wohlfarth (p. 1124). *Berlin*—M. Moesner and Kohn (p. 1057), and M. Haenel (p. 1065). *Canada*—Messrs. Bureau and Morcotte, of Quebec (p. 968); and Messrs. Starke and Co., of Montreal (p. 968).

Printing in Gold.

Dibdin, in his Decameron (vol. ii., p. 416), states, that "This country has also an honour and a treasure to boast of in Mr. Whittaker's 'Magna Charta,' printed in letters of gold, with illuminations. His manner of operating is yet a secret. The Society for the Encouragement of Arts offered Mr. Whittaker a premium for his ingenuity, upon the condition, as is usual, of his making the process known; but Mr. Whittaker, aware of the importance of keeping it secret, declined the premium. There are some copies on vellum, beautiful, splendid, and characteristic, beyond any similar work (I had almost said ancient as well as modern) which it has ever been my good fortune to behold. Indeed, taking it 'all in all,' those who have not seen such a union of typographical and graphical skill as those illuminated copies display, can have no idea of the extraordinary felicity of their execution." The method adopted by Mr. Whittaker is the following, for which the Jury is indebted to the kindness of Mr. John Harris (Class XXX., No. 244), who was employed on the work. The page is composed in moveable type in the usual way; a stereotype-plate is taken. A piece of iron of the size of the page, about half-an-inch in thickness, is made hot, and placed on the table of an ordinary typographical printing-press: the stereotype-plate is then placed on the iron plate, and gets hot, and leaf-gold of an extra thickness, of the size of the plate, is laid very carefully on the surface of the plate; then the paper or vellum is placed on the tympan in the usual way, having been previously sifted over with dried glare of egg and rosin finely pulverized, which adheres to it in sufficient quantity; the tympan is then turned down, and the pull dwelt on. The degree of heat must be ascertained by practice; if the plate be too hot, the gold is dead and drossy; if too cold, then it appears bright but imperfect. This process is similar to that now used by bookbinders in block gilding with an arming-press.

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* Cameo embossing was re-introduced by the late Mr. Branston.

† *Double-Colour Printing-Machine.*—When Sir William Congreve was engaged in contriving a method of printing stamps in two colours, for the prevention of forgery, for the Stamping Department of Government, he applied to Mr. Donkin for his assistance; and Mr. Wilks, who afterwards became that gentleman's partner, invented an apparatus, and made a design for a machine for the above purpose, which being immediately approved by Sir William Congreve, a model was made, half size, at Messrs. Donkin's works, under the direction of Mr. Wilks, and in 1820 was set to work at Sir William Congreve's residence in Cecil Street, and afterwards taken to the Museum at Woolwich.

About twenty years ago, M. Sturz introduced into England printing in gold from copper-plates. His process was to mix with printers' weak burnt oil a certain quantity of gold or silver bronze, to the same consistency as that of strong copper-plate ink, and filling the plate with it, to dab it in with the fingers. The plate had to be engraved deeper than usual, and when filled it was delicately cleaned off, first with a rag dipped in a very weak solution of pearlash, and then with the palm of the hand in the usual way. It was afterwards submitted to a heavy impression of the copper-plate press, being printed in the manner called "through press," and the impression, when dry, polished by passing it through the press several times with the printed face against a highly-polished steel plate, by which a beautiful brightness was imparted to the bronze. This process, decidedly the best where great perfection is required, has been abandoned by most of the copper-plate printers for the cheap and less tedious one of first printing with a coloured-ink ground with gold-size and oil, and then rubbing the bronze on the paper when just printed.

Printing in gold by letter-press soon followed the method of copper-plate gold printing. Messrs. Vizetelly and Branston were the first to apply it; and their visiting and address cards, printed by letter-press, from rose-engine plates, have never been surpassed for the brightness and beauty of their execution.

About the same period Mr. De La Rue, in conjunction with the late Mr. Balne, of Gracechurch Street, produced a large royal 8vo edition of the New Testament, printed in gold, twenty-five copies of which were in pure gold powder. Nothing has since been produced equal to this unique edition. At the coronation of Queen Victoria, Mr. De La Rue undertook to produce the "Sun" newspaper printed in gold. The rapidity with which this had to be effected was one of the many difficulties he had to encounter. Messrs. Clowes and Sons afforded him every aid by placing at his disposal the printing-machines of their extensive establishment. Upwards of one hundred persons were employed to rub the bronze on the printed sheets, which had to be brought from the printing-office in Stamford Street, as soon as printed, to Messrs. De La Rue's works in Bunhill Row, to be there bronzed and finished. More than 100,000 copies were thus produced; 10,000 in time for the publication of the "Sun" on coronation day.

Gold printing is now applied to numerous purposes in most countries. The following is the best method of producing good and bright results by letter-press printing. Take the best printer's varnish, grind it to a thick consistency with the best burnt sienna or brown umber, and reduce this with De La Rue's gold-size until it be of the thickness of thin treacle; ink the form in the usual manner, and when printed apply the bronze by rubbing it gently over the article with cotton wool. If leaf-gold or leaf-metal is required, it must be laid on carefully, and when dry the sheets should be wiped, to clear them of the superfluous bronze or metal. The gold printing is much improved by its being passed over polished steel plates, between powerful rollers.

The following exhibitors of printing in gold and silver bronze, and in metal, displayed a variety of specimens, all possessing merit.

England—Mr. J. MANSELL (p. 539), Mr. KRONHEIM (p. 549), Messrs. DEAN and SON (p. 537), and also Messrs. ARLISS and Co. (p. 541), who had specimens of printing on tinfoil. *France*—M. ANGRAND (pp. 1169, 1170), M. GUESNU (p. 1188), Madame MAYER, Rue de la Vieille Monnaie (p. 1207), M. MEYER, Rue de l'Abbaye (p. 1208), and M. LEFEBVRE, of Paris (p. 1311). *Zollverein*—MM. SCHAEFFER, OTTO, and SCHEIBE (p. 1056), M. E. MANIAC, M. HAENEL, of Berlin (p. 1065), M. F. FECHNER, of Guben (p. 1063). *Bavaria*—M. A. DESSAUER, of Aschaffenburg (p. 1101). *Grand Duchy of Hesse*—M. FREUND, of Offenbach (p. 1128). *Warsaw*—MM. FETTER and RAHN (p. 1375). *Austria*—MM. HAAS and SON, of Prague (p. 1028), who had a missal printed in gold, as well as a miscellaneous collection of articles.

PRINTING—FRANCE.

As early as 1470, printing was introduced into Paris by the influence of La Sorbonne; its progress was rapid. Rembold, the partner of Géring, Antoine Vérard, Simon de Colines, Pigouchet, and others, carried the art of printing to a high degree of perfection. The typographical merit of the publications of Robert and of Henry Stephens would itself be very remarkable in all respects were it not surpassed by the high literary merit of those learned printers.

The Camuzats, the Delatours, the Cousteliers, and the Barbous, maintained the good traditions of the ancient printers; and towards the end of the last century Ambroise Didot was intrusted by Louis XVI. with the printing of the collection of the French Classics, called the Dauphin Collection. From the united labour of Pierre Didot and Firmin Didot, who were at the same time engravers, type-founders, and printers, subsequently resulted the beautiful publications at the national palace of the Louvre. They introduced many improvements into the typographic art. By their side and in their establishment youthful typographers were instructed, who have carried the taste for their art into the provinces and into foreign lands.

Now, however, in most countries, by the effect of competition carried to its utmost limits, the distinctive, original, and personal characteristic of the ancient typographers is becoming gradually effaced. The system of the division of labour does not permit them now, as formerly, to cut and cast the type themselves, to make their own ink, to superintend the construction of their presses, or even to take the balls from the hands of the pressmen, to show them how they should be used; to a knowledge of these technicalities many of the ancient printers united extensive literary acquirements.

At the present day competition compels every one to concentrate all his efforts and all his aptitude upon one only of the branches which combine to form the art of typography. The engraver is merely an engraver; the type-founder is only engaged in that branch; so it is with the ink-maker and the manufacturer of printers' rollers, with the bookseller and the publisher, and of necessity even more so with the printer, who can only succeed in this laborious and difficult profession by dint of being above all a skilful manager. In many printing establishments, therefore, there are often two partners; one of them occupied with the technical details of the art, the other with the commercial or administrative department. To this arrangement, and to this extreme division of labour, must be attributed a certain uniformity which is to be observed in the productions of modern typography, and perhaps also an absence of originality. It must, nevertheless, be stated, that in general, and even as a consequence of this concentration of efforts upon every single branch of the art, the results are satisfactory.

The National Printing-office of France was founded in 1640 by Louis XIII., who there collected the punches cut by Garamond by order of Francis I., and confided these punches to the most eminent printers of his time, who were honoured with the title of *Royal Printers*. Under the preceding reigns this printing-office had distinguished itself by large publications, such as the collection of Ordonnances of the Kings of France, that of the Fathers of the Church and of the Councils, and that of the Byzantine Historians, &c. At the fall of royalty it became a vast establishment, in which was concentrated all the printing of the Government departments, divided hitherto among private printing-offices. Napoleon confided the direction of it in 1809 to M. Marcel, who had accompanied the expedition to Egypt, and had founded a printing-office at Cairo. Making use of the types of the Propaganda of Rome, which had been removed to Paris, M. Marcel printed the Lord's Prayer in 150 languages.

It was especially under the reign of Louis-Philippe that the printing-office, then a royal establishment, improved its means of execution, and caused a great number of Oriental types to be engraved under the special direction of the most learned Oriental scholars, such as MM. Burnouf, Mohl, Hase, &c. All the types are remarkable for their beautiful execution, and for the happy combinations which, without impairing the purity of form of characters, has simplified their cutting and facilitated their composition. We may particularly instance the hieroglyphic character, composed of 2,400 punches, with which all the Egyptian inscriptions can be reproduced; and the Assyrian character, the decomposition of which has brought down to 100 the number of punches necessary to form its various combinations. The 150 foreign founts in the specimen-book of the National Printing-office offers an interesting subject of comparison with the rich collection of the Imperial Printing-office of Austria. The Jury have particularly remarked the pure taste and perfect execution of the borders printed in gold and in colours, in imitation of the drawings and vignettes of the elegant Oriental manuscripts.

It is to be desired that the National Printing-office of France, following the example of the Imperial Printing-office of Austria, and of the manufactures of Sèvres and the Gobelins in France, should successively increase its rich store of foreign type, and devote itself more especially to every kind of experiment relating to typography. The making of such experiments, which require the co-operation of learned men and good artists, would be honourable for a nation like the French.

The typographic execution, with reference to the types, the harmony, the clearness, and the purity of the designs executed by MM. CHENAVARD and CLERGET, is perfect. Nothing can be more beautiful than the three volumes of the Oriental Collection sent by the National Printing-office. These are—

1st. The First Book of Kings.
2nd. The First Volume of the History of the Mongols.
3rd. The First Volume of the Bhagavata Purana.

The Jury have found the bookselling business of Paris honourably represented in this Exhibition by MM. RENOUARD (p. 1194), BAILLIÈRE (p. 1197), and GAUME (p. 1220), for the sciences and literature; by MM. LANGLOIS and LECLERCQ (p. 1190), and by M. PAGNERRE (p. 1225), for educational works; by MM. BANCE (p. 1200), GIDE (p. 1188), and CHARLES TEXIER (p. 1228), for architectural works: by M. MATHIAS (p. 1241) for his industrial and scientific library, so suitably adapted to the wants of mechanical science; and, lastly, by Madame HUZARD, for works upon agriculture.

Amongst other works, the Jury have remarked the edition of Hippocrates, in Greek and French, forming seven octavo volumes; and the first volume of the collection of the Greek Physicians, issued from the press of the National Printing-office. M. BAILLIÈRE (p. 1197) is the publisher of these works, as also of the Anatomy of the Human Body, by Cruvelhier.

The "Complete Works of St. John Chrysostom, and of St. Basil," with the Latin translation in juxtaposition with the Greek text, and the edition of the "Complete Works of St. Augustine," published by M. GAUME (p. 1220), are beautiful and honourable literary undertakings. Worthy also of mention are the *Lives of the Painters and Artists*, published by M. JULES RENOUARD (p. 1190); the *Monuments of Nineveh*, by M. GIDE (p. 1188), executed at the National Printing-office; and in another class of works some books intended for scientific studies, such as the *Lessons in Botany*, by M. LEMAOUT, and the *Course of Chemistry*, by M. REGNAULT.

French printing has been honourably represented at this Exhibition; for Paris by M. DUPONT (p. 1182), whose extraordinary production of fac-similes,[*] of old books, in the style of anastatic reproductions, and whose general specimens of printing as exhibited, deserve particular mention; by M. DIDOT (p. 1184), who has raised monuments worthy of the old masters in his last three great publications—the Thesaurus of Stephanus, Ducange's Glossarium, and Bibliotheca Scriptorum Græcorum, all produced in a country village, the whole of the composition of the types being made by young girls; by MM. **Plon Brothers** (p. 1243), whose books, albums, vignette engravings, and woodcuts, are of great merit; by M. **Claye** (pp. 1218, 1219), whose illustrated books are of first-rate workmanship, and whose woodcut impressions are truly beautiful;* and for the provinces, by MM. **Mame**† (p. 1192), who exhibit books neatly bound and fairly printed, at most extraordinarily-low prices; by M. **Silbermann** (pp. 1194, 1195), who has contributed to improve the art of surface-coloured printing; by M. **Desrosiers** (p. 1219), who in a small provincial town has produced his "Ancient Auvergne," &c., in a very creditable manner; and by M. **Barbat** (p. 1229), who exhibits illustrated volumes of the Scriptures.

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[*] Mr. Harris, so well known for his extraordinary production of fac-similes of old books, restoration of defective leaves, &c., has favoured the Jury with the following description of the means he employs. His specimens were in Class XXX., and consequently out of the jurisdiction of the Jury of Class XVII.:—

"In the history of mankind there are few things so remarkable, as that the press and the easel have been the means of producing works of art which have most conspicuously tended to the civilization of man and the unity of nations. The avidity with which these productions are sought after, up to the present time, is fully proved by the prices given either for early printed books or ancient paintings, of which the former especially are often imperfect. From this latter circumstance the collector has been induced to seek the means of having ancient and valuable works in typography and painting completed by fac-similes, and thus restoring to the present generation works which most probably in a few more years would have been buried in oblivion.

"It was about the year 1815 that I was first employed by the late Mr. John Whittaker, of Westminster, an eminent bookbinder at that period; and I believe the idea of having ancient books of the early printers, &c., perfected by fac-similes, was first suggested to him by the late Earl Spencer, for whom many books were so done; and numerous specimens are preserved of some of the rarest productions of the press in the library at Althorpe. Specimens are also to be seen in the King's Library, which were done in the lifetime of His Majesty King George III., the art of imitation by fac-simile being patronized by him; also by the late Earl Fitzwilliam, the Hon. Thomas Grenville, and many others. I continued to work for Mr. Whittaker till about 1820, when I was sent for by Lord Spencer, for whom I completed a Pentateuch in Hebrew and Chaldee, and several other works; also I was employed by the late Mr. Grenville, in whose library are numerous specimens of various works completed by me, as there are also in the libraries of many other noblemen and gentlemen by whom I have been employed during the last 30 years. It now only remains to give a brief sketch of the process employed. Formerly I made an accurate tracing from the original leaf, and afterwards retraced it on to the inlaid leaf by means of a paper blacked on one side; this produced an outline lettered page, which, by being gone over carefully and imitating the original, produced the desired leaf. This process was found to take up much time, and was consequently expensive, but it was the method I adopted while employed by Mr. Whittaker; and he, to carry out the deception still further, had two sets of tools cut of the large and small letters generally used by Caxton, with which he has often been at the trouble to go over the pages after my work was done, to give the appearance of the indentation of the type. The process afterwards adopted by me was to make the tracing in a soft ink, to transfer the same to a thin paper, and to re-transfer on to the intended leaf: by this means I saved one-third, or one tracing of the work, which was a great saving both in time and expense. I pursued this process for some years; but I have within the last 10 or 12 years had recourse to lithography, producing the tracing on to the stone, and finishing up the letters on the same: this has been beneficial, particularly when more than one copy was wanted; but I occasionally find even this process irksome and uncertain, and frequently at this present time have recourse to my own, or the second method described, and execute fac-similes by manuscript process. I have thus endeavoured to give a concise and clear statement of the method employed in producing fac-similes. With respect to early printing, the specimens produced by me are entirely done by hand, and are specimens of a style now little in use in water-colour painting."

PRINTING—SPAIN AND PORTUGAL.

The Jury would have been gratified to see displayed in the Exhibition any typographical production executed in Spain,—the country which in 1772 produced at Madrid the superb edition of "Sallust," printed in such perfection and on such beautiful paper by the King's printer, Joachim Ibarra.

It is in Spain that the most ancient manufactories of paper known in Europe were established.

The same feeling is to be expressed as regards Portugal, for the Jury cannot consider as a specimen of Portuguese printing the sample exhibited from Madeira, under the title of *Amostra de Imprensa*, though every beginning, however small, ought to be encouraged. The printers of Lisbon might have sent some well-known editions of their classics.

PRINTING—BELGIUM AND THE NETHERLANDS.

Printing was introduced into the Low Countries at the same time as into England. Martin d'Alost, in 1473, and the Brethren of *la Vie Commune*, at Brussels, published their first works. The art of printing made rapid progress in the skilful hands of Joannes de Westphalia, in 1474, at Louvain, and soon extended itself to Antwerp, Andenaude, Ghent, Bruges, Hasselt, &c. Towards the year 1554, the Plantins at Antwerp, and, in 1616, the Elzevirs, first at Leyden and afterwards at Amsterdam, carried the typographic art to such a degree of perfection, that their publications are still sought after throughout the whole of Europe. The Wetsteins, the Blaeuws, and the Moreti (who, being ennobled, received permission to continue the art of printing without derogation to their nobility), were emulators and successors worthy of them. The political events of the seventeenth and eighteenth centuries had a baneful influence on the progress of typography, which revived, particularly in Belgium, in 1815. The number of able printers increased considerably in both countries; and, since 1830, Belgium has witnessed with satisfaction the annual increase of original publications, notwithstanding the unfavourable position in which the publishers are placed from the competition of the reprints of foreign works. Such, however, is the influence of the development of a national spirit, that during the last twenty years the Belgian press has issued a greater number of original works than in the 150 years which preceded the recognition of the independence of the country.

Amongst the printers of Belgium, where the mechanical part of the art is good, the town of Malines has long since made itself known by its Prayer and Liturgic Books, successfully and economically printed in red and black—thanks to the incessant labours of M. P. T. Hanicq. Typography is also represented in the Exhibition by the well-printed Bibles and Testaments of M. **Briard**, of Ixelles (p. 1159); the illustrated books and woodcuts of M. **Tamar**, an art recently cultivated in Belgium; the Missals of M. **Westmael Legros**, of Namur (p. 1160); the cheap publications of M. **Casterman**, of Tournay (p. 1159); the Academical Collections of M. **Hayez**, of Brussels (p. 1159); the Statistical Tables of the Population and Agriculture of Belgium of M. **Lesigne** (p. 1159); the *Album de Pomologie* of M. **Parent** (p. 1159); the Specimens of Illustrated Works of M. **Muquardt** (p. 1176); and the Collection of Letters and the Historical Initials of M. **Jacqmain**, of Ghent (p. 1165).

Few printers of the Netherlands have sent specimens of their productions. The neat and cheap Bibles of MM. **Enschedé Johannes and Sons** (p. 1146); the curious Journal of the Embassy of the Earl of Portland in France, printed by M. **Noordendorp**, at the Hague (p. 1149); and the "Graduale Romanum," and "Antiphonarium Romanum," by M. **Zweesaardt**, of Amsterdam (p. 1149), have been remarked by the Jury.

We will also mention the continuation of the voluminous publication of the "Lives of the Saints," commenced by Bollandus, and forming fifty-three volumes in folio. The first of these enormous volumes, printed in 1845, is entirely devoted to the Life of St. Theresa. It is satisfactory to know that this great enterprise, supported by the Belgian Government, is to be continued, as it equally embraces religion, history, and geography.

PRINTING—DENMARK.

The Jury have not been able to judge of the state of printing in Denmark, that country not having sent a single printed book. There was only an ingenious machine for composing the types after an entirely new system.

PRINTING—SWEDEN.

M. **Broling**, the printer to the Bank of Sweden, exhibited specimens of printing bank-notes by letter-press, of superior merit from their varied combinations, brightness of colour, good register, and the difficulty thrown in the way of forgery by the different processes employed.

PRINTING—RUSSIA.

A single broadside sheet from St. Petersburgh exhibited specimens of several Russian and Oriental characters surrounding a vignette on wood, representing varieties of the Russian people. The whole is neatly printed.

PRINTING—GREECE.

It is to be regretted that the typographical productions of Greece were not exhibited amongst those of other civilized nations. A printing-office was established at Athens at the time of the independence of Greece.

At this Exhibition, Greece has confined herself to inscribing upon her banners, in large letters, the sentences from her ancient poets as the harbinger of a better future:—

> *Θαρσεῖν χρὴ . . . . τάχ' αὔριον ἔσσετ' ἄμεινον.*
> *Ζηλοῖ δέ τε γείτονα γείτων*
> *Εἰς ἄφενον σπεύδοντ'. Ἀγαθὴ δ' ἔρις ἥδε βροτοῖσι.*

PRINTING—PERSIA.

Europe might have possessed the art of printing ever since the year of our Lord 1310, had she been acquainted with a work by Râchid-ed-din, who, as far back as that period, had described the process of printing as known to the Chinese, in his Persian work entitled *Djemma'a et-tewarikh.*

Persia has sent to the Exhibition some beautiful manuscripts only, and some books printed in Europe; nevertheless, the typographic press is not unknown in that country, since a newspaper in the Persian language is published there.

PRINTING—EGYPT.

Whilst at the present day the ancient languages of Egypt are printed in Europe with hieroglyphic, Coptic, or Greek characters, it was interesting to see displayed in the Exhibition in London, 165 volumes of all sizes, printed in Arabic, in Turkish, and in Persian, at Cairo

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* By a singular coincidence these three were pupils of the typographic establishment of M. Firmin Didot.

† According to M. Mame's statement, they keep a stock of 1,500 volumes always ready; throughout the year they produce 15,000 volumes per day, averaging 240 pages each volume. They have 20 steam cylinder machines, one machine turning out 14 reams of printed work per hour. All the wood engraving is done in their establishment: they employ 1,200 persons.

(the ancient Memphis).* Amongst these books we have remarked some which are enriched with arabesques, tastefully executed by means of typography. These are printed upon a peculiar paper, manufactured at Boulac, by the old vat process. The pulp appears to resemble that which is obtained in China and in India by the use of raw materials, such as the bamboo and the banana tree. It may be that the ancient papyrus is now reappearing in Egypt under this new form. Amongst the Arabian books, devoted almost entirely to military science, medicine, geography, and education, the Jury have remarked *The History of the Kings of France contemporary with the Sultans of Egypt*; *The History of the Ottoman Empire*, by Wassef; *The Advantages of War in a Religious Point of View*: and in translation, *The Geography of Malte Le Brun*; *The Treatise of Good Advice*; *On the Care of Little Children*; *The Children's Friend*, by Berquin; *Tom Thumb*; and, lastly, *A Journey in America*, with a few engravings, also executed at Boulac.

PRINTING—UNITED STATES OF AMERICA.

It is well known that there are some works printed in the United States which give a more favourable idea of the productions of America than those which have appeared at this Exhibition. The American printers have contented themselves with sending a number of newspapers, the printing of which is not remarkable. Even the lowness of price has nothing surprising in it, as there is no stamp duty, neither is there any tax upon paper.

PRINTING—CANADA.

In the collection of articles exhibited by Canada, we have observed a specimen book containing a large number of beautiful types from the foundry of Mr. **PALSGRAVE** (189, p. 968), at Montreal. He also exhibits some stereotype plates.

PRINTING—AUSTRALIA.

The Jury have examined, with real interest, several works printed in Van Diemen's Land, at Hobart Town, some of them by **HENRY DOWLING** (331–33, p. 999), such as the *Tasmanian Kalendar* and the *Tasmanian Journal*, in 8vo; and two large volumes, accompanied by lithographs, likewise designed and printed in Australia; and the execution of which is satisfactory.

The same may be said of the *Acts and Ordinances of the Governor and Council of New South Wales*, printed at Sydney, in 1844, by **WILLIAM JOHN ROW** (4, p. 999), with types cast at Sydney.

It is to be regretted that, introduced as it now is even to the confines of the earth, all the productions of the press have not been represented in this universal gathering; for printing is a gift almost as necessary to man as speech, for the manifestation of his thoughts.

New Process relating to Galvanoplastic, Galvanographic, Galvanoglyphic, and Chemitypic Printing.

The Imperial Printing-office of Austria has exhibited the whole collection of the new applications of the typographical art, such as the galvanoplastic process, galvanography, galvanoglyphy, and chemitypy, which, bringing their co-operation to the aid of typography, enable it to reproduce, in some degree, nature itself. It may therefore be said that these new branches are to typography what photography is to the art of drawing.

The Galvanoplastic Process.—We have, for instance, seen antediluvian fishes reproduced upon paper, at this Exhibition, with the exactness of nature itself. By means of successive layers of gutta percha applied to the stone inclosing the petrified fish, a mould is obtained, which being afterwards submitted to the action of a galvanic battery, is quickly covered with coatings of copper, forming a plate upon which all the marks of the fish are reproduced in relief, and which, when printed at the typographic press, gives a result upon the paper identical with the object itself.

M. **HULOT** (p. 1222), a mechanist and chemist attached to the Mint of Paris, has exhibited some sheets, each of them containing three hundred heads intended for *postage stamps*, which are impressed at one stroke, from a plate of brass of a single piece, containing these three hundred figures in relief. By a peculiar process, M. Hulot succeeds in identically reproducing, without the least contraction, the original engraving, which is on steel, but which might be engraved on any other metal, or even on wood. It is by this same process that M. Hulot has reproduced, for the Bank of France, the notes engraved in relief in such perfection by French artists.

Galvanography.—The Austrian Printing-office has shown us some remarkable results of this process. An artist covers a plate of silvered copper with different coats of a paint composed of any oxide, such as that of iron, burnt terra sienna, or black lead, ground with linseed oil. The substance of these coats is of necessity thick or thin, according to the intensity given to the lights and shades. The plate is then submitted to the action of the galvanic battery, from which another plate is obtained reproducing an intaglio copy, with all the unevenness of the original painting. This is an actual copper-plate, resembling an aquatint, and obtained without the assistance of the engraver.

Galvanoglyphy.—The experiments in galvanoglyphy are no less interesting. Upon a plate of zinc, coated with varnish, a drawing is etched; then, with a small composition roller, a coat of ink is spread upon this varnish and left to dry. The ink is deposited only on those parts where the varnish has not been broken through by the graver, and leaves the sunken portion of the engraving free. When the first layer is dry, a second is applied, then a third, and so on, until it is considered that the original hollows are deep enough. The plate thus prepared is placed in the galvanic battery, and another plate is the result on which all the hollows of the engraving are reproduced in relief. This relief is more or less raised, according to the number and thickness of the coats of ink successively applied. The process was invented in England, and patented by Mr. Palmer, of Newgate Street.

Chemitypy.—For the purpose of obtaining casts in relief from an engraving, the process of chemitypy is equally ingenious. A polished zinc plate is covered with an etching ground; the design is etched with a point and bitten in with diluted aquafortis; the etching ground is then removed, and every particle of the acid well cleaned off. For this purpose the hollows of the engraving are first washed with olive oil, then with water, and afterwards wiped, so that there may not remain the least trace of the acid. The plate, on which must be placed filings of fusible metal, is then heated by means of a spirit-lamp, or any convenient means, until the fusible metal has filled up all the engraving; and when cold it is scraped down to the level of the zinc plate, in such a manner that none of it remains except that which has entered into the hollow parts of the engraving. The plate of zinc, to which the fusible metal has become united, is then submitted to the action of a weak solution of muriatic acid, and as of these two metals the one is negative, and the other positive, the zinc alone is eaten away by the acid, and the fusible metal which had entered into the hollows of the engraving, is left in relief, and may then be printed from by means of the typographic press.

Paneiconography.—This is a new process, invented by M. **GILLOT**, of Paris (p. 1201), and consists of a method of reproducing, by means of the typographic press, any lithographic, autographic, or typographic proof, any drawing with crayon or stump, or any engraving upon wood or copper.

Upon a plate of zinc, polished by means of pumice-stone, the artist executes the required design with lithographic crayon or ink, or transfers impressions from lithography, wood-engraving, or copper-plates. The surface is then inked over with a roller, so as to increase the thickness of the ink, which is afterwards consolidated by dusting finely-powdered rosin over the plate, by means of a pad of wadding: the rosin adheres only to the ink, and is readily removed from the other parts of the plate. Afterwards, for the purpose of obtaining a relief block, the plate is placed on the bottom of a shallow trough, containing very dilute sulphuric or hydrochloric acid. By means of a rocking motion given to the box, which for that purpose is fastened to an axis, the acid is caused to pass slowly and continuously to and fro over the surface of the plate. After the lapse of half an hour, if it be a crayon drawing, the etching is completed, and a relief block is obtained, in which it is only necessary to remove the large *whites* by saw-piercing. In case, however, of the plate containing written matter, or many very fine lines, it is necessary to withdraw it from time to time, and again ink the surface with lithographic ink, and dust the powdered rosin, so that the edges may be protected as much as possible from the undermining action of the acid; these operations must be repeated until the necessary depth is obtained. Transfers may be made from very old impressions of wood-engravings by sponging them several times at the back with acidulated water, and then operating as is usual with lithographic transfers.

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* At Boulac, a suburb of Cairo.

Music Printing.—As early as 1490, music was printed by letter-press. The edition of the Psalms, printed at Mayence in 1490, had the music (*plain chant*) in two colours, the notes being in black and the ledger-lines in red. The shape of the notes in this edition is different from the square notes subsequently adopted for sacred music. The notes of the music executed by Peter Hautin, an engraver, typefounder, and printer, were lozenge-shape, and each note was cast separately with the ledger-lines. Peter Attaignant, of Paris, printed, in 1530, twenty-nine songs with this description of music. In 1552, Adrian Leroy, musician to Henry II. of France, and Robert Ballard, his brother-in-law and partner, obtained the title of King's printers for music. The types were engraved by William Le Bé, an eminent artist of that period, and were on the same plan as those of Peter Hautin.

In 1579, Angelo Gardano printed in Venice, from music types, the "*Madrigali à sei voci di Sabino.*" The process was the same as Peter Hautin's, but the execution was very inferior. The opera of "*Thésée,*" the music by Lulli, was printed by Ballard in 1688; the typographical execution was imperfect. The same work, in folio, was printed in 1720, by Beausenne, from copper-plates, and was so superior to the music printed from types, that the old method was abandoned for that of printing from engraved plates. The exclusive privilege granted to Ballard was maintained in his family, without opposition, until 1639, when Sanlecque, another engraver in Paris, obtained letters patent from Louis XIII. of France for a ten years' sole right of printing the *plain chant* music by a new process of his invention. In consequence of this patent, copper-plate music printing superseded typographic music printing as early as 1675. In 1746, M. Dornel, organist of the church of Ste. Geneviève, Paris, entered into partnership with M. Klebin, an engraver and typefounder, for the purpose of casting music types in sand. By this kind of stereotyping the printing appeared to possess some advantages, but the plan was abandoned. In 1764, M. Breitkopf, a type-founder and printer at Leipzic, succeeded in casting music types. The electoral Princess of Dresden was so much pleased with his plan, that she gave him to print the music of a drama of her own composition, called "*Il Trionfo della Fidelta.*" In this type music the notes were each composed of separate pieces; and in Germany, until then, there had been only one piece for each note and ledger-line. The system of casting music with the notes separately possessed some advantages, although the composition was tedious and the founts costly. At the same period MM. Enschédé, of Haarlem, caused M. Feischman, an eminent artist employed in their foundry, to engrave music types, the perfection of which has scarcely been surpassed; but the system which they adopted was too complicated for general use. In 1762, M. Rosart, of Brussels, being desirous of diminishing the number of pieces, cast a new fount of music with only 300 separate sorts. M. Fournier, jun., further improved the casting of music types by reducing the number of types to 160. At the sitting of the Royal Academy of France in August, 1762, these improvements were noticed favourably.

M. Reinhard, of Strasburg, obtained a patent for a new process of printing music; he printed the ledger-lines from surface engraved plates, and the notes from moveable types. The work was good, although the notes were of different tint from that of the ledger-lines, in consequence of the two printings. About 1810, M. Olivier, a French engraver, produced beautiful moveable music types, but the mechanical difficulties of setting up rendered this plan useless. In 1832, M. Duverger, of Paris, invented an ingenious mode of casting the notes separately from the ledger-lines. M. Duverger's plan was to compose a page of music without the ledger-lines, he then took a plaster cast, and with the aid of a straight edge he ruled lines in the plaster with a graver to the same level as the surface of the notes; he then cast stereotype plates, and thus obtained perfect music pages for surface printing. MM. Tanterstein and Cordel, pupils of M. Duverger, invented another method of producing music; they set up the music with moveable types combined with the ledger-lines; they then took plaster casts, and simply repaired in the plaster the imperfections in the ledger-line joints, previous to stereotyping. Good specimens of this system were in the Great Exhibition.

The music types of Messrs. **SINCLAIR**, of Edinburgh, did not possess any novelty, but their execution was good.

M. **DERRIEY**, of Paris (185, p. 1183), is the only exhibitor of music types showing any marked improvement. The notes were cast either in one or more pieces, so as to admit of the ledger-line crossing the notes when they were required to be on the line. Each ledger-line was in one piece, and of the full width of the page, either in brass, zinc, or hard type metal. Music printed from such types is a nearer approach to impressions from engraved plates than any hitherto produced, yet it is doubtful whether by continued wear the interstices may not become visible, and render this system imperfect.

Notwithstanding the many attempts for the improvement of music types, several difficulties have yet to be surmounted before music printed by letter-press can equal that which is printed from engraved plates. Good work is produced by transfers of engraved music on lithographic stones, although the cost of printing is greater than by letter-press.

Punch-cutting and Type-founding.

In the earliest books printed in Germany, the shape of the letters was at first Gothic; they were then rounded and became semi-Gothic. In Italy, under the influence of the Roman inscriptions, and of the beautiful manuscripts of antiquity, their form was completely changed. A Frenchman, Nicholas Jenson, engraver to the Royal Mint of France, was sent to Mayence, in 1462, by Louis XI., to learn the secrets of the new-born art of printing. Civil commotions having prevented him from introducing this art into France, he engraved in Venice, for the printing-office which he there established, the beautiful types of Roman characters which Garamond afterwards took for his models, and from which models it is scarcely possible to depart, without falling into extravagance or bad taste.

In England, Caxton adopted, for printing his works upon chivalry, a style of letter in imitation of the handwriting of that period. Antoine Verard printed his works in France at the same period, with types very similar, but better cut and better cast. Both seem to have been desirous of giving *fac-similes* of the manuscripts of their times.

The Roman characters adopted by the Aldi, and by the Stephani, caused the semi-gothic shapes to fall into disuse; and it was the elder Aldus who invented the *italic* character, which was engraved by Francis of Bologna, after the beautiful writing of Petrarch.

The Elzevirs employed for their works types engraved by Garamond and Sanlecques.

Ibarra in Spain, Baskerville in England, and Enschédé in Haarlem, modified the form of the types in accordance with the then prevailing taste. Of these the letters engraved by Enschédé and Fleischmann, at Haarlem, are very remarkable specimens.

At the close of the last century, the younger Fournier, a punch-cutter and type-founder, caused some improvements to be made in this art, which he has described in his *Manual*.

M. Firmin Didot, who engraved the types used by his father for his beautiful publications, exerted himself for the purpose of imparting to types of all descriptions the highest degree of elegance. Nothing can be more perfect than his punches for the edition of Racine's works printed at the Louvre; and the types, in imitation of handwriting, are masterpieces. Some years later M. Henry Didot engraved small types called microscopic, which were used in printing the edition of the *Maxims of La Rochefoucault* and the works of *Horace*. The types are extremely small, and presented great difficulties both in the casting and in the engraving.

In 1823, M. Louis John Pouchée took out patents for the three kingdoms for a machine for casting type, consisting of a mould formed by a combination of steel bars with grooves and matrices, secured by a frame and a brace of iron upon a strong wooden bench, and a lever carrying a heavy rammer, to fall down into the mould, for the purpose of forcing a portion of the fluid type metal, which had been poured out of a ladle into the receptacle between the ends of the grooves (each groove forming the mould of a separate type), through small apertures into the grooves and matrices (placed at the opposite end of the grooves) where the body and face of the letter are cast. By this apparatus about 200 types may be cast at one operation, and the casting repeated twice in a minute, or even quicker. M. Pouchée, having cast a large quantity of type by this machine, offered the type for sale, and the printers refused to purchase unless at a reduced price; M. Pouchée preferred melting it. At the sale of M. Pouchée's type-founding effects, a quantity of this machine-cast type (which had escaped melting) was sold, and was afterwards discovered to be machine-cast by a private mark on the side, and an after-cut nick. The machine was not offered for sale. But Mr. Reed, a printer in King Street, Covent Garden (related to Mr. Blake, of the firm of Blake and Stephenson, type-founders at Sheffield), was employed by the type-founders to negociate with M. Pouchée for the purchase of the machine, which was effected for about 100*l*. The machine was conveyed to Messrs. Caslon and Livermore's and destroyed, on which condition it was purchased. There was included in this purchase a valuable planing-machine, and cross-cutting machine for cutting the grooves. It was the invention of M. H. Didot, to whom M. Pouchée paid 48,000 francs for the patent right in England.

The English punch-cutters, whilst retaining elegance in their types, endeavour to make them more durable, and perhaps more legible, by strengthening the fine strokes and giving a greater slope to their punches, thus obtaining a higher degree of perfection. It must be remarked, nevertheless, that in all their specimen-books the engraving of vignettes and borders has made little progress, and contrasts unfavourably with the beauty of their types. The same remark applies to Germany. In France some degree of taste has been applied to ornaments of this species. Latterly, the caprice of fashion has caused the shapes of the letters to be elongated, widened, and made either thin or thick, according to the whim of each engraver. It is the same with the fantastical types fitly designated by the name of *fancy letter*, which are carried to absurdity, in order to attract attention by their very eccentricity.

Mr. Whittingham, at the suggestion of Mr. Pickering, first reintroduced the old letters of Garamond and Jenson, and many of the London printers have since followed; some very beautiful works have already been printed with these old letters, so true it is *there is nothing new in this world except that which is old*. This saying applies also to the manufacture of paper, for in place of the beautiful paper called *vellum*, the evenness of which is perfect, the English public at the present day give the preference to *laid papers*, though these show the wire-marks of the moulds as much as at a period when the weaving of wire was not thoroughly understood.

Since the invention of casting types by Peter Schoeffer —a process which goes back as far as the origin of printing itself—this art has made little progress. It was only at the commencement of the present century, that a slight improvement resulted from the use of the mould called the American mould, which renders the work of the founder somewhat more easy.

In 1806, M. Firmin Didot invented the sloping mould, with a salient and returning angle, and by an ingenious division of the letters of the alphabet, and their various combinations, succeeded in imitating English handwriting, which presented the greatest difficulty, and in completel doing away with the inconvenience of leaving the separation between each letter visible, an obstacle which had till then prevented the success of every attempt of this description. The types cut by him and by his son were a real progress in the art, and met with great success in Europe. Copper-plate engraving and lithography alone can vie with the perfection of this system.

About the same period, M. Henry Didot invented the compressing mould, and afterwards the mould which he named *polyamatype*—by means of which 140 letters are cast at once. M. Marcellin Legrand, the successor of M. Henry Didot, has exhibited the products of this mould, which requires great accuracy and great care, in order to give successful results. In spite, therefore, of the advantages which it offers, it is only in his establishment that it has been applied on a large scale with success. Some years since the use of mechanical moulds, moved first by hand (soon superseded by steam-power), was introduced from the United States, where this invention originated, into Germany, England, and France. Germany has been able to turn this invention to better account than either England or France: the cause of this may perhaps be, that in the German alphabet the extremities of the thick strokes of the letters are not terminated by sharp lines intersecting each other at right angles, and which, exposing the least unevenness in *ranging*, constitute at once the merit and the difficulty of type-founding.*

We had an opportunity at the Exhibition, of seeing M. Brockhaus' mechanical mould, which he has employed with success for a long time in his own printing-office, and in that of M. Didot. In the one the movement of the platten of the mould acts horizontally, and in the other vertically. The injection of the melted material is accomplished in each by means of a piston working in the metal pot, and driving the material briskly into the mould.

In 1844, M. Marcellin Legrand exhibited in Paris a series of 4,600 punches, and the same number of matrices, for the purpose of reproducing all the signs representing the words of the Chinese language. This system, which consists in adding to the piece representing the *key* another piece which modifies it, has completely succeeded, for it has been adopted not only in America, but in China itself, and at the present moment works are printed at Macao, and at Ning-Po, with the types engraved by M. Legrand. We have seen in the Exhibition the Gospels printed in China by the Presbyterian Missionary Society of America. M. Marcellin Legrand was the first to undertake singly this immense labour, by means of which Chinese writing is brought within the compass of European typography. A printed table, in which each word is accompanied by a cipher, is now sufficient to indicate to the workman the cipher corresponding to the word. Each of the types is arranged in the case in numerical order, and bears upon its side a number corresponding with that of the table, thus facilitating the manual labour, and preventing many errors. There was also in the Exhibition, a page printed in the Chinese types engraved by M. Auguste Beyerhaus, of Berlin. By means—1st, of 1,200 punches and matrices capable of combination; 2ndly, of 2,800 characters, each engraved in a single piece; 3rdly, of 105 others, called *perpendiculars*, he composes 25,000 different characters. The characters in this system are always divided perpendicularly, whilst in that adopted by M. Marcellin Legrand some of the divisions are perpendicular and others horizontal. This system, judging of it by the printed page displayed at the Exhibition, appears to be successful. In point of execution, it leaves nothing to be desired; and Mr. William Wells, an accomplished Chinese scholar, residing in that country, has bestowed great praise upon it.* M. Beyerhaus has also engraved an Egyptian type, at the suggestion of M. Bunsen. The characters of it are open, whilst the two founts which the National Printing-office of France has had engraved are black (*en silhouette*).

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* There may be other reasons; for it is well known that the invention patented in this country could be successfully worked. Messrs. Figgins, who purchased it, have abstained from putting it in practice, probably in deference to the journeymen type-founders.

The Imperial Printing-office of Austria, decomposing each part of a Chinese word into as many pieces as it contains strokes of the pen, reconstructs the words by means of these little pieces, which the compositor groups together so as to construct any Chinese word. The number of *points* and *strokes* is about 400, and they appear to be a most complete system of Chinese typography.

Nearly all the languages of the world were typographically represented either in the specimens of the National Printing-office of Paris, in the numerous tables of the Imperial Press of Austria, in the Bibles printed in almost all languages by the Bible Society, in the specimens of general type-founding at Paris, in those of M. Decker of Berlin, or in those of the English founders, and especially in those of the late Mr. Watts of London, who has himself engraved an extensive series of Oriental types, which are an honour to his type-founding, and form the richest series of this kind existing in any private establishment.

Amongst all the types which express the gift of speech, the most numerous and complicated are those of the Chinese language, in which every idea and each word is represented by a different character. Owing to typography, there will soon be no single idiom which may not be saved from oblivion; for typography contributes to the preservation of languages as essentially as did the press of Guttemberg to the preservation of books at the time of its discovery.

The Jury have, in this important branch of art, remarked the productions of the following contributors:—

England.—Messrs. **Caslon** and Co. (78, p. 543), exhibited a great variety of beautiful types; Messrs. **Duncan Sinclair** and **Son** (92, p. 543), specimens of general excellence; Messrs. **Figgins** (124, p. 545), types of great excellence and beauty; a super-royal form containing 220,000 pieces of pearl type, locked up and showing the care bestowed in finishing, in order to insure correct justification; and a specimen of curious and newly-cut Tudor type, imitating the inscriptions from monuments and tombs; Messrs. **Miller** and **Richard** (150, p. 546), a specimen of ruby type, in which "Gray's Elegy" is printed, thirty-two verses in two columns, occupying 3¼ inches in length; Messrs. **Besley** and Co. (195, p. 550), a great variety of beautiful and original types, among which a complete series of Elizabethan, or church text, as well as the typographical ornaments taken from the remains of Nineveh and Etruria. The Jury also mention the specimens of Messrs. **Ferguson Brothers** (90, p. 543); of Messrs. **Stephenson, Blake** and. Co. (182, p. 549); and a curious fount of complicated type of the cuneiform character, used in the Babylonian inscriptions, exhibited by Messrs. **Harrison** and **Son** (212, p. 552). Messrs. **King**'s new music (22, p. 537) presents an improvement, the result of having very few kerned types. Mr. **Armstrong**'s illustrated music offers no peculiar character.

France.—M. **Derriey** (p. 1183), the eminent punch-cutter and type-founder, exhibited types and flourishes of first-rate merit, and music types with separate ledger-lines running the whole length of the line, in brass or other metal, a great improvement on the ordinary music types—M. **Gauthier**'s neatly-cut and cast letters (234, p. 1187) deserve mention—MM. **Laboulaye** and Co. (895, p. 1223), successors to Didot, have shown great skill in their printing types. M. **Roussel** (361, p. 1194) exhibits music composed with moveable types and matrices, in which there appears to be no marked novelty.

Russia.—M. **Révillion** (361, p. 1383) has shown good specimens of Greek, Oriental, and other types.

Sardinia.—The Jury have remarked MM. **Farina**'s (47, p. 1304) small punches and types.

Holland.—MM. **Enschédé** and **Sons** (79, p. 1146) maintain the reputation of their old establishment for good printing types and stereotype plates.

Germany.—Besides the Exhibitors whose merits have already been noticed, M. **Dressler**, of Frankfort (5 Zollv., (24, p. 1122), exhibited types said to be of new metallic composition; M. **Schelter**, of Dresden (3 Zollv., 182, p. 1113), a variety of printing types; and M. **Haenel** specimens of types, brass types for bookbinders, electrotype matrices for casting large types, and electrotypes from woodcuts, all possessing merit.

Type-founding in the United States.

Before the separation of the American colonies from the mother-country, paper, printing-presses, and types were almost all imported from England. Christopher Sower, who established a printing-office at Germantown, near Philadelphia, in 1735, was the first who cast his own types. In 1768, Mr. Mitchelson attempted to set up a foundry in Boston, and the same year Mr. Buel another in Connecticut, but neither of them were successful. Soon after the close of the American War, however, Mr. John Baine, of Edinburgh, established a type-foundry at Philadelphia, and he was, it is believed, the first who regularly carried on the business of type-founding in the United States. But the importation of British type, and the small number of newspapers, still constituted difficulties in the way of success. Baine died in 1790, and his partner returned to Scotland. About this time Mr. Archibald Binny and Mr. James Ronaldson established another foundry at Philadelphia, unconnected with any other business, and were eminently successful. In England, at this time, the assortments of type in the foundries were about twenty in number, of which the largest was the twelve-line pica, and the smallest the diamond, of 202 lines to a foot. The assortments of Messrs. Binny and Ronaldson at first embraced only the more essential founts, such as brevier, bourgeois, long primer, small pica, pica, and two-line letters. At this period the increase of printing in the United States was most extraordinary. The number of newspapers in ten years from 1790 increased from 70 to 200, and the number of offices for miscellaneous printing exceeded 50. The printing business in these ten years increased probably threefold. There was, of course, a corresponding increase in the business of type-founding; and before long Messrs. Binny and Ronaldson's assortment became as extensive as in the chief foundries of England. It is to them the world is indebted for the first real improvement in type-founding since the days of Peter Schoeffer. This important improvement was in the type-mould, by means of which a caster could cast 6,000 types in a day as easily as he could have accomplished 4,000 by the old process.

About the beginning of the present century the invention was introduced into Europe, and is now generally known as the *American Mould.* Messrs. Binny and Ronaldson's type was considered good at that time; with it Dobson printed the first American edition of the **Encyclopædia**, in 21 large 4to. volumes, 1798–1803. About the year 1805, another type foundry was set up in Baltimore, by Samuel Sower and Co., which contained some of the moulds and matrices used by Christopher Sower mentioned above, who cast his own type in Germantown in 1740. They were chiefly for German letters. To these were now added a variety of excellent Roman and Italic types, and among others the diamond with a smaller face than had ever before been cast either in Europe or America. Nearly about the year 1805, Messrs. White and Wing established a foundry at Hartford, in Connecticut, where they devised and used a plan of their own for casting twenty or thirty letters at a time, and are said to have brought their invention to a useful degree of perfection. On Mr. White's removal to New York, in 1811, when he established the first regular and extensive foundry in that city, this invention seems to have been abandoned, and the old plan of casting by single letters was pursued, as it is to this day. Thus we see that in 1811 there were four foundries in the United States. During the preceding ten years the newspapers increased from 200 to 360, of which 27 were daily papers. It is estimated there were at least 500 printing-offices in the country; indeed so great was the demand for type in 1811, that it advanced in price 25 per cent. on what it cost in 1806. In 1813, Messrs. D. and G. Bruce established another foundry in New York, which soon became a stereotype foundry, of which we shall speak in another place. In 1818, and within a very few years after, type and stereotype foundries were set up in Boston, Cincinnati, Buffalo, St. Louis, Louisville, &c. The business soon became overdone, and the price of type receded to the old standard of 1806, and caused many failures.

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* M. Beyerhaus has made a smaller type, which is also very well executed.

In 1828, Mr. William M. Johnson took out a patent for the invention of a machine for casting type, by which he was enabled to give a sharper outline and better face to the letter by using a pump to force the liquid metal into the mould. This idea subsequently underwent many modifications and improvements by different individuals. Several patents for improvements in the machinery for casting printing types have been issued within the last ten years, so that at present all obstacles to this mode of producing types seem to have been surmounted, and this practice is now in general use—in large establishments chiefly by the aid of steam. By these improvements three times the quantity of type is produced by a caster in a day that was cast by Binny and Ronaldson's improved mould, and five times the quantity that was produced by the hand-mould half a century ago. On the first of June 1850, there were 2,800 newspapers in the United States, with an average circulation of 1,785 copies, giving the enormous aggregate of 422,600,000 copies printed annually. There were 350 daily and 2,000 weekly newspapers. The whole number of printing-offices is now not less than 4,000. Hence the demand for printing types is constantly and rapidly increasing. There has been a corresponding increase in type and stereotype foundries. There are now four foundries in Boston, seven in New York, three in Philadelphia, one in Buffalo, one in Albany, two in Connecticut, one in Baltimore, and one in St. Louis. These twenty establishments give employment to about 800 persons, and produce daily 4,400 pounds of type. By the recent improvements in machinery, type is at present produced at a cheaper rate by 25 per cent. than in 1841. These twenty foundries supply not only the United States, and a great part of Canada, but export largely to the British, Spanish, and Danish West India Islands, Mexico, and South America. The exports of printing-presses and types for the year ending June 1851, amounted to 71,401 dollars. The quality of the American type will, it is said, bear a favourable comparison with that of Europe, and it is cheaper. The metal used is a mixture of lead, antimony, and tin, in proportion to the kind of type required. The average of lead is 75 per cent.

A statement of the prices of types for the last half-century may be interesting, we therefore give a table of them from the last Official Report, naming only some of the principal sorts.

NAMES OF BODIES.	1801	1806	1811	1819	1827	1831	1841	1850	1850
	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	In English Currency.
									s. *d.*
Pica - - -	·35	·44	·55	·44	·42	·36	·38	·30	1 3
Small Pica -	·40	·48	·58	·48	·46	·33	·40	·32	1 4
Long Primer -	·47	·56	·66	·56	·50	·40	·42	·34	1 5
Bourgeois -	·56	·66	·76	·66	·58	·46	·46	·37	1 6½
Brevier - -	·67	·76	·86	·76	·70	·56	·54	·42	1 9
Minion - -	–	1·03	1·13	1·00	·83	·70	·66	·48	2 0
Nonpareil -	1·12	1·40	1·75	1·40	1·20	·90	·84	·58	2 5
Agate - -	–	–	–	–	1·44	1·10	1·08	·72	2 11
Pearl - -	–	–	–	–	1·75	1·40	1·40	1·08	4 5½
Diamond - -	–	–	–	–	–	–	–	1·60	6 7½

The application of electrotyping to the formation of matrices is another improvement deserving mention, inasmuch as it saves much labour and tends to the reduction of price. The process is probably the same as that employed in England and France, but in America it is much more extensively used, in consequence of no law of registration being in existence there as in the former countries. It is found that the Patent and the Copyright Acts do not reach this case, as there is no date-mark on the type to identify it. The consequence is, that the moment any new or improved letter or ornament is produced either in Europe or even in the United States, it is at once electrotyped and reproduced by all the other founders. This seems unjust, although it tends to render the types more uniform throughout the country.

A patent has very recently been granted—10th December 1850—to Mr. George Mathiot, for an ingenious device for preventing the electrotype cast from adhering to the original plate. Many ways have been tried to obviate this difficulty, but the present is considered to be a decided improvement upon them. On the 20th of August 1850, a patent was granted to Mr. Luke Vander Van Newton for a new process of plating or coating the surface of metallic printing types, stereotype plates, and other printing plates, whether cast or engraved, with an additional coat of metal by means of galvanic electricity. This process of coating types with copper is asserted to be of great practical utility, and is said to add much to the durability of the types.* We are indebted to Mr. Ewbank's Official Patent Office Reports for 1851 for most of the facts stated.

Among the American exhibitors of types were Messrs. HOBART and ROBINS, of Boston (399, p. 1462); and Mr. T. TOBIT, of New York (394, p. 1462); the latter exhibited combinations or logotypes, which he states are unequalled for rapid composition, although it is well known that in the "Times" newspaper office they were disused many years since, as presenting no advantages over separate or single types. Lord Stanhope also tried logotypes without greater success.

Stereotyping

is one of the means for making fac-similes in type-metal of pages of types, woodcuts, &c., for surface printing. At the commencement of printing, the idea of stereotype must have occurred from seeing the reproductions in relief of legends upon bells cast in the middle ages; it is probable, however, that many attempts failed from the imperfect means used. As early as 1735, all the pages of Bibles in German and French, set up in moveable types, were kept standing by many printers. In the last century Samuel Luchtmans obtained plates by a process of *clichage*, from which he was enabled to print. About 1700, Valleyre printed in Paris some almanacs and pamphlets which he had obtained by casting. In 1725, Mr. William Ged, a goldsmith in Edinburgh, produced some stereotype plates from which he printed, in 1739, an edition of Sallust, but his process was little encouraged, and it was abandoned after his death, although those that opposed his method did not scruple to use his plates. In 1729, Mr. Ged entered into partnership with Messrs. James and Fenner, of London, for the purpose of carrying on the stereotype business. In 1782, Mr. Tilloch joined Messrs. Foulis, of Edinburgh, for the same purpose. In 1784, M. Hoffman, of Alsace, France, succeeded in obtaining stereotype plates from moulds of clay mixed with gelatine. He printed a work entitled "*Récherches Historiques sur les Maures, par Chénier*," in 3 vols. 8vo.; but the process was found imperfect, and was soon afterwards abandoned. In 1791, M. Carez, of Toul, a printer, conceived the plan of attaching to a heavy piece of wood suspended from a beam, a page of moveable types, well-locked with screws, in a proper frame, with the face downwards, and letting it fall sharply on lead in a state of fusion, just when on the point of setting; he thus obtained good matrices, which were used to make relief stereotypes by attaching these matrices to the piece of wood as already described, and letting it fall on fusible metal when also just on the point of setting. Good plates were obtained; but it often happened that the types were melted when the lead was too hot, or bruised when too cold. This mode of stereotyping was therefore abandoned, and yet the plan of polytyping, carried on to this day, is not very dissimilar, although the use of more perfect machinery and different metal has much simplified the process, and rendered it less destructive to the types.

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* Messrs. Orchard, Willis, and Co. of London, are the patentees for the United Kingdom, and for France, Belgium, and Holland.

Profiting by these various attempts, M. Firmin Didot conceived the idea of casting types in very hard metal, composed of 30 parts of lead, 30 of antimony, 30 of tin, and 10 of copper. He gave to these types less height that their solidity might be increased; then, by means of a fly-press, he pressed each page (composed of these hard types, strongly fastened together in an iron box) into a plate of pure lead. The plate or matrix of the page thus obtained was affixed to the under side of the hammer of a stamping press, on the bed of which was placed in a paper case an alloy, still in a state of fusion, similar to that used for ordinary types, and at the moment when after having been rolled up into a pasty consistency in this paper case it was upon the point of setting, the matrix of the page attached to the stamping press descended upon the alloy, forming a page in relief, the clearness of which was perfect, as may be seen from the collection known by the name of the stereotype edition, composed of more than 200 volumes. At the same time that Firmin Didot succeeded by this process, M. Herhan, who at first had been his partner, resorted to another method, which consisted in striking in copper a great number of matrices arranged in such a manner as to admit of the pages being set up with these matrices as if they had been types, with this exception, however, that instead of being in relief, like the letters, the matrices were sunk. The page when composed was attached to the hammer of a stamping press and allowed to fall upon an alloy still in a state of fusion, and thus a whole page in relief was obtained by means of these hollow matrices. This expensive process was attended with more inconveniences than that of Firmin Didot. Both of them were superseded by the process invented by Lord Stanhope in 1800, who, resuming the first attempts at stereotyping, moulded in plaster or in alabaster, the pages composed with ordinary types, and obtained casts in relief by drying the moulds in a proper manner, and plunging them into a vessel filled with metal in a state of fusion.

Numerous attempts have since been made to substitute for plaster moulds the employment of sheets of paper with whiting placed between them, but the results appear inferior to the plaster moulds.

For vignettes, casts of bitumen answer very well, and stereotype plates of bitumen give good results.

Among the products which particularly deserve to be mentioned, are those of the RUBELAND DUCAL FOUNDRY INSPECTION (780, pp. 1093, 1094), whose specimen of stereotype in cast iron, with the Bible printed from it, shows a new application of that metal; of Messrs. KNIGHT and HAWKES (107, p. 544), who exhibit good specimens of stereotypes from engravings in wood, steel, &c., and plates for printing in various colours; and also of Messrs. MANCHIN and MOREL, of London (128, p. 545), for their successful application of bitumen to the purpose of stereotype. This process, although new in England, seems to have been used in other countries for some time, and in the "Illustration," by Mr. PLON, who has an improved mode of mounting the plates. Mr. BARKER'S specimens of casts (189, p. 550) from wood matrices are produced by a most ingenious process, of foreign invention. They are used extensively by calico-printers in Manchester and other places. The mode of obtaining these casts is as follows: a pattern of the size required is put on wood in the manner well known to pin and coppered pattern makers, care being taken that, in driving the pieces of copper in the wood block, they are forced to equal depth. Tin in a melted state is then poured on this pin or coppered pattern to the thickness of half an inch, and when cold the pattern block is placed on the bed of a screw-press, constructed for the purpose, and held fast by means of screws, whilst the part on which the tin has been poured, is affixed by clamps to the screw of the press, and by it drawn out from the pattern-block, the tin holding in a solid mass the copper forming the pattern, and leaving the wood as a matrix, from which a number of plates can be obtained by casting with fusible metal. The casts exhibited by Mr. BARKER are very beautiful and perfect, and of greater depth than can be obtained by any other known process. Mr. MUIR, of Glasgow (174, p. 548), had an electrotype from a page of diamond type, which appeared good. M. CURMER, of Paris (135, p. 1177), had some specimens of stereotype from paper moulds, which seems to be the same system as that patented by Mr. Kronheim some years ago, and which did not prove practicable. Mr. STARR, of Philadelphia (88, p. 1438), also exhibited stereotypes and electrotypes of some merit.

Printing Ink.

The ink of the earliest printed works of the fifteenth century presents to our view every desirable quality. It is black, glossy, and the lapse of four centuries has demonstrated the fact that it has retained its primitive qualities up to the present day. It is not the same with later impressions, in the greater part of which the ink is more or less decomposed; nevertheless that which the Aldi, the Stephani, the Elzevirs, the Ibarras, the Bodonis, the Plantins, and all other printers who were zealous for typographical renown, manufactured themselves, has retained all its primitive quality. At present the manufacture of ink is in many respects good, and the grinding, which cannot be too complete, has become more perfect by the application of improved machinery; but the ink is too often deteriorated by adulteration.

It is especially to Mr. De La Rue that this manufacture owes some real improvements, as may be judged from his specimens of printing in different colours, both upon card and upon paper. The brightness of his colours is as remarkable as their variety, and his inks are capable of being glazed almost immediately after printing. The brightness of the printing in gold, executed by his process at his manufactory, is very superior to others. At the same time it is doubtful whether the brightness of vermilion ink is equal to the intensity of the red used in the printing of the fifteenth and sixteenth centuries.

As to the printing inks sent to the Exhibition, time is the only test capable of deciding their respective qualities, and as, moreover, an ink suitable to one climate may not suit another, and lastly, as the ink must be differently modified according to the state of the atmosphere, always so variable, the Jury, on weighing these considerations, have deemed it their duty to refrain from giving any opinion upon this class of products, fearing that their judgments might be set aside by time, which alone is able to disclose the truth.

Composition Printing Rollers.

Lord Stanhope entertained the idea that the forms at press could be inked by some better means than by the usual printers' balls. He had recourse to revolving cylinders for that purpose, and tried them covered with skins dressed expressly in a variety of ways, but without success. Eventually, Mr. Foster,* an ingenious compositor, adopted the composition of the dabbers used in the potteries and made printers' balls with it. He laid it upon canvas, and when thus prepared, he produced what was so much required; the composition balls held the ink better, distributed it evenly, and imparted it equally over the form; they were easily kept clean, soft, and pliable, and thus the *first* improvement in inking by hand was accomplished. In 1811, while engaged upon the invention of the Polygonal printing-machine, Mr. Bryan Donkin's attention was directed to the improvement of printing rollers, which, as before stated, had been imperfectly made of soft skins; and the idea struck him of casting cylinders of a composition of treacle and glue, similar to that used by Mr. Foster in his printers' balls. He accordingly had some cast in tin moulds, and applied them to Donkin and Bacon's printing machine. These rollers were soon introduced into general use, but it was found that the composition became too hard and dry to retain its elasticity, and by the advice of Mr. Tyrrel, the celebrated mechanical engraver, a certain quantity of carbonate of soda was introduced into the composition, whereby the elasticity was rendered more durable. Both Mr. Kœnig and Mr. Cowper used these rollers in their printing-machines, with Mr. Donkin's permission, some time after their invention.

At the commencement of 1819, M. Gannal, of Paris, who had been for a long time occupied in the manufacture of mouth glue, which consists of a mixture of sugar and glue, and Mr. A. Chegaray, overseer in Mr. Smith's printing establishment in Paris, made printers' rollers of this composition. They are stated to be more durable than those made of treacle and glue.

In 1813, when Messrs. Applegath and Cowper's printing-machines came in more general use, the patent inking-tables and composition rollers were introduced to the hand-printers; but the prejudices of the pressmen against their use were carried to such an extreme, that it appeared almost impossible to succeed in introducing them. Mr. Harrild, however, whose knowledge of the printing business rendered him equal to the task, persevered in conciliating the pressmen, and demonstrating to them how greatly the adoption of this beneficial invention would be for their advantage, till after displaying the most untiring energy, his efforts were at last crowned with success; and he had thus the satisfaction of not only benefiting the men themselves, but of also rendering an essential service to the printing business. He was rewarded by the large demand created for rollers, every pressman becoming as eager to put aside the use of balls as he had been to oppose that of composition rollers. The manufactory which he subsequently established, and the perfection of his inking rollers, proves his sound knowledge of what was required. Messrs. Harrild's manufactory is now on an immense scale, and supplies the greater part of the printers in England with inking-rollers, which possess every requisite quality. Mr. Cowper, who is the inventor of inking-tables and hand-rollers, has never benefited by this valuable acquisition to the printing business, a fact which cannot but be regretted. Messrs. HARRILD (157, p. 284) exhibited in the Machinery Department, Class VI., inking composition rollers and balls, and were the only exhibitors of this kind of rollers.

M. LENDENMANN (Switzerland, 232, p. 1281), of Grub, Canton of Appenzell, Switzerland, was the only other exhibitor of printers' rollers, which he called "Swiss imitation caoutchouc." The Jury had no means of practically ascertaining the merit of these rollers, but it must be stated that the fissures on their surface left anything but a favourable impression.

Printing for the Blind.

The Jury have noticed with pleasure the large number of exhibitors, from England, France, the Zollverein, and the United States, of inventions and devices for the instruction of the blind. It has been estimated that in the European countries one person out of every 1,200 or 1,400 of the entire population is blind, and in America one in every 2,000. The great and increasing attention that is paid to the intellectual and moral instruction of this unfortunate class is one of the distinctive features of the progress of our age. A few years ago printing for the blind was considered only a curious or doubtful experiment, but it is now established beyond all question that books are true sources of profit and pleasure to them. Whilst embossed books have recently very rapidly increased, it is delightful to notice that the blind readers have multiplied far more rapidly. These circumstances have induced the Jury to attempt a brief historical sketch of the origin and progress of printing for the blind, together with the present state of the art.

The invention of printing for the blind marks a new era in the history of literature. The whole credit of this invention, so simple yet so marvellous in its results, belongs to France. It was M. Valentine Haüy who, in 1784, at Paris, produced the first book, printed with letters in relief, and soon after proved to the world that children might easily be taught to read with their fingers. It has been said by his biographer that he took his idea of embossed typography from seeing that Mademoiselle Parodis, a blind pianist of Vienna, who visited Paris that year, distinguished the keys of her instrument by the sense of touch, and also readily comprehended the maps in relief which a short time before had been invented by M. Weissembourg of Mannheim. After employing letters of different forms and sizes, and experimenting with the blind as to the precise shape of the letter that could be the most readily distinguished by the touch, he at length fixed upon a character differing very slightly from the ordinary Roman letter, or perhaps a little approaching *italics*. There was the usual mixture of the upper and lower case, the capitals taking more of the *script* form than the small letters. He submitted his first efforts and experiments to the Academy of Sciences of Paris. A committee was appointed to examine them, consisting of the Duc de la Rochefoucauld, M. Desmarets, M. Demours, and M. Vicq-d'Azir, and their favourable Report on the 18th of February, 1785, rendered his success a triumph. Great *éclat* attended the public announcement of this invention. A new Institution was established, called the *Institution Royale des Jeunes Aveugles*, and M. Haüy was placed at the head of it. Among the books which he embossed were a grammar, a catechism, and small portions of the Church service, and also several pieces of music. The printing of the music was inferior. The abbreviations which he introduced into his grammar, it has been said, did not afford sufficient advantages to counterbalance their inconvenience. His principal work, is entitled *Exposé de différends moyens vérifiés par l'expérience pour les mettre en état de lire à l'aide du tact, d'imprimer des livres dans lesquels ils puissent prendre des connaissances de langues, d'histoire, de géographie, de musique, etc.; d'exécuter différends travaux relatifs aux métiers. Imprimé par les Enfants Aveugles. Paris*, 1786, 4to. This celebrated essay was translated into English by Dr. Blacklock, the blind poet, and in 1793 was published in London with his poems, in quarto. On the 26th of December 1786, twenty-four of M. Haüy's pupils exhibited their attainments in reading, writing, arithmetic, music, and geography, before the King and the royal family, at Versailles, who were delighted with the wonderful results. For a while all went on prosperously, but M. Haüy's friends soon began to give him credit for zeal rather than discretion in the management of his Institution, and consequently as the novelty wore away their admiration cooled, the funds fell off, and the Institution languished until it was put upon a government foundation. The blind really received but little advantage from an invention that at first promised so much. The fault, however, seems to have been not so much in the plan as in the execution of it. The books were bulky and expensive, and the letters, though beautiful to the eye, and clearly embossed, wanted that sharpness and permanence so essential to perfect tangibility; besides that, though the letters filled three spaces, they were too small to be well adapted to the sense of touch. Large editions of the few books printed were published, the idea having taken a strong hold of the public mind, so that though the evil was soon perceived, it was not easy to abandon the defective alphabet and assume a better, for that step involved the sacrifice of all the previous labour. Hence this noble invention, except, perhaps within the walls of the Institution, soon sank into oblivion, and very little more was heard of it until 1814, when Haüy, having fallen into disrepute, was pensioned off on 2,000 francs a-year, and Dr. Guillié, an active and enterprising gentleman, was made *Directeur-Général* in his place. Dr. Guillié soon revived the printing, and having considerably modified the letters, commenced the publication of a series of elementary and other works, among which are the following (see Table No. I., p. 415).

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* It is stated, on the authority of Mr. Harrild, that the composition was discovered by a Mr. Edward Dyas, printer and parish-clerk, of Madely, near Wellington, Shropshire, from the simple circumstance of a glue-pot being upset, and not having a pelt ball ready, Dyas took a piece of glue in a soft state, and inked a form with it. It is further stated that he added treacle afterwards to keep it soft. Mr. Harrild himself introduced composition balls in 1810.

The mechanical execution of these volumes was exceedingly heavy. Most of them were ponderous folios and very expensive, still they formed for many years almost the only literature of the blind, not alone in France, but in other countries. We should not omit particularly to mention the following book which has come under our notice:—*Notice Historique sur l'Instruction des Jeunes Aveugles. Par M. Guillié, Directeur-Général de l'Institution Royale des Jeunes Aveugles de Paris. Paris, Imprimé par les Jeunes Aveugles*, 1819, 4to, 52 pages, with 17 lines to a page. Two leaves are pasted together, so that it is read as if embossed on both sides of a sheet. This is the second edition, the first having been embossed in 1817, the third in 1820, and a fourth edition enlarged in 1821. On page 52 is a curious specimen of printing in relief, in colour, so as to render the letters more easily read by the eye. This book was a valuable contribution to the library of the blind, but still retains nearly all the objections that were made to Haüy's first books; it can only be read by those possessing a very delicate touch. It is replete with information respecting the means then employed for the instruction of the blind in Paris; it proves, however, that the art of embossed typography had made but very little progress. It is singular that in this book no mention is made of the author's predecessor, Haüy, to whom, we should not forget, the idea of finger-reading is due.

Between the years 1821 and 1840 very little printing was done by this Institution, except religious books, and music after the system of notation by letters and ciphers. The annexed is a list of them(see Table No. II., p. 415).

L'Institut des Jeunes Aveugles de Paris, since its foundation in 1784, has at times been in a deplorable condition, but about the year 1840 it underwent a thorough reorganization, and is now, under the able management of M. Dufau, justly entitled to the front rank of institutions of this class in Europe, from its usefulness no less than its age. A radical reform in the printing department has been made: M. Dufau has devised a system of types consisting of capitals and lower-case Roman letters, and has greatly improved the character of the embossing. The French books are now well embossed, sharp, clear, and durable. They have also been so much reduced in bulk that they are offered at a moderate price. M. Dufau has proposed to print a *standard library* for the blind, to consist of 10 vols., in quarto, for elementary instruction, and 10 vols. for higher instruction. The first series is nearly completed, and this is the list (see Table No. III., p. 415).

The second series of this library, not yet printed, it is to be hoped will soon follow. For the above lists, and other interesting information respecting the Paris typography for the blind, the Jury is much indebted to a valuable pamphlet published by M. J. Guadet, entitled *L'Institut des Jeunes Aveugles de Paris, son Histoire et ses Procédés d'Enseignement, Paris*, 1850, 8vo, pp. 115.

At Vienna an institution for the blind was established in 1804, but the Jury is not aware of any printing having been executed in Austria before the year 1830 or 1831. About this date the intelligent publishers Treusinsky, of Vienna, embossed sheets with the Lord's Prayer in various languages, in Roman letters, and afterwards printed works for elementary instruction. The subject has been recently taken up by the Imperial Printing-office, and several volumes have been published, but the Jury are unable to give a bibliographical description of them.

In 1806, M. Haüy was invited to establish institutions for the blind at Berlin and St. Petersburgh. His system of instruction was adopted in each of these institutions, and the books used were for a considerable time supplied from the press of Paris. Both of these institutions in a pecuniary point of view were unsuccessful to M. Haüy, and in 1808 he returned to Paris, and for a while resided in quiet with his brother the celebrated Abbé Haüy.

The Jury have not been able to trace the progress of the printing for the blind at Berlin or St. Petersburgh, but they learn that the amount of matter embossed in Germany until very recently did not exceed half of the New Testament.

It was in Great Britain and in the United States that the first improvements were made in embossed typography; and only within the last 15 years that the blind generally have derived any considerable advantages from books. Before 1826, when Mr. James Gall, of Edinburgh, first began to turn his attention to the intellectual and moral education of the blind, it is believed that not a single blind person in any public institution of this country or America could read by means of embossed characters. To Mr. Gall is due the credit of reviving this art. With the most commendable zeal, patience, and perseverance, he canvassed the form of every letter until at length he adopted his angular alphabet. He seems, from his own *Historical Sketch of the Origin and Progress of the Literature of the Blind, Edinburgh*, 1834, 8vo, pp. 388, to have experimented long and patiently with a great variety of *arbitrary* and Roman alphabets, with a view of finding one sufficiently simple and tangible for finger-reading. On the 28th of September 1827, he published "A First Book for teaching the Art of Reading to the Blind; with a short statement of the principles of the art of printing as here applied to the sense of touch. Edinburgh, published by James Gall." This is believed to be the first book printed for the blind in the English language. It is a small oblong octavo volume, of nine pages, price sixpence, with four preliminary leaves in which the author sets forth his "principles." The embossing is in high relief, and though it presents rather a rude appearance from the fact of its having been printed from wooden types, yet it soon rendered the practicability of reading by the blind a matter of experience in Great Britain. Mr. Gall then issued sheets printed by metallic type, which were easily read by the pupils in the asylum at Edinburgh. Encouraged by his success, in March 1828, he issued his prospectus for the publication, by subscription, of the *Gospel by St. John*, but it was not until about the middle of 1829 that he perfected his alphabet to his own satisfaction. He tried three different founts of type:—first, the *double english* size; second, the *double pica*; and third, the *great primer*; and, after printing and cancelling sheets in each of these three founts, he at length, in January 1832, finished the printing of his great work. The blind must ever feel indebted to Mr. Gall for the zeal and honest endeavour which he displayed in accomplishing what he thought would most benefit this unfortunate class. Notwithstanding the last sheet of his work was printed in January 1832, yet it was not till October 1834 that he was enabled to publish it. It is entitled, "The Gospel by St. John, for the Blind: with an Introduction, containing some Historical Notices regarding the Origin of a tangible Literature for their Use. By James Gall. Edinburgh: James Gall, 24 Niddry-street. 1834. In 4to." The Introduction, in common type, comprises 18 pages. The text, in embossed characters, consists of 141 pages, with 27 lines on a page

Table No. I.

TITLE.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Centimètres in a Page.	Price.
						Francs.
Une Grammaire Anglaise	1	folio	1817	–	840	Published at 50 francs a volume, but since sold for waste paper.
Morceaux extraits d'Auteurs Anglais	1	,,	1818	96	840	
Une Grammaire Latine abrégée de celle de Lhomond	2	,,	1818	171	840	
Une Grammaire Italienne	2	,,	1818	240	840	
Morceaux extraits d'Auteurs Italiens	1	,,	1819	–	840	
Une Grammaire Grecque	2	,,	1819	244	840	
Extraits d'Auteurs Grecs	1	,,	1819	120	840	
Une Grammaire Espagnole	2	,,	1819	237	840	
Une Géographie	2	,,	1819	220	840	
Les Choix de Lectures pieuses	1	,,	1819	120	840	
Les Elements de Lecture	1	,,	1820	88	840	
Un Catéchisme	1	,,	1820	79	840	
Choix de Morceaux empruntés aux Prosateurs Latins	2	,,	1820	240	840	
Extraits des Poëtes, Phèdre, Horace et Virgile	1	,,	1820	100	840	
Les Offices du Matin et du Soir	2	4to.	1820	232	840	

Table No. II.

TITLE.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Inches in a Page.	Price.
						Francs.
Epitres et Evangiles des Dimanches et Fêtes	2	folio.	1823–8	–	–	–
Prières du Matin et du Soir	1	4to.	1825	–	–	–
Annuaire de l'Organiste, par G. Gauthier	2	folio.	1828	–	–	–
Office Noté des Jeudi, Vendredi, et Samedi Saints	1	4to.	1829	–	–	–
Procédés pour écrire au Moyen des Points, par L. Braille	1	,,	1829 & 1837	–	–	–
Manière de mélanger les Jeux de l'Orgue, par Marius Gruét	1	,,	1830	–	–	–
Traité de la Fugue, par Fétis	1	,,	1830	–	–	–
Office Noté	1	,,	1830	–	–	–
Eléments d'Arithmétique extraits de Reynaud	3	folio.	1830 et suiv.	–	–	–
Nouvelle Méthode pour représenter la Musique au moyen de Lettres de Chiffres, etc., par M. Moulin	1	4to.	1831	–	–	–
Traité Harmonie, par Catel	1	folio.	1833	–	–	–
Figures de la Géométrie et de la Trigonométrie de Legendre	1	4to.	1833	–	–	–
Figures de la Statistique de Poinsot	1	,,	1833	–	–	–
Choix d'Anecdotes (Système d'écriture en Points)	1	,,	1834	–	–	–
Grammaire Française de Noël et Chapsal	1	folio.	1834	–	–	–
Méthode de Lecture	1	,,	1836	–	–	–
Doctrine Chrétienne de Lhomond	5	,,	1837 et suiv.	–	–	–
Histoire-Sainte	1	,,	1838	–	–	–
Principes élémentaires d'Harmonie à deux parties, par Gautier	1	4to.	1838	–	–	–
Petite Mémento d'Arithmétique, par L. Braille	1	,,	1838	–	–	–
Recueil de Cantiques pour Trois Voix, par Gautier	3	,,	1838	–	–	–
Cours pour apprendre à accorder les Pianos, par Moulin	1	folio.	1839	–	–	–
Principes de Musique, par Collat	1	,,	1839	–	–	–
Principes d'Harmonie à plus de deux parties, par G. Gautier	1	,,	1839	–	–	–
Etudes pour Piano, par Cramer	1	4to.	1839	–	–	–
Examen de Conscience	1	,,	1840	–	–	–

Table No. III.

TITLE.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Centimètres in a Page.	Price, Half-Bound, Cloth Backs.
						Francs.
1. Grammaire Française, par MM. Noël et Chapsal, simplifiée à notre usage	1	4to.	1846	144	476	5
2. Complément du Cours de Grammaire	1	,,	Not out	–	476	5
3. Traité d'Arithmétique Elémentaire, par M. Dufour	1	,,	1845	146	476	5
4. Géographie élémentaire, par M. Poulain de Bossay	1	,,	–	114	476	5
5. Histoire Sainte*	1	,,	Not out	–	476	5
6. Histoire Ancienne*	1	,,	1847	159	476	5
7. Histoire Romaine*	1	,,	Not out	–	476	5
8. Histoire de France*	1	,,	1845	146	476	5
9. Histoire Naturelle, extraite de divers Auteurs	1	,,	1847	108	476	5
10. Géométrie élémentaire	1	,,	Not out	–	476	5

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* These four histories were composed by M. Guadet upon a new plan, and are peculiarly adapted to the use of beginners.

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of 70 square inches. The leaves are not pasted together. The subscription price of the volume was one guinea, but it was subsequently sold for 6*s*. Gall was very sanguine of the entire success of his noble enterprise, and, probably, had he chosen a less angular character, and one a little more resembling our common alphabet, as he has since done, he would soon have seen his books used in every institution in the country. His alphabet was the chief objection raised to his system. His printing was clear, sharp, and permanent, and his books in every respect were a great improvement on Haüy's and Guillié's. He published five or six other little elementary books in 1834, at the time he issued his chief work; but his system seems not to have come into extensive use. It is to Mr. Gall, perhaps, more than to any other man that the interest in the education of the blind was awakened throughout Great Britain and America. Nor has he allowed his exertions to flag. In 1837, he published "The Epistle of Paul the Apostle to the Ephesians, printed for the Blind, on the largest type." The shape of the characters is similar to that upon which the Gospel of St. John was printed, but instead of being smooth the letters are fretted or serrated. It is a small octavo volume of 72 pages, 17 lines to a page; 250 copies were printed at the price of 1*s*. 6*d*. It is printed in the lower-case letters without capitals. The Epistle to the Philippians was also printed, in octavo, price 1*s*. 6*d*. The following year he again modified and improved his alphabet by bringing it back to a still greater resemblance to the common alphabet, but unfortunately he yielded to the suggestion of the Society of Arts of Edinburgh by introducing the use of capital letters at the beginning of sentences and proper names. His next book was "The Gospel according to St. Luke, printed on the common alphabet, for the use of the Blind, and capable of being read by any blind person, 1838. Printed for the British and Foreign Bible Society, London. Printed by James Gall, 22 Niddry-street, Edinburgh." This is a well-printed volume of 158 pages, 28 lines on a page of 70 square inches; price 5*s*. The same year the Acts of the Apostles were printed in the same serrated letter in 150 pages, price 5*s*. Besides these books Mr. Gall printed a series of tracts for the blind for the London Tract Society, in 1837, price 6*d*. each. It is a matter of surprise that these excellent and well-printed books of Mr. Gall are not more generally used. With the exception of the school at Abbey Hill, near Edinburgh, it is believed they are adopted by no public Institution in Great Britain. It is still a question if the roughness of the serrated character possesses any advantage over the smooth, sharp embossing. Old and used books are frequently preferred by the blind to new and fresh ones.

While Mr. Gall was thus engaged at Edinburgh, the Rev. Mr. Taylor, of York, displayed an intelligent and active interest in the education of the blind. In 1828, he published the *Diagrams of Euclid's Elements of Geometry in embossed or tangible form*, in 8vo. This was done on Bristol board, but was found too expensive. His mode of embossing, we believe, was forcing the paper, by means of heavy pressure, into the deep cut lines of a copper plate. It was not successful. He published also a map of England and Wales. In 1836, he printed in raised characters "Selections of Psalm Tunes and Chants" in oblong 4to. Also a short history of Elijah the Prophet, and of Naaman the Syrian; and the History of Joseph.

The efforts of Mr. Alexander Hay, in the cause of embossed typography, deserve mention, although an entire failure. He devised an alphabet of 26 arbitrary characters, which by certain combinations could represent the abbreviations and double letters; so that in all, he had 58 characters. He procured types and other printing apparatus, and in 1828 or 1829, issued a prospectus for publishing the Gospel of St. Matthew, at 7*s*. 6*d*. The book was never published.

The public interest in the blind became so great, that in 1832 the Society of Arts of Edinburgh offered a gold medal of the value of 20*l*. "for the best communication on a method of printing for the blind," and the result was that between the 9th of January 1832, and the 25th of February 1835, no less than 19 different alphabets were submitted, of which 16 were in a purely arbitrary character. The grand problem was to produce an alphabet that would unite cheapness and legibility.

While the puzzling question of an alphabet best adapted both to the fingers of the blind and the eyes of their friends, was under warm discussion on this side the Atlantic, Dr. Howe was developing his system at Boston, in the United States. In 1833, the Perkins Institution for the Blind was established at Boston, and Dr. S. G. Howe, a gentleman distinguished through a long series of years for his philanthropic labours, was placed at its head. As Gall had done, Dr. Howe took Haüy's invention as the basis of his system, and soon made those improvements and modifications which have rendered the Boston press so famous. He adopted the common Roman letter of the lower case. His first aim was to compress the letter into a comparatively compact and cheap form. This he accomplished by cutting off all the flourishes and points about the letters, and reducing them to the minimum size and elevation which could be distinguished by the generality of the blind. He so managed the letters that they occupied but a little more than one space and a half instead of three. A few of the circular letters were modified into angular shapes, yet preserving the original forms sufficiently to be easily read by all. So great was this reduction, that the entire New Testament, which, according to Haüy's type would have filled nine volumes, and cost 20*l*., could be printed in two volumes for 16*s*. Early in the summer of 1834 he published the Acts of the Apostles. Indeed, such rapid progress did he make in his enterprise, that by the end of 1835 he printed in relief, the whole of the New Testament for the first time in any language, in four handsome small quarto volumes, comprising 624 pages, for four dollars. These were published altogether in 1836. The alphabet thus contrived by Dr. Howe in 1833, it appears, has never since been changed. It was immediately adopted, and subsequently became extensively and almost exclusively used by the seven principal public institutions throughout the country. It is now the only system taught or tolerated in the United States, and deserves only to be better known in Great Britain and elsewhere to be appreciated. In America, seventeen of the States have made provision for the education of their blind, and as universal education is the policy of the country as well as its proudest boast, these books for the blind soon became in great demand. Dr. Howe some time since proposed a library for the blind, and with a view of increasing the number of books as rapidly as possible, arrangements have been made between the several institutions and presses to exchange books with each other, and not to print any work already belonging to the library of the blind. This harmony of action, together with the uniformity of the typography, presents so many obvious advantages, that the Jury cannot but wish a similar system were pursued by the Institutions of Great Britain and the continent of Europe. We subjoin a list of the books printed at the press of the Perkins Institution in Boston (see Tables p. 417).

From this list it appears that, exclusive of the three volumes not fully described, 7,903 pages, containing on an average 77 square inches, have been printed at this press, or more than 12 times the quantity of matter contained in the New Testament. Almost all the books are stereotyped, and small editions are struck off as they are required. They are sold at the actual cost, the cost of the larger works being averaged on an edition of 250 copies. The above prices include the binding; 50 per cent. discount is made for books sold in sheets. The books are embossed in the Institution under the superintendence of Dr. Howe himself, by means of a powerful press, built for the purpose. The sale of books in 1851 amounted to 427 dollars. This, however, is exclusive of the Scriptures. The American Bible Society, which now uses the stereotype plates of the Bible described above, distributed last year 149 volumes of the Bible. In short, the Boston books possess a neatness, clearness, sharpness, and durability of impression peculiar to themselves. The seventh volume of the Cyclopædia is already printed, and the Jury learn with pleasure that the printing of the remaining volumes will be resumed and probably be

TITLES.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Inches in a Page.	Prices.			
						Dolls.	£.	*s.*	*d.*
The Bible, containing the Old Testament	5	4to.	1842	1849	117	16·00	3	6	1
The New Testament (small)	4	,,	1836	624	84	4·00	0	16	6
The New Testament (large)	2	,,	1842	430	117	4·00	0	16	6
(The several books sold separately at corresponding prices).									
The Acts of the Apostles	1	,,	1834	–	84	–	–		
Lardner's Universal History	3	,,	1837	437	88	9·00	1	17	2
Howe's Geography	1	,,	1836	174	88	3·00	0	12	6
Howe's General Atlas	1	folio.	–	–	–	3·00	0	12	6
Howe's Atlas of the United States	1	,,	–	–	–	2·00	0	8	4
Howe's Atlas of the Islands	1	4to.	1838	44	80	2·50	0	10	4
English Reader, First Part	1	,,	1838	146	75	3·00	0	12	6
English Reader, Second Part	1	,,	1839	139	75	3·00	0	12	6
Dairyman's Daughter	1	,,	1835	162	50	1·00	0	4	2
The Harvey Boys	1	,,	1837	77	85	1·00	0	4	2
The Spelling-book	1	,,	1835	80	51	1·00	0	4	2
Bunyan's Pilgrim's Progress	1	,,	1836	184	84	2·50	0	10	4
Baxter's Call	1	,,	1836	139	76	1·50	0	6	3
Murray's English Grammar	1	,,	1835	112	51	1·00	0	4	2
Howe's Blind Child's First Book	1	,,	–	32	30	1·00	0	4	2
Howe's Blind Child's Second Book	1	,,	1846	45	30	·75	0	3	1
Sixpenny Glass of Wine	1	,,	–	26	41	·50	0	2	1
Life of Melancthon	1	,,	1837	50	32	1·00	0	4	2
Book of Sacred Hymns	1	,,	–	–	–	1·00	0	4	2
Howe's Blind Child's Manual	1	,,	1840	65	35	·75	0	3	1
Constitution of the United States	1	,,	–	25	75	·75	0	3	1
Book of Diagrams	1	,,	1836	58	48	·75	0	3	1
Viri Romæ	1	,,	1839	52	75	2·00	0	8	4
Peirce's Geometry, with Diagrams	1	,,	1840	85	75	2·00	0	8	4
Political Class Book	1	,,	1841	112	75	2·00	0	8	4
First Tables of Logarithms	1	,,	1841	75	88	1·00	0	4	2
Second Tables of Logarithms	1	,,	1841	133	80	2·00	0	8	4
Principles of Arithmetic	1	,,	1840	49	75	1·00	0	4	2
Astronomical Dictionary	1	,,	1841	49	63	1·50	0	6	3
Smellie's Philosophy of Natural History	1	,,	1845	189	75	3·00	0	12	6
Olmsted's Rudiments of Natural Philosophy	1	,,	1845	122	80	3·00	0	12	6
Cyclopædia	6	,,	1845-9	1,388	114	18·00	3	14	4
The Book of Common Prayer	1	,,	1845	240	114	1·00	0	4	2
Guide to Devotion	1	,,	1846	141	114	1·00	0	4	2
Book of Psalms	1	,,	1837	146	88	1·00	0	4	2
Book of Proverbs	1	,,	1842	38	117	·50	0	2	1
Psalms in Verse	1	,,	1835	97	73	1·00	0	4	2
Psalms and Hymns	1	,,	1848	189	120	2·00	0	8	4

finished in 20 volumes very soon. Want of funds is the temporary and only obstacle.

About the time that the Perkins Institution was established at Boston, another was set up in Philadelphia. A meeting of benevolent persons was called on the 21st of January 1833, when arrangements were made to open a school for the instruction of the blind, and Mr. J. R. Friedlander was placed at its head. This school became the Philadelphia Institution for the Blind by Act of Incorporation, 27th of January 1834. The blind owe much to Mr. Friedlander for the Philadelphia contributions to their literature. On the 21st of November 1833, he held his first public examination, and astonished the public by the progress of his pupils in reading, writing, geography, music, &c. The pupils read fluently from tangible letters executed by themselves with *pin-types*. These were small pieces of wood about two inches long, having a letter cut in relief on one end, and the same letter formed at the other by steel points. Maps of the world and of the United States were also exhibited, made by perforating the outline from behind. The result of this exhibition was highly satisfactory. In his address, Mr. Friedlander set forth the great advantages that would accrue to the blind by a general system of instruction. He repeated the usual unanswerable arguments against the adoption of *arbitrary* characters, and stenographic or phonetic systems, and strongly recommended the use of our own alphabet. He followed generally Haüy's plan of instruction. Early in 1833, Jacob Snider, a young gentleman, native of Philadelphia, applied his mind to the contrivance of a method of printing in relief. The alphabet at first adopted was a mixture of the upper and lower case italics, and the relief was produced by heavy pressure on thick paper between two sheets of copper having the letters deeply cut. The embossing was thus on both sides. His first attempt, after printing a few elementary sheets, was on the Gospel of St. Mark, which he completed by the end of 1833, in a large quarto volume, and published early in January 1834. An account of his first American book for the blind may be found in Poulson's American Daily Advertiser of the 10th of January 1834. The four Gospels were soon after printed in Roman capitals; but being found too bulky and otherwise objectionable they were abandoned, and a smaller, more compact, and sharper type, in the Roman capitals, was adopted. For the list of books printed at the Philadelphia press, see Table, p. 418.

It appears that the Boston and Philadelphia Institutions were founded almost simultaneously, and that their presses and system of typography were established without being apprised of the efforts of each other. Time, however, has at length remedied this diversity. The typography of the Philadelphia books is exceedingly well executed, and compares most favourably with the best of the Glasgow books, but the press has ceased to work, and printing in capital letters will not probably be resumed. From the preference which the present distinguished and intelligent Director of the Philadelphia Institution, Mr. William Chapin, late Superintendent of the Ohio Institution, is known to entertain for the Boston system of typography we may reasonably hope that when printing shall be resumed there it will be with Howe's alphabet. It is the opinion, however, of Mr. Chapin that all the American Institutions should unite, not only in the use of the same alphabet, but that they should all contribute to support one press. It may be

TITLES.	Size.	Number of Vols.	Date of Publication.	Number of Pages.	Number of Square Inches in a Page.
St. Matthew's Gospel	4to.	1	1834	–	60
St. Mark's Gospel	,,	1	1833	169	60
St. Luke's Gospel	,,	1	1835	–	60
St. John's Gospel	,,	1	1835	–	60
Select Library	folio.	5	1839	500	–
Ruth and Esther	,,	1	1838	50	–
Student's Magazine (published monthly)	,,	6	1838–43	–	140
Proverbs	,,	1	1839	96	–
Spelling-Book	,,	1	–	86	–
Church Music	,,	3	1840	300	–
Psalms and Hymns	,,	1	1840	68	–
Early Days of Washington, and Declaration of Independence	–	1	1834	71	–
De Oster Eier (in German)	,,	1	–	84	–
Auswahl (in German)	,,	1	–	44	–
French Verbs	,,	1	1839	25	–
Dictionary of Musical Terms	,,	1	–	–	–

remarked here that the pupils in all the American Institutions read fluently in both the upper and lower-case letters, but it is presumed that Philadelphia and Glasgow books will soon be entirely abandoned there; and as the Boston books can now be obtained in London at a price cheaper than any of the five different systems of books printed in Great Britain, it is to be hoped that they will come into general use here. If it be thought that the letters are too small for adults to read with ease, books may be printed with larger types, and even then be less bulky and expensive than any of the systems in arbitrary characters now in use.

In the year 1848 or 1849 the Virginia Institution set up a press, and has printed several elementary and school books. The Boston type is adopted, with the exception that capitals are used at the beginning of sentences and proper names. This alteration, in the opinion of the Jury, is not an improvement, as the blind are thus compelled to learn two alphabets instead of one. The Virginia books are well embossed, and it is hoped that in future books capitals will be omitted.

To the American Bible Society at New York much praise is due for their commendable efforts in the circulation of the Scriptures among the blind. The stereotype plates of the Bible in six volumes, executed at the Boston press, under the superintendence of Dr. Howe, now belong to this Society. They have printed a second edition from the same plates, and annually distribute gratuitously from 100 to 300 volumes.

It had ceased to be a matter of surprise in the United States that the blind could read, before the public attention was loudly called to the subject in Great Britain, for we see that in 1836, there were two active printing establishments for the blind in the United States; by one the whole of the New Testament had been published in a cheap form, in the common lower-case letters, and by the other the four Gospels in Roman capitals. Let us now return to the Society of Arts of Edinburgh, and their Prize Medal, to which we have already referred. It was not until the 31st of May, 1837, that the Society's Medal was awarded. In 1836, when the 19 different alphabets were before the Committee of the Society, circulars were drawn up and distributed, with specimens of the several alphabets, to the various institutions for the blind in England and Scotland, and every means employed to arrive at a correct result. The opinions of Mr. Taylor, of York, and Mr. Alston, of Glasgow, seem to have been those which the society chiefly followed. They were in favour of the common Roman capital letter, merely deprived of the seruphs, or small strokes at their extremities, and accordingly the prize was awarded to Dr. Fry, of London; and on the 31st of May, 1837, a Medal was granted to him for the *invention* of an alphabet which appears to have been in use since 1833 in Philadelphia.

On receiving the Society's circular in 1836, submitting the forms of all the competing alphabets to him, Mr. Alston was struck with the simplicity of Fry's, and immediately conceived the idea of making such alterations as he thought necessary, and putting it to the test. The changes made were simply to reduce the size of the letters and render the faces thinner. On the 26th of October 1836, he exhibited his first specimen of printing in relief in the Roman capital letter at a public examination of the blind. It was Fry's alphabet slightly changed to improve the sharpness of the embossing. He then made a successful appeal for a printing fund. After great exertions and most commendable perseverance he procured a printing-press, with two founts of type, and the other necessary printing apparatus. In January 1837, he issued a few elementary works. By March 1838, he had made such progress that the whole of the New Testament was printed in four super-royal 4to volumes. The type is great primer, and there are in the four volumes 623 leaves of 42 lines to a page. In December 1840, Mr. Alston completed the printing of the Old Testament in 15 super-royal quarto volumes, in double pica type. Of nine of the volumes he printed 200, and of the remaining six, 250 copies. There are in all these 15 volumes, 2,535 pages, with 37 lines on a page. Mr. Alston was justly proud of his great work, the entire Bible, containing the Old and New Testaments, in 19 volumes. In his "*Statements of the Education, Employments, and Internal Arrangements adopted at the Asylum for the Blind, Glasgow, with a short Account of its Founder, &c.*," 10th Ed., 1846, 8vo, p. 80, he says, "this is the first Bible ever printed for the blind;" but in this he was evidently in error, as we have shown that the greater part of it had long before been printed in Boston. We allude to these facts merely because it seems a matter of much regret that Mr. Alston should have devoted so much enterprise and money in producing the Scriptures when he might have ascertained that they had already been printed, and could have been bought at less money than it would cost him to print them. The main difference between the Glasgow and the Boston alphabets is that one is in the upper and the other is in the lower case, which difference is certainly not of sufficient consequence to demand two editions. Had he expended the same energy and money in producing other valuable books, and exchanged them with the Boston and Philadelphia Institutions, as he was urged to do, the three Institutions would have been greatly benefited by the large outlay, and the blind of both countries would have had a great increase to their library. On the 18th of January 1838, the officers of the Philadelphia Institution wrote to Mr. Alston, informing him that they possessed a printing press, and "understanding that you adopt the same character, it appears to our Board of Management that both Institutions would gain by an interchange of volumes." Mr. Alston at once acceded to this proposition, and immediately shipped 150 volumes, being 10 full sets of the New Testament, and 50 single copies of the Gospels, besides multiplication tables and other works. We subjoin a complete list of the books issued from the Glasgow press since its first establishment.

TITLES.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Inches in a Page.	Price.		
						£.	s.	d.
The Bible: the Old Testament complete	15	4to.	1839–40	2,535	90	7	10	0
,, the New Testament complete (or separately)	4	,,	1838	623	90	2	0	0
1. Genesis	1	,,	1840	159	90	0	10	0
2. Exodus and Leviticus	1	,,	1840	229	90	0	13	0
3. Numbers	1	,,	1840	137	90	0	9	0
4. Deuteronomy	1	,,	1840	115	90	0	7	6
5. Joshua, Judges, and Ruth	1	,,	1840	165	90	0	10	0
6. Samuel	1	,,	1840	178	90	0	11	0
7. Kings	1	,,	1840	186	90	0	11	0
8. Chronicles	1	,,	1840	190	90	0	11	0
9. Ezra, Nehemiah, and Job	1	,,	1840	159	88	0	9	0
10. Psalms	1	,,	1840	217	82	0	13	0
11. Proverbs, Ecclesiastes, Song of Solomon, and Esther	1	,,	1840	127	88	0	8	6
12. Isaiah	1	,,	1840	152	90	0	10	0
13. Jeremiah and Lamentations	1	,,	1839	188	90	0	11	0
14. Ezekiel	1	,,	1839	160	90	0	10	0
15. Daniel to the end	1	,,	1840	173	90	0	11	0
St. Matthew	1	,,	1839	79	90	0	5	6
St. Mark	1	,,	1837	50	90	0	4	0
St. Luke	1	,,	1838	84	90	0	5	6
St. John	1	,,	1838	62	90	0	4	6
Acts of the Apostles	1	,,	1843	80	90	0	5	6
Galatians, Ephesians, Philippians, and Colossians (editions in large type)	1	,,	1845	53	90	0	4	0
Epistle to the Romans	1	,,	1842	42	90	0	4	0
Church of England Catechism	1	ob. 8vo.	n. d.	16	40	0	1	0
Church of Scotland Shorter Catechism	1	4to.	1839	32	55	0	2	6
Selections from Eminent Authors	1	ob. 8vo.	1839	23	38	0	1	6
Selections of Sacred Poetry, with Tunes	1	,,	n. d.	22	40	0	2	0
Map of England and Wales	sheet.	folio.	n. d.	–	285	0	2	0
Specimens of type:—Ruth and James	1	4to.	1837	19	80	0	2	6
First and Second Book of Lessons	1	–	n. d.	30	42	0	1	6
A Selection of Æsop's Fables, with Woodcuts	1	ob. 8vo.	1838	28	40	0	2	0
Psalms and Paraphrases (Scotch version)	2	4to.	1838	342	63	0	16	0
Lessons on Religion and Prayer	1	ob. 8vo.	1843	26	44	0	1	6
Psalms and Hymns (version of Tate and Brady)	1	folio.	1841	207	104	0	12	0
Morning and Evening Services (Liturgy)	1	4to.	1839	34	68	0	2	6
Epitomized History of the Bible (Second Edition)	1	,,	n. d.	37	44	0	2	0
Musical Catechism, with Tunes	1	,,	1838	38	40	0	3	6
English Grammar	1	ob. 4to.	1838	72	67	0	5	0
Todd's Lectures	3	ob. 8vo.	1841	185	53	0	7	6
Description of London, by Chambers	1	,,	1841	75	48	0	3	0
Meditations on the Sacrament, and Prayers	1	4to.	1843	42	90	0	4	0
Scottish Songs	1	ob. 8vo.	1844	25	70	0	3	0
Introduction to Astronomy	1	,,	1841	32	52	0	3	6
Alphabet, on Card	–	,,	n. d.	1	33	0	0	2
Outlines of Natural History (Quadrupeds)	1	,,	1842	15	38	0	1	0

Since the death of Mr. Alston, on the 20th of August, 1846, the Glasgow press has almost ceased to work. A few of the volumes have been reprinted. It is at present engaged in reprinting the Gospel of St. John and the Acts of the Apostles. Since 1837 it has been almost the only press that has supplied England, Ireland, and Scotland with embossed books in Roman type. These books are typographically well executed, and the Jury think that Mr. Alston and the Glasgow press are deserving of great praise. The objections, however, to the small Roman capitals, in which most of the books are printed, are such that it is to be hoped that ere long this press will follow the example of that at Philadelphia, and adopt Howe's typography.

It has generally been supposed that the Glasgow press was the only one in Great Britain that printed anything of consequence in the common letter. But we cannot omit to mention a valuable work that has come under our notice; it is a "*Magazine for the Blind. London: Simpkin, Marshall, & Co., Stationers' Court; Price 6s.; in twelve monthly parts.* 1839-40." After two volumes were printed, the first Magazine for the Blind in this country was discontinued. It is in quarto form, and has 23 lines on a full page. The type is the ordinary mixture of the upper and lower case of Roman letter, and the work is beautifully printed. The first volume contains 78 pages, and the second 73. It is to be regretted that so valuable a contribution to the literature of the blind should not have found better support. It consists of miscellaneous information, with fragments of authors, poetry, anecdotes, woodcuts, &c.

In 1806, an Institution for the Blind was established at Stockholm, and it is with pleasure that we learn that Mr. Watts, of Crown Court, London, has, at the expense of the British and Foreign Bible Society, printed in relief, with the ordinary Roman type, in capitals and lower-case, the Gospel according to St. Luke, in Swedish, for this Institution. The volume was printed in 1848, and is a beautiful specimen of embossed typography. It is in quarto, consisting of 132 pages, 27 lines on a page of 70 square inches. Price, as sold by the Bible Society, at cost, 6s.; 500 copies were printed.

In France, Belgium, Prussia, Austria, Switzerland, Sweden, and the United States, the Roman lower-case alphabet is used. In most, if not all, of these countries, the Institutions for the Blind are supported and partially controlled by Government, and perhaps this is the reason why, in all of them nearly, the same system of typography prevails.

In Great Britain, however, the case is different. There are now five entirely different systems of typography in use here, and vigorously pressed upon the benevolent public. The unfortunate blind are thus deprived of the advantages they might have if harmony of action and uniformity of typography were adopted. This diversity of opinion is causing great injustice to them, and the Jury cannot but urge upon the parties concerned the speedy adoption of some one system throughout the country. Our opinion is decidedly in favour of Howe's American typography. Perfection is not claimed for this system, but it seems to us that there are fewer objections to it than to any of the others, and it may be the more easily improved; but any one of the five principal systems now used in England is far better than so many. The present state of printing in the Roman character in Great Britain is, as we have seen already, that every press has been stopped, while the books in arbitrary characters seem to be increasing and gaining public favour. The principal of these is one known as Lucas's. It was devised by T. M. Lucas, of Bristol, about the year 1835. It consists of arbitrary characters, and is said to be founded on Byron's system of stenography. It is simple, speedily learned, and easily read by the touch, and is generally acknowledged to be of all the arbitrary systems the best. The printing in this system began at Bristol, and the following are the works published there:—

1. The Gospel according to St. John, edited by T. M. Lucas, inventor of the system for teaching the blind to read by embossed stenographic character; July, 1837; Bristol; in 4to, 66 pages, and 27 lines to a page. Two pages are pasted together.

2. The Acts of the Apostles (according to the authorized version), in T. M. Lucas's embossed stenographic character; 1838. Published under the direction of the Bristol Society for Embossing and Circulating the Authorized Version of the Bible for the use of the Blind; Bristol; in 4to, 118 pages, 27 lines on a page.

This second publication of Mr. Lucas was announced as containing some improvements,—as widening the spaces, and lessening the abbreviations.

3. The Gospel according to St. Matthew (according to the authorized version), in T. M. Lucas's embossed stenographic character, 1839; published, &c.; Bristol; 4to, 116 pages. In this third publication is announced the firm conviction that this system will prevail over any other plan, on account of its tangibility.

4. The Gospel according to St. Mark, &c.; Bristol, 1840; 4to, 71 pages.

The above, with the exception of a few small elementary works, are, we believe, all that appeared at Bristol. In the year 1839, a Society was formed, called "The London Society for Teaching the Blind to Read." They adopted Lucas's system, and have been gradually improving it. The following year the types and printing apparatus was transferred from Bristol to London; and in 1841, the Society issued "The Epistle to the Romans." Since then their press has not been idle, as the following list will show. The printing is now done by the blind at the Institution in the Avenue Road, Regent's Park.

TITLES.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Inches in a Page.	Price to Subscribers			Price to Non-Subscribers		
						£.	s.	d.	£.	s.	d.
THE BIBLE AS FAR AS PRINTED	14	4to.	1842-50	–	70	4	7	0	5	14	4
The New Testament complete	9	,,	1839-51	–	70	1	10	6	2	0	0
(May be had separately.)											
Genesis, Part I.	1	,,	1843	113	70	0	4	0	0	5	4
Genesis, Part II., and Exodus, Part I.	1	,,	1843	112	70	0	4	0	0	5	4
Exodus, Part II.	1	,,	1843	110	70	0	4	0	0	5	4
Numbers, Part I.	1	,,	1849	139	70	0	4	6	0	5	6
Numbers, Part II., and Deuteronomy, Part I.	1	,,	1849	117	70	0	4	0	0	5	4
Deuteronomy, Part II., and Joshua, Part I.	1	,,	1850	123	70	0	5	0	0	6	0
Psalms, Part I.	1	,,	1842	95	70	0	3	6	0	4	8
Psalms, Part II.	1	,,	–	–	70	0	4	0	0	5	4
Proverbs, Ecclesiastes, and Song of Solomon	1	,,	1849	111	70	0	4	6	0	5	6
Isaiah, Part I.	1	,,	1844	98	70	0	3	6	0	4	8
Isaiah, Part II., and Hosea	1	,,	1844	98	70	0	3	6	0	4	8
Jeremiah, Part I.	1	,,	1847	104	70	0	4	0	0	5	4
Jeremiah, Part II.	1	,,	1848	109	70	0	4	0	0	5	4
Joel to Malachi	1	,,	1846	119	70	0	4	0	0	5	4
Matthew, New Edition	1	,,	1846	108	70	0	4	0	0	5	4
Mark	1	,,	–	71	70	0	3	0	0	4	0
Luke, New Edition	1	,,	1851	119	70	0	4	0	0	5	4
John, New Edition	1	,,	1846	86	70	0	3	0	0	4	0
Acts, New Edition	1	,,	1845	120	70	0	4	0	0	5	4
Romans	1	,,	1841	41	70	0	2	0	0	2	8
Corinthians to Ephesians, inclusive	1	,,	1844	100	70	0	3	6	0	4	8
Philippians to Hebrews, inclusive	1	,,	1844	95	70	0	3	6	0	4	8
James to Revelation, inclusive	1	,,	1844	101	70	0	3	6	0	4	8
Liturgy, Select Portions	1	,,	1849	111	70	0	4	6	0	5	6
Prayer-book Psalms, Part I.	1	,,	1849	104	70	0	4	0	0	5	4
Prayer-book Psalms, Part II.	1	,,	1849	95	70	0	4	0	0	5	4
Prayers and Hymns	1	,,	1842	109	70	0	4	0	0	5	4
Hymn-book, embossed by the Blind Pupils	1	8vo.	1845	72	70	0	2	0	0	2	8
Scripture Lessons	1	–	–	–	–	0	0	6	0	0	8
First-Class Book	1	–	–	–	–	0	0	6	0	0	8
Second-Class Book	1	–	–	–	–	0	0	6	0	0	8
Tin-foil Alphabet	–	–	–	–	–	0	0	6	0	0	8
Card Alphabet	–	–	–	–	–	0	0	2	0	0	3
Ciphering Board and Type	–	–	–	–	–	0	17	6	1	0	0
Raised Maps of Europe, Asia, Africa, America, (North and South), each	–	–	–	–	–	0	15	0	0	17	6
An Apparatus for embossing in Lucas's System, adapted by Mr. Wood, the Master	–	–	–	–	–	0	15	0	0	17	6
The Figures of the First Book of Euclid's Elements of Geometry, on Five Boards, by Mr. Wood, each	–	–	–	–	–	0	10	6	0	12	0
A Chess-Board, adapted to the use of the Blind, by Mr. Wood	–	–	–	–	–	0	9	0	0	11	0
The Book of the Prophet Ezekiel, and a New Edition of the Psalms (Bible version) is in course of preparation	–	–	–	–	–	–			–		

In May 1838, the "London and Blackheath Association for embossing the Scriptures in various languages, and for teaching the Blind to read on the Phonetic System," was established. Its object is to stereotype the Holy Scriptures in James Hartley Frere's phonetic characters. About the year 1839, Mr. Frere devised a cheap plan for embossing or stereotyping. It consists simply of small wires, drawn with angles laid down upon tin plates. The wires are bent, and cut by means of ingenious spindles to form the characters, which are similar to those of Gurney's system of short hand. The wires are attached to the plate by heating it sufficiently to melt the coating of tin, into which the wire sinks and is fast when cold. The common printing press is used in embossing. Mr. Frere's books are read from left to right, and back, after the manner of the ancient Greek boustrophedon writing. Mr. Frere's books are well embossed, and from his plates the books can be printed as they are wanted. The objections to phonetic alphabets are obvious. Mr. Frere, however, does not claim to supersede the common spelling, or the common printing, or common embossing, but to form an easy introduction to them. The following is a complete list of Mr. Frere's books.

TITLES.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Inches in a Page.	Price.		
						£.	s.	d.
The New Testament complete	8	ob. 4to.	1839-51	723	110	2	10	0
The Old Testament as far as Printed	7	,,	–	811	110	2	0	0
(Each Volume sold separately.)								
Matthew	1	,,	–	83	110	0	6	0
Mark	1	,,	–	72	110	0	5	6
Luke	1	,,	–	88	110	0	7	0
St. John	1	,,	–	96	110	0	5	6
Acts	1	,,	–	110	110	0	7	0
Romans to Corinthians	1	,,	–	89	110	0	6	0
Galatians to Philemon	1	,,	–	74	110	0	5	6
Hebrews to Revelation	1	,,	–	111	110	0	7	0
Genesis	1	,,	–	132	110	0	8	0
Exodus	1	,,	1843	112	110	0	7	0
Joshua	1	,,	1852	65	110	0	3	6
Judges	1	,,	1852	65	110	0	3	6
Proverbs and Ecclesiastes	1	,,	–	76	110	0	5	0
Isaiah	1	,,	1843	128	110	0	7	6
Daniel, Esther, and Ruth	1	,,	–	69	110	0	5	6
Psalms (Prayer Book Version)	2	,,	–	164	110	0	12	0
Grammar	1	,,	–	13	110	0	1	0
Morning and Evening Prayer	1	,,	–	33	70	0	2	0
Hymns from Cowper and Newton	1	,,	–	40	70	0	2	0
Five Addresses to those who wish to go to Heaven	1	,,	–	21	110	0	1	6

More recently still another system has been devised by Mr. W. Moon, Master of the Brighton Blind Asylum. The characters are arbitrary, though Mr. Moon defines them as the "Common Alphabet Simplified." He claims also a new mode of stereotyping, by which the characters are rendered sharp and prominent. The lines are read forwards and back like Frere's plan, and it is even more bulky and expensive than his. The new mode of stereotyping is believed to be quite the same as Frere's, by means of wires laid on tin plates. We subjoin a list of Mr. Moon's publications:—

The different sizes of the print are distinguished thus:—

1. Lines very wide apart, for beginners.
2. ,, wide.
3. ,, nearer.
4. ,, flatter as well as nearer.

Size of Print.	TITLES.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Inches in a Page.	Price.		
							£.	s.	d.
–	The New Testament complete	9	ob. 4to.	1848–51	–	110		–	
	(Volumes sold separately.)								
2	Psalms	1	,,	1851	–	110	1	1	0
3	St. Matthew's Gospel	1	,,	1849	–	110	0	12	0
3	St. Mark's Gospel	1	,,	1849	–	110	0	7	0
2	St. Luke's Gospel	1	,,	–	–	110	0	13	0
2	St. John's Gospel	1	,,	1848	–	110	0	8	0
3	The Acts of the Apostles	1	,,	1849	–	110	0	13	0
2	Romans and Corinthians	1	,,	1850	–	110	0	12	0
4	Galatians to Philemon	1	,,	1849	–	110	0	7	0
2	Epistle to the Hebrews—James, Peter, John, and Jude	1	,,	1850	–	110	0	10	6
3	Revelation	1	,,	1851	–	110	0	7	0
2	1st, 2nd, and 3rd Epistles of St. John	1	ob. 8vo.	1851	–	50	0	4	0
1	St. John's Gospel, Chapters XIV. and XV., each	2	,,	1850	20+18	50	0	1	6 each.
1	Epistle to the Hebrews, Chapter XII.	1	,,	1851	15	50	0	1	6
1	Isaiah LIII. and Psalms XXIII. and CXXV.	1	,,	1851	–	50	0	1	6
1	First Lesson Book, containing Freeman's Card and Scripture Texts	1	,,	1850	19	50	0	1	6
1	Morning and Evening Devotions	1	,,	1847-50	–	50	0	6	0
4	The Last Days of Polycarp	1	,,	1847	10	50	0	1	0
4	The Last Days of Cranmer	1	,,	1847	–	50	0	1	6

Size of Print.	TITLES.	Number of Vols.	Size.	Date of Publication.	Number of Pages.	Number of Square Inches in a Page.	Price. £.	s.	d.
1	The Cataract of Niagara - - - - - - -	1	ob. 8vo.	1849	13	50	0	1	2
4	A Remarkable Tiger Hunt - - - - - - -	1	,,	1847	–	50	0	1	6
4	The Seaman's Leap for Life - - - - - -	1	,,	1847	–	50	0	1	0
4	The Sagacity of a Lioness - - - - - -	1	,,	1847	7	50	0	1	0
4	Anecdotes of Two Dogs - - - - - - -	1	,,	–	8	50	0	1	0
1	The Lord's Prayer in English - - - - - -	sheet.	–	–	–	–	0	0	4
1	The Lord's Prayer in the Irish, French, Spanish, German, Italian, and Chinese Languages, each - -	sheets.	–	1849	–	–	0	0	6
–	Animals, various, each - - - - - - - -	sheet.	–	1851	–	–	0	0	6
–	Mathematical Diagrams from Euclid - - - -	1	–	1851	–	–	1	1	0
–	Patterns for Knitting - - - - - - - -	1	–	1851	–	–	0	3	0
–	Hymns arranged for four voices - - - - -	1	–	1851	–	–	0	10	6
–	Hymn Tunes, arranged for the Pianoforte - - -	1	–	1851	–	–	0	10	6
–	Maps—Africa, North America, South America, Ireland, Palestine, Jerusalem, and British Isles, each -	sheets.	–	1849	–	–	0	1	0
–	Hymn for the Blind - - - - - - - - -	1	ob. 8vo.	1851	6	50	0	1	0
–	English Dictionary (begun 1850) - - - - - -	1	ob. 4to.	1850	–	–		–	

If now the New Testament, printed in all the six systems used in the English language, be taken as a standard of comparison, the following Table will show the results:—

SYSTEMS.	Number of Vols.	Size.	Number of Pages.	Number of Lines in a Page.	Number of Square Inches in a Page.	Price. £.	s.	d.
The New Testament:—								
Howe's - - -	2	4to.	430	–	117	0	16	0
Alston's - - -	4	,,	623	42	90	2	0	0
Gall's - - - -	8	,,	–	28	70	2	0	0
Lucas's - - -	9	,,	841	27	70	2	0	0
Frere's - - -	8	ob. 4to.	723	–	110	2	10	0
Moon's - - -	9	,,	–	25	110	4	10	0

By a comparison of all these lists it will be found that Howe's books are not only much less in bulk than any of the others, but are also much cheaper.

Apparatus and Books for the Blind.

England.—Mr. E. A. Hughes (20, p. 537), of Mount Row, Westminster Road, exhibited a machine for enabling persons born blind to write, in raised characters, without using types; a machine to write with a pen or pencil in skeleton Roman capitals; a machine to cast accounts and make general arithmetical calculations by tangible characters; a machine to copy and compose music on paper, &c. Mr. Wedgwood, of Lombard Street, exhibited an improved noctograph, useful to persons who have become blind, *after having learnt to write.*

The Society for Teaching the Blind to Read (198, pp. 550, 551), Avenue Road, Regent's Park, exhibited embossed books for the blind; ciphering boards for the blind; maps for the blind; geometrical boards for the blind; apparatus invented by Mr. W. Wood, for enabling the blind to emboss Lucas's characters, and thus to communicate with each other; a specimen of music by Mr. Wood, for the blind, in raised characters; and chessboards for the blind. The system adopted is Lucas's, which has already been fully described, and has the objection of being in arbitrary characters: this also applies to the machine. This is a well-established Institution, and great pains were taken during the whole of the Exhibition, by the master, Mr. Wood, to demonstrate the successful operation of the various plans he has adopted to educate blind persons.

Mr. James Gall, Myrtle Bank, Edinburgh (171, p. 548), exhibited Gall's triangular alphabet for the blind, which, by its similarity to the Roman alphabet, is said to be easily read by eye and touch without previous instruction. A volume, containing the Epistle to the Ephesians, printed with this alphabet, and Gall's apparatus for writing by and to the blind. The apparatus consists of a stuffed frame, on which paper is placed; of a cover with bars to guide the lines, which are written from the bottom upwards; and of small stamps, with the letters formed of common pins, which are pricked through the paper and read on the opposite side.

The Edinburgh School for the Blind, Abbey Hill, Edinburgh (170, p. 548), exhibited Dr. Foulis' tangible ink for the blind. This ink contains a large quantity of solid matter, which is deposited on the paper, so as to present a raised surface to the finger. Dr. Foulis' manuscript music notation for the blind. Mr. Gall's typhlograph for the blind. Mr. Gall's system of arithmetic for the blind, accomplished by common pins stuck into a pin-cushion, and Mr. Gall's types for correspondence, by which blind persons can correspond with one another, or jot down memoranda for private use. Dr. Foulis' tangible ink appears to present some advantages, and will probably become a useful adjunct to the numerous means devised for the instruction of the blind, and for enabling them to read and write. The letters on the specimens exhibited were sufficiently raised to be quite perceptible to the touch.

Apparatus, &c., for the Blind—United States.

Mr. C. Starr, of New York (89, p. 1438), exhibited books for the blind. Two Bibles, embossed with Dr. Howe's characters. Two leaves are pasted together, and a stout strip of paper stuck between and around these leaves, so as to form a rim to prevent the characters from being flattened on shutting and opening the book. This plan has also the same advantage as if each leaf were printed on both sides. The types are rather small, but the whole work is one of merit.

Dr. S. G. Howe, Boston (439, p. 1463), exhibited books for the blind: his system has been fully described, and to it the Jury give the preference above all others.

Mr. Dodge, Superintendent of the American Department, exhibited Xenophon and Virgil; characters on Dr. Fry's plan, known as the Glasgow type, all in Roman capitals. This is the system adopted at the Manchester School for the Blind. It has been in use for about 15 years.

THE INSTITUTE FOR THE BLIND, Stanton, Virginia, exhibited specimens of books and types for the blind. The characters are capitals and lower-case; the printing is sharp and good.

APPARATUS, &c., FOR THE BLIND—FRANCE.

M. MARCELLIN LEGRAND, Paris (584, p. 1206), exhibited type-plates to print in relief for the blind. The characters are rather too small, and possess the disadvantage of having both capitals and small letters.

APPARATUS, &c., FOR THE BLIND—AUSTRIA.

G. B. MARCHESI, of Lodi (139, p. 1014), exhibited a writing-machine for the blind, producing the characters in black or in relief. The letters are formed with pin points, and they are sufficiently tangible; but having capitals and small letters, this plan offers the disadvantage that two alphabets have to be learnt.

APPARATUS, &c., FOR THE BLIND—BAVARIA.

MM. FEHR and EISENRING, Augsburg (2 Zollv. 54, p. 1100), exhibited metal plates, with letters and characters in relief. The letters are too broad, and are not well adapted for the blind.

The Jury beg to suggest that a uniform system should be adopted, and that, in future, all books printed for the blind should be printed in the same character. Dr. Howe's plan appears simple, easy, and fit for general adoption.

II. BOOKBINDING.

Splendour in the binding of books is a taste which dates back from remote times. The rarity of manuscripts, and the ornaments of every kind with which they were enriched, rendered them so precious that they were exhibited upon desks for the purpose of gratifying the sight and the pride of their possessors. Seneca said of them: "*Plerisque libri non studiorum instrumenta sunt, ad adum ornamenta.*" But if these rich bindings, some beautiful models of which still exist in public libraries, were suitable before or soon after the invention of printing, when books were almost as scarce as manuscripts, they are an anachronism, when we are compelled to heap them so closely in our libraries. These magnificent covers, executed for the greater part by jewellers, who enriched them with reliefs in gold, silver, steel, and ivory, with precious stones, with enamels, and with decorations of every kind, could only be suitable for the missals, and the antiphoners placed in churches. On seeing at the Exhibition, inclosed in the beautiful articles of furniture from Austria, the superb bindings in ivory carved with so much art, or in gold and silver inlaid with gems, and enamels still more precious, it might be supposed that these were shrines inclosing sacred relics, or even the casket of Darius, in which Alexander deposited the poems of Homer.

Between simple bindings and those in which costliness is carried to extreme, a medium may be found which lovers of books delight in, combining elegance with solidity and simplicity, qualities preferable to richness of gilding. At the period of the *Renaissance*, artists of great taste executed admirable bindings for kings, princes, and a few rich and learned *amateurs* whose names are preserved in the recollection of bibliopoles, who maintained in their houses binders whose taste they directed.* Some chose the Byzantine style; but the greater portion adopted the style called the *Renaissance*. After them, the binders confined themselves to imitation, applying this style of ornament indiscriminately to every species of book.

Some attempts have been made to submit bookbinding to general principles, and to adapt the binding either to the period in which the books were written, or according to the subjects of which they treat; and a variety of ornaments have been devised in consequence. The idea, though a happy one, is not new, but has not generally been adopted. We have seen the cap of liberty, the owl, and the wand of Æsculapius applied to bindings with respect to the contents of the works. The Egyptian, Grecian, and Roman ornamental emblems have been resorted to, as well as the Gothic borrowed from monuments. Others have thought it desirable that bookbinders, departing from the beaten track, should endeavour to give a more peculiar character to their bindings, a character which should mark our era; and that thus the choice of colours—more or less sombre or more or less bright—might always be in accordance with the nature of the subject treated of in the books. They contend that this system would at once afford, in a large library, the advantage of facilitating the search for books by immediately striking the eye: that it is also to be desired that certain styles of ornament should indicate whether such a work, on Egypt for example, belonged to the Pharaonic, the Arabic, the French, or the Turkish era; and that it should be the same with ancient Greece, Byzantine Greece, or modern Greece, the Rome of the Cæsars or the Rome of the Popes.

All these suggestions may be useful if they are placed under the control of taste and judgment.

Modern bookbinding is carried on in England on a scale of such magnitude as the binders of former times could scarcely have foreseen. The production of books greatly exceeds that of any former period, and has caused the application of so much machinery to bookbinding, that it may fairly be said to have become a manufacturing business. Books, handsomely bound, gilt, lettered, embossed, and otherwise ornamented, no longer depend upon individual skill; but are produced, with extraordinary rapidity, by the aid of machinery. Mr. Burn, of Hatton Garden, first introduced rolling-machines to supersede hammering; the iron printing-presses of Hopkinson and others were altered to form arming-presses, by which block-gilding, blind-tooling, and embossing can be effected with accuracy and rapidity. Leather covers, embossed in elaborate and beautiful patterns by means of powerful fly-presses, were introduced by M. Thouvenin, in Paris, about 25 years ago; and almost simultaneously in this country by Messrs. Remnant and Co., and by Mr. De La Rue, who were quickly followed by others. Embossed calico was also introduced about the same period, by Mr. De La Rue; hydraulic presses, instead of the old wooden screw-presses; Wilson's cutting-machines, which supersede the old plough: the cutting-tables with shears, invented by Mr. Warren De La Rue, and now applied to squaring and cutting millboards for book covers: all these means and contrivances, indispensable to large establishments, prove that machinery is one of the elements necessary to enable a binder on a large scale to carry on that business successfully.

MR. STARR, of New York (88, p. 1438), had, in the United States Department, two machines, one for backing, and one for finishing backs; but the Jury were not fortunate enough to see them at work, although they made many applications for the purpose.

Binding in cloth-boards is carried on with such rapidity by houses like the Remnants, the Leightons, the Westleys, and others, that 1,000 volumes can be put in cloth, gilt, in *six hours*, provided the covers be previously got ready, and this can be done in less than two days! Notwithstanding all these numerous improvements, the Jury could have wished for some advantages and real progress in ordinary leather bindings, where large quantities are not bound at one time. Those in the Exhibition were generally well executed; but the price is still high in proportion to that of the books, the cost of which has been much reduced by modern improvements in printing and paper-making.

France applies binding in boards chiefly to ephemeral books, which must attract the eye by their splendour, and which are intended either to ornament the drawing-room tables or to be given as prizes, and especially to books which are exported to South America. The bindings in boards exhibited by **M. MAME**, of Tours (France, 321, p. 1192), display elegance combined with a relative degree of solidity.

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* This is probably the cause which has kept us in ignorance of the names of these artists.

It is to be deplored that appearance should be so often preferred to reality, and that instead of the solidity which our fathers sought before everything, the inconstancy of our age should, by a contrary excess, prefer changeableness and variety. But, after all, books cannot be surrounded by too many attractions in order to inspire all classes with a taste for reading.

For bindings in boards a system has been for some time adopted, of employing ornaments allied by their style of design to the subject treated of in the book covered by them.

Amongst the beautiful bindings exhibited by the different bookbinders, the Jury have particularly remarked the works of the following exhibitors:—

Bookbinding—England.

Remnants and Co., Lovell's Court, London (5, p. 537).—The design shows excellence and good taste; their workmanship is perfect; and in the application of carved wood to binding, by the patent mode of burning in the pattern, a great degree of beauty and cheapness, compared with carving, is attained.

J. S. Evans, Berwick Street (8, p. 537).—An imperial 4to album, bound in vellum, illuminated by Joseph Stuart Evans, with the rose, shamrock, and thistle, intertwined and inclosed within a border of gold and colours. The interior of the book embellished with illuminated pages of various designs, and on the inside of the covers the arms of Her Majesty the Queen and His Royal Highness Prince Albert, also illuminated by the same method. The clean and superior finish of this album deserves great praise. An album in the Etruscan style, black kid inlaid upon a brown ground, the edges of the leaves ornamented to correspond. The Art Union Illustrations of the "Pilgrim's Progress," bound in morocco, finished in outline; the subject, "Christian met by Evangelist." By lines and gauges; a style of decoration totally unsuited for the purpose. The gold is well worked and bright. The whole of the binding exhibited by Mr. Evans is well executed.

Messrs. Leighton, of Brewer Street (24, p. 538).—These bookbinders evince, in various styles, great perfection, and all kinds of binding seem easy in their hands. Their manner of restoring fac-similes of missing pages to valuable works is first-rate. A quarto Lexicon, unfinished, showing a new mode of covering a book in such a manner as to preserve the strength of the leather at the joints. This appears to be an advantage. The taste displayed in the Royal Bible, with heavy ornaments, was inferior and of less happy adaption to the subject than Luke Limmer's general designs.

Mr. Josiah Westley (48, p. 540).—Spenser's works in white vellum, a 4to Bible in russia antique, and other specimens, show excellence in workmanship.

Messrs. Bowe and Sons (52, p. 541).—Their specimens of binding attracted the attention of the Jury by the cheapness and general excellence of their cloth binding.

R. J. Hayday (106, p. 544) sustains his well-earned reputation in the bindings exhibited by Cundall and Addey.

M. D. Batten, Clapham Common, London (59, p. 541).—The books exhibited by him were elaborately worked, although requiring more careful attention in finishing.

J. Wright, of Noel Street (139, p. 545).—"Das Niebelungenlied," royal 4to. A fine specimen of vellum illuminated binding, in the Grolier style, the design by an English workman. The price of binding, 10*l.* "Pugin's Glossary," royal 4to, inlaid illuminated morocco, well and expensively executed; the design taken from the contents of the book, and adapted to the decoration of the binding. The price of the binding, 10*l.* Owen Jones and Humphrey's illuminated books of the middle ages, imperial folio, dark-brown morocco, blind-tooled in imitation of the old monastic binding. The manner of fastening the leaves so as to open freely, by means of silk joints, appears superior to caoutchouc, where so large a book is required to open freely without twisting. Price of binding, 4*l.* "Silvester's Universal Paleography," imperial folio, brown morocco; the sides beautifully and accurately tooled in the old French style, in gold. It is a first-rate specimen of forwarding, solidity, and correct workmanship. Price of binding, 4*l.* "Law's Domestic Animals of Great Britain," chastely decorated and good workmanship. "Rogers' Poems," and "Italy," specimens of rich and accurate tooling, the edges marbled and well gilt over. "Mémoires de Napoleon," royal 8vo. A specimen of emblematical binding. "Bohn's Standard Library," in calf gilt, is a fine specimen of sound, durable, and useful binding, and the price moderate, being 3*s.* 6*d.* per volume. "Bohn's Classical Library," as a revival of the English style of binding of the period of 1760, with highly-raised boards, is another specimen of superior workmanship. The whole of the specimens justify the reputation Mr. Wright has acquired.

Messrs. Westley and Co., of Friar Street (111, p. 544) had, among other well-bound specimens, a royal folio Bible in purple morocco, bevelled boards, richly enchased gilt clasps, corners, and centres. The interior of the boards worked in gold, the edges of the leaves illuminated in gold and colours in the missal style. The cost of this binding is 75*l.* The workmanship is highly meritorious, and proves that if work can be so well and elaborately executed, it is worthy of better designs.

Messrs. Macombie and Co., Percy Street (26, p. 539).—A Cambridge folio Bible, red morocco, gilt centres, one in tortoiseshell and buhl; a royal 4to Bible in russia, and numerous other specimens, showing many points of great merit, but somewhat deficient in the finishing, an error which could and should have been avoided, particularly where so much elaborate work is bestowed. The prices given are—

	£.	*s.*	*d.*
A Cambridge folio Bible, red morocco, elegant, gilt corners and centre, silk insides – – – – – – – –	25	0	0
A Cambridge folio Bible, tortoiseshell and buhl, silk insides, elegant – –	15	0	0
A London folio Bible, morocco buhl –	15	0	0
A London demy folio Bible, bronze and blind-tooled – – – – – – –	5	0	0
A royal 4to Bible, russia – – –	6	10	0
A royal 4to Bible, maroon morocco, silk insides – – – – – – –	7	10	
A royal 4to Bible, brown morocco –	6	10	0
A royal 4to Bible, purple morocco, plates	5	10	0
A crown 4to Bible, brown morocco, silk insides – – – – – – –	4	4	0
A crown 4to Bible, purple morocco, silk insides – – – – – – –	4	4	0
A crown 4to Bible, calf, imitation wood	2	2	0
A crown 4to Bible, velvet-pierced, gilt sides – – – – – – – – –	8	10	0
A royal 4to Prayer – – – – – –	8	0	0
A royal 8vo Prayer – – – – – –	5	0	0
A pica 8vo imperial Bible, inlaid – –	5	0	0
A long primer 8vo, reference – –	2	10	0
A Boccacio, vellum, illuminated – –	7	0	0
A crown 4to Bible – – – – – –	7	0	0

Mrs. Lewis, Duke Street (163, p. 547).—"Horne's Commentary," "Glossary of Architecture," and other works, among which was one in the Gothic style, all bearing evidence of good and careful workmanship.

Messrs. Barrett and Co., Fleet Street (196, p. 550).—Specimens of carefully and well-executed work, among which is a royal 4to Altar Service, ultramarine border round the pages, and carved wood boards, covered in Turkey morocco: the electro-metal corners and centres deserve mention. Mr. Barrett had also numerous small Common Prayers and Church Services, perforated and engraved, solid covers, &c.

Mr. P. Sapsford, London (35, p. 539).—An illuminated and elaborately finished 4to Bible, in red morocco, with metal edges.

Mr. Tarrant, London (43, p. 540).—The Works of Sir Thomas Lawrence, morocco illuminated, neatly bound.

Mr. Neil, Edinburgh (91, p. 543). An imperial 4to Bible, white morocco, super-extra, morocco inside, with satin fly-leaves, the outside of the boards and back hand-tooled and illuminated. A fine specimen of what can be effected where care and judgment in the execution are combined, even under the disadvantages of working after a day's hard labour, this Bible having been bound in the winter evenings, by gas-light, after Mr. Neil's daily occupation.

Mr. Budden, Cambridge (97, p. 544).—An Album, inlaid in colours, with interlacing band pattern, inside joints, and inlaid vellum, gilt and painted, displaying great care, skill, and taste in the execution.

Mr. Orr, London (109, p. 544).—A number of volumes neatly blocked, and a thin book under the title of "Fiddy," very neatly bound.

Mrs. Leighton and Son, Harp Alley, London (158, p. 547).—Various specimens of blocking, some in silver, said to be protected from tarnishing. "The Women of the Bible," a volume showing good block-gilding.

Mr. Rivière, Great Queen Street (89, p. 543).—A volume, "Virgilii Opera," royal 8vo, inlaid white morocco, inside covers tooled in foliated curves, beautifully put out of hand; "The Chronicles of England," 4to, tree-marbled calf, also a fine specimen of this style of binding.

Mr. John Clarke, of Frith Street, Soho (68, p. 541).—Sir Joshua Reynolds' "Discourses," and a folio Bible in the Harleian style; a Bible in antique morocco, single hand-tooling, remarkable for its extremely well forwarded and finished style of work. Four volumes in calf, tree-marbled, in which Mr. Clarke excels.

Mr. Macnair, of Glasgow (117, p. 544), Mr. Clark, of Dunfermline (68, p. 541), Messrs. Clark and Donaldson, of Mauchline (135, p. 545), exhibited specimens of average workmanship.

After having attentively observed the amount of elaborate work which is bestowed on most of the productions exhibited by the bookbinders of the United Kingdom, the Jury cannot disguise the fact that there is a general want of good designs; and they beg to remark that more attention should be paid to a subject which impresses a special character on the products of a country. The attempts at emblematic binding are generally not very successful; but the imitations of the old English style of bindings are a nearer approach to simple, useful, and good work.

Bookbinding—France.

M. Niédrée, of Paris (665, p. 1211), exhibited numerous works, among which several are forwarded, designed, and finished in a first-rate style. The ornamental tooling in gold is a near approach to all that can be desired.

A. Lortic, Paris (1652, p. 1256), among other works bound in a superior manner, a large folio "Balbus de Janua," illuminated Greslier intersected pattern, with the insides elaborately gilt, is deserving of high praise. Some few specimens of very thin books displayed a degree of skill seldom surpassed.

Madame Gruel, of Paris (857, p. 1221), exhibited a smaller number of elegantly bound books than could have been expected from her well-known establishment. Those that were in her glass-case were principally ornamented in elaborately carved wood and ivory. A large folio, "España Artistica y Monumenta," red morocco illuminated, intersected pattern, deserves commendation for its elaborate workmanship.

M. Simier, of Paris (693, p. 1212): this name brings back recollections which impose duties on his successor, whose specimens contain merit of only an average kind.

M. Le Brun (No. 906, p. 1223) and M. Auguste Dauthuille, of Paris (1171, p. 1233), exhibited bindings of an average description.

The Jury regret that MM. Beauzonnet, Ottman, Cape, and other eminent bookbinders in Paris, have abstained from sending their works to the Great Exhibition.

In general, the bindings of French artists are remarkable for a superior degree of taste in their design, as well as for neatness of execution in the hand-tooling and finishing. Their best designs, however, are imitations of old artists.

Bookbinding—Austria.

Bookbinding on a large scale is carried on in Vienna and in Prussia, where also the manufactory of fancy leather articles has considerably increased of late years.

The principal part of the specimens exhibited were placed in M. Leistler's rooms, enclosed in a bookcase, and as the Jury were informed that these goods were private, there was a certain degree of delicacy in asking more than once for leave to inspect them. The names of the binders and ornamenters of the books and album-cases were not found by any number affixed to the cases, and it was not until the 20th of June that it was communicated to the Jury that the books, &c., were exhibited by individual persons who were desirous that they might not escape notice.

The designs of the portefeuilles exhibited by M. Habenicht (376, p. 1029), bookbinder of Vienna, are by Professor Charles Raesner and Professor Van der Nulh, and show what can be accomplished when artists are employed, instead of leaving the workman to follow his own notions of what constitutes appropriate ornamentation. These portefeuilles, got up by M. Habenicht, can only be noticed in this place for the very superior workmanship displayed in gilding and ornamenting, for they do not constitute bookbinding in its strict meaning. All the portefeuille-cases in the shape of books are specimens of first-rate workmanship and appropriate design, and reflect great credit on M. Habenicht and the artists who designed them.

The following is a list of six of those elegantly finished and ornamented productions:—

An elephant folio, in dark-blue velvet cover, with the figure of our Saviour and Cross, in chased silver, in the centre.

An elephant folio, green velvet, with exquisitely pierced ivory ornaments.

An elephant folio, with tortoiseshell cover, profusely ornamented with inlaid metal ornaments, Gothic design, pierced ivory and coloured glass border, silver and gilt device of three figures in the centre; the lettering in exquisitely formed raised letters of metal gilt.

An elephant folio, in blue and red morocco, illuminated in gold, with rose bouquet, and raised intersected ornaments, in ten compartments, each filled with highly finished tableaux.

An elephant folio, in dark puce velvet, raised gold ornaments, with three small ivory figures, and beautifully carved ivory ornaments round the sides.

An elephant 4to, light purple velvet, profusely ornamented with gilt metal, ebony, and pearls; females playing harp and lute in the centre, in gilt metal. Raised gilt letters, top, bottom, and sides.

M. Girardet, of Vienna, had also two beautiful portefeuilles, designed by Professor Charles Raesner, and of perfect workmanship. One an elephant folio, covered in light blue, red morocco tooled border, gold and ivory scroll ornaments, gilt metal centre, with female figure holding a tablet, in gilt metal, on a brown ground, with the names of celebrated Austrian music composers—perfect in the forwarding and finishing. The other, an elephant 4to, in dark-blue velvet, bronze and gilt metal, raised intersected pattern in fourteen compartments, ornamented with gold, with highly finished drawings of the costumes of Austria, and the imperial arms in the centre, in bronzed and gilt metal.

M. Girardet had also in the book-case upwards of 200 volumes of books, exquisitely bound. The whole of M. Girardet's productions were supposed to be with the book-case, and not exhibited for competition, and no information was afforded to the Jury to enable them to view them as a collection placed there by an exhibitor—there was neither number nor name to indicate who was the binder. Considering the superior workmanship, it is probable that M. Girardet would otherwise have received the marked approbation of the Jury by their awarding him a Prize Medal.

Bookbinding—The Zollverein.

Only two bookbinders have submitted specimens, although some of the booksellers and printers, combining this branch of the book trade, had also some bound works. M. **SCHOENING**, of Berlin (1 Zollv., 154, p. 1057), exhibited a large Altar Bible in morocco, well bound. M. **GRAF**, Duchy of Saxe Altenburg (1 Zollv., 746, p. 1091), a large Altar Bible in purple morocco; as a specimen of block gilding it is perfect, and considering the large size of the engraved block, which is stated to be in one piece, much skill is displayed in its being so skilfully applied.

BOOKBINDING—NETHERLANDS.

M. **REGEER**, of Rotterdam (112, p. 1141), exhibited the works of Hogarth, in folio, as a specimen of binding, neatly and carefully executed.

BOOKBINDING—SWEDEN.

M. F. **BECK**, of Stockholm (104, p. 1354), exhibited ten specimens of binding, possessing fair merit.

BOOKBINDING—UNITED STATES OF AMERICA.

Judging from the collection in the American Department, bookbinding has not advanced in that country as much as some other branches of the book trade. The works exhibited are loosely forwarded, and twist in handling; and although much labour is bestowed in gilding and finishing, sufficient attention is not paid to the minor details on which good workmanship so much depends. The following is a list of the exhibitors:—Mr. B. **BRADLEY**, Boston (473, p. 1465)—books in cloth, well blocked. These specimens were enclosed in a case in the form of an immense book, well and neatly covered. Mr. **HENRY GASSETT**, Boston (420, p. 1462), and Messrs. **LIPPINCOTT, GRAMBO, and Co.**, of Philadelphia (57, p. 1437)—specimens of binding, of moderately good workmanship. Mr. G. P. **PUTNAM**, of New York (122, p. 1441)—five or six specimens of mediæval binding. Messrs. **WALKER and Co.**, New York (123, p. 1441)—a large 4to Bible in two vols., bound in Gothic style, green morocco, gilt metal ornaments and corners, most elaborately worked fly-leaves, illuminated in green, red, and white, with recesses in each side for a family register, embellished paper, and finished in such a manner that when the recesses are shut up the inside of the cover remains even. This is the best specimen in the American Department, and possesses some novelty and care in forwarding and finishing.

BOOKBINDING—VAN DIEMEN'S LAND.

THE COUNCIL OF THE ROYAL SOCIETY OF VAN DIEMEN'S LAND (345, p. 999) displayed a collection of books neatly bound by Mr. **ROLWEGAR**, of Hobart Town (196, p. 996); and one volume, said to be gilt and lettered with gold leaf from Californian gold, manufactured by Mr. R. V. **HOOD**, also of Hobart Town.

Vellum Binding.

Vellum binding is a separate branch of the trade, and consists in binding all kinds of account books, from the largest ledger to the smallest memorandum book. The covers are usually vellum, forril, russia leather, smooth and rough calf, and the larger books are in general neatly worked with russia bands, which add both to their appearance and durability. The English vellum binders, whose works were in the Exhibition, fully sustain their high reputation for beauty of execution and solidity of workmanship. The ledgers of MM. **GAYMARD** and **GERAULT**, of Paris (517, p. 1203), however, show that remarkable progress has taken place in France within the last 10 years in this branch of trade. In the American Department, also, Mr. **HERRICK** (502, p. 1466) and Messrs. J. and W. **MCADAMS**, of New York (482, p. 1465), had ledgers ruled in a very superior manner. An improved mode of numbering the leaves of account books has been introduced within the last few years, by means of a paging machine, patented by Mr. Shaw. There are other machines for the same purpose; and Mr. **SCHLESINGER** (38, p. 539) had one at work in Class XVII. during the whole of the Exhibition, which is very simple in its construction; and appears to answer the purpose, although it may be less durable than Shaw's. Mr. Hancock took out a patent some years since for the purpose of applying caoutchouc to the manufacture of account and other books: the leaves are fastened together with caoutchouc in a semi-fluid state, instead of stitching them, thus obtaining much greater freedom in opening when the book is bound; this appeared at first to be a superior mode, and promised to supersede all others. It was not found, however, to be sufficiently strong to sustain the severe wear and tear consequent on the constant opening and shutting of ledgers. It is a process by which books that do not require such constant handling may be bound to advantage, as they open much more freely. It appears admirably adapted for music-books, albums, small pocket ledgers, and similar works.

The English exhibitors of account books were Messrs. **THOMAS and SON**, Cornhill (44, p. 540); J. **WILLIAMS**, of Bucklersbury (53, p. 541); **EVANS**, Berwick Street, (8, p. 537); **HARRIS** and **GALABIN**, Fenchurch Street (173); **ROYSTON** and **BROWN**, Broad Street (34, p. 539); **WATERLOW** and **SONS**, London Wall (46, p. 540); **COWAN** and **SONS** (101, p. 544); **DE LA RUE** and Co. (76, pp. 541–543), for pocket ledgers; and Mr. **WODDERSPOON** (159, p. 547), whose new mode of fastening the sections with cloth bands appears to be an improvement.

From France, MM. **GAYMARD** and **GÉRAULT** (No. 517, p. 1203) exhibited an immense and well-bound ledger; and M. **NÉRAUDEAU** (661, p. 1209), whose various account books were of an average quality. From America, Messrs. **SIBELL** and **MOTT**, New York (339, p. 1456), in addition to those already mentioned.

III. PAPER.

The introduction of paper, first made of cotton, and afterwards of linen rags,* dates from the arrival of the Arabs in Spain and Sicily, in this part of Europe, and from the time of the Crusaders as regards the Southern portion. Thus it is from two different parts of the East that we have derived this process, originally invented in China, where the art of making sheets of paper from the bark of trees, from bamboo, old rags, silk, hemp, or cotton, reduced to pulp, dates from the commencement of the second century of the Christian era.†

The use of papyrus, manufactured in Egypt, ceased in Europe about the ninth century, and the cotton paper, then in great use in the East, was introduced into Europe at this time, through the commercial relations of Venice, Naples, and Sicily.

Edrisi, who wrote in 1150, tells us that the paper made at Xativa, an ancient city of Valencia,‡ was excellent, and that it was exported to the East and West.

At the commencement of the fourteenth century there existed at Fabriano, in the Picenum, and at Colle, in Tuscany, paper-mills moved by streams of water.§ It was from these Fabriano mills that Bodoni, at the commencement of the present century, obtained the paper for his beautiful editions; and this manufacture is still carried on with success, judging from the superb vat-made paper exhibited by M. **MILLIANI**, of Fabriano (Rome, No. 12, p. 1285).

At Nuremberg, in Germany, a paper-mill was established in 1390.

The introduction of paper-making in France dates from the fourteenth century. The towns of Troyes and Essonnes are the first quoted in relation to this manufacture.

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* "Ex rasuris pannorum," are the words of Peter the Venerable, Abbot of Cluny.

† Between the years 89 and 105 after the birth of Jesus Christ.

‡ Xativa is a pretty town, with castles, the beauty and solidity of which have passed into a proverb; here is made paper, the equal of which cannot be found in the whole universe. It is exported to the East and West.—(Geography of Edrisi, translated by A. Jaubert, vol. ii., p. 37.) Xativa is now called San Felipe.

§ The Charter of the 6th of March 1377, relates to the lease of a mill with a waterfall, *ad faciendas cartas*.

In England the manufacture of paper was introduced much later,[*] and was imported from France. Yet it appears by verses, in a book printed in 1496 by Wynkyn de Worde, under the title of *Bartholomæus de Proprietatibus rerum*, that the paper had been made for it by John Tate, jun., at his mill in Stevenage, Hertfordshire. Probably the manufacture was not successful, for it was in 1558 that Queen Elizabeth granted to her jeweller, John Spelman, the right to erect a paper-mill, which was established at Dartford: this has been erroneously stated to have been the first put to work in England. So late as the middle of the last century, only very common paper, principally wrapping, was made in Great Britain. It was not until 1770 that the celebrated J. Whatman established fine paper-making at Maidstone, in Kent, after his return from the Continent, where he had worked as journeyman in most of the principal paper-mills.

When the art of paper-making was first introduced into Europe, parchment (sheepskin), or vellum (calfskin), was used for writing and printing. In place of these substances, paper was required to possess greater strength and solidity than that made of cotton; it was therefore manufactured of hemp and linen rags, not weakened by bleaching, according to the present mode, which, by removing the natural gum enveloping vegetable fibres, injures them more or less. It is remarkable, that these old papers, having been well-sized with gelatine, preserve their original qualities to this day.

In 1750, Baskerville, to obviate the roughness of the laid paper of that time, had it made on wove moulds; his beautiful edition of Virgil, 1757, is chiefly printed on this wove paper. This attracted the attention of M. Ambroise Didot, who employed M. Johannot, of Annonay, to make similar paper, which he called "vellum paper" (*papier vélin*).[†] Until that period the rags were reduced to pulp by means of stampers, a slow process, requiring considerable motive power; to remedy this, cylinders with sharp steel blades for tearing the rags were invented in Holland, where the windmills, then used for giving power, were found inadequate to put these stampers in regular and constant motion. Holland still maintains a high reputation for its hard-sized hand-made laid writing-papers, as was shown by those exhibited in the Dutch Department.

At the end of the last century (1799), the first trial was made at Essonnes, in France, in the paper-mill of M. François Didot, of a machine for making continuous paper. It was the invention of M. Robert, a workman in that establishment, who obtained a patent for 15 years, and a sum of 8,000 francs from the French Government. Some sheets of paper in continuous lengths were then made; but the troubles in which France was involved at that time caused delay in the necessary experiments, which were both tedious and expensive. As soon as the Peace of Amiens restored intercourse with England, M. Didot, jun., convinced of the great utility of the invention, came over with it to seek in England what was then wanting in France—capital engineers and enterprising paper-manufacturers; he was accompanied by Mr. John Gamble, his brother-in-law, who had resided several years in Paris. Having obtained patents in England, one in 1801, and the other in 1803, they were assigned to Messrs. Henry and Sealy Fourdrinier in 1804. Dartford, in Kent, was selected as the place best adapted for realizing the patentees' plans, and Mr. Hall's establishment as the fittest engineering concern for that purpose. In that manufactory, Mr. Bryan Donkin, since so celebrated as a paper-machine maker, was employed; and to this gentleman the credit of perfecting the paper-machine is mainly due. In 1803, after intense application, Mr. Donkin produced a self-acting machine, or working model, which he erected at Frogmore, in Hertfordshire; and in 1804, he put up the second machine at Two Waters, which was completely successful; and the manufacture of continuous paper became one of the most useful discoveries of the age. In the first ten years from 1803, Messrs. Donkin made and set to work 13 paper-machines; in the second ten years they put up 25; and in the present year, 1851, Messrs. Donkin and Co. are making their 191st machine. Of these 83 have been made for Great Britain, 23 for France, 46 for Germany, 22 for the North of Europe, 14 for Italy and the South of Europe, 2 for America in 1826, and 1 for Mr. Marshman, for India, in 1825. The first machine made by them for France was sent to M. Canson, in 1822; the second, in 1823, to M. Maupeau; and the third, in 1825, to M. Didot. The first machine made by Messrs. Donkin for Germany was in 1818, for the Prussian Government, sent to Berlin; the second, in 1823, for M. Rauch, of Heilbronn. The first machine sent to Russia was in 1835, for Moscow. In 1837, one for the Bank of Poland, sent to Warsaw. In 1805, Mr. Donkin altered the position of the cylinders, so as to dispense with the use of the upper web, an improvement by which the machine was much simplified—the paper on the web being slightly pressed before passing through the pressing rollers—thus an all-important advantage was attained.

In 1809, Mr. Dickinson, paper-maker, invented another method of making endless paper. It consists in causing a polished hollow brass cylinder, perforated with holes or slits, and covered with wire-cloth, to revolve over and in contact with the prepared pulp; the cylinder being connected with a vessel from which the air has been exhausted, the film of pulp adheres to the hollow cylinder. It is then turned off continuously upon a solid one covered with felt, upon which it is condensed by the pressure of a third revolving cylinder, and is thence delivered to the drying rollers.—See Ure's Dictionary, article *Paper-making*. In 1826, M. Canson, of Annonay, first applied suction-pumps to the Didot and Fourdrinier machines. He kept it secret for six years, and in 1832, communicated it to Messrs. Wyse and Middleton.

In 1836, Mr. Brown, of Esk Mills, near Edinburgh, obtained a patent for applying suction-pumps to the Fourdrinier machine. He places a rectangular box transversely beneath the horizontal wire-cloth, without the interposition of any perforated covering.

In April 1839, Mr. T. B. Crompton took out letters-patent for producing a partial and continual vacuum under the wire by means of a fan; and a uniform rarefaction is obtained by this arrangement. It has been successfully applied since that period at his extensive mills, Farnworth, near Bolton, Lancashire.

The first machine for continuous paper actually made in France was constructed at Sorel, near Anet, by Messrs. Berte and Grévénich, under the directions of M. Didot, who had obtained a patent in France. M. Calla, an ingenious French mechanic, was the maker. The machines first made in France were very inferior to those made by Messrs. Donkin, consequently he supplied the principal paper-makers in that country with machines made by him in England.

Notwithstanding the great benefits derived by the perfection of the Didot and Fourdrinier paper-machines, and the immense quantities of paper produced by these machines, it was not till 1821 that the advantages of this invention were fully developed. This was effected by Mr. T. B. Crompton, who took out a patent on the 1st of November 1820, for "drying and finishing paper by means of a cloth or cloths, against heated cylinders, and the application of a pair of shears to cut the paper off into suitable lengths, as it comes from the machine or rollers." The old tedious and expensive process of drying in lofts was no longer necessary. The paper was much better finished and cut than had been found possible until this improvement. Through the imperfection of the patent laws of that period a number of persons eventually succeeded in setting aside Mr. Crompton's patent.

In 1828, Mr. T. B. Crompton, in conjunction with Mr.

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[*] See the argument of De Thou, in favour of the 24 sworn booksellers.—*Parliament Records*, 17th January 1564.

[†] The first specimen is in one of the volumes of the collection which he printed for Mons. le Comte d'Artois (Charles X.).

Enoch Taylor, obtained a "patent for cutting paper longitudinally, by means of revolving circular blades."

In 1826, Mr. Firmin Didot introduced into his mill, at Mesnil, Mr. Crompton's drying process. This was the first time that it was put into operation in France.

Fine writing-paper is now made, sized with gelatine, dried, and cut into sheets, at the rate of 60 feet a minute in length, and 70 inches in width, at the works of Mr. William Joynson, at St. Mary Cray, Kent, which produces, from only two machines, the large quantity of 25 tons per week.

The paper used in England for newspapers is required to be very strong and firm: to obtain these qualities it is sized with gelatine. To Mr. T. B. Crompton is due this mode of sizing with rollers. The amount of Excise duty on paper made by him has been no less than 15,000*l.* per annum, taking an average of ten years, and now exceeds 20,000*l.*, giving the enormous weight per annum of 1,400 tons.

In August 1830, the late Mr. Thomas Barratt, of St. Mary Cray, obtained a patent for inserting the water-mark and maker's name to continuous paper, so as to resemble, in every respect, paper made by hand. It is to this ingenious man that we are indebted for the improved means of finishing paper, owing to the perfection he attained in making cast-iron rollers truer than was possible by the old mode of turning them in a lathe. This consists in grinding the rollers together, allowing merely a small stream of water to flow over them, without emery or any other grinding material; and, by continuing the operation for many weeks, true cylinders are obtained. This is the mode now adopted in finishing rollers for all purposes requiring great accuracy.

In August 1831, M. Jean Jaques Jequier obtained a patent for making continuous paper with wire marks, similar to the laid papers usually made by hand; to which the preference was still given for their greater strength and peculiar appearance.

In 1830, Mr. Ibotson, of Poyle, paper-maker, obtained a patent for a peculiar construction of strainers. He intrusted the getting up of these strainers to Messrs. Donkin, who used great care in their manufacture. By Mr. Ibotson's simple contrivance, the sand, lumps, knots, and other impurities, are kept from flowing with the pulp at the moment of its running on the wire web on which the paper is formed. Most countries have since adopted these strainers; and paper is now free from the imperfections which formerly caused so much damage to types in the printing, spoiling large founts and valuable wood-cuts, after they had been in use only a short time: this great improvement also superseded the operation of picking the lumps, &c., after the paper was made, which caused so much retree (damaged paper) to otherwise good and well-made paper. Other kinds of strainers are used; but few are found to work as well as Ibotson's, made by Donkin and Co. Mr. John Wilks, a partner in the firm of Donkin and Co., obtained a patent in 1830 for a channelled and perforated roller, technically called a "dandy," to remove part of the water from the pulp, to facilitate couching, to enable paper to be made with increased rapidity, and to close its upper surface. To this gentleman manufacturers are greatly indebted for many valuable suggestions and improvements in the numerous utensils and implements required in the making and finishing of paper.

In England, writing-papers are sized with gelatine, and are stronger and harder than those of other countries: they are also cleaner, generally better *put up*, and show greater care in the manufacture than those of France and of other countries. The old cream laid papers, now so fashionable in England, were re-introduced by Messrs. Hollingworth, of Turkey Mill, Kent, a few years since, and they are still preferred for letter and note paper. The thinnest post writing-papers, however, are much better manufactured in France, Belgium, and other parts of the Continent, than in England. Those exhibited from Angoulême in France, and Heilbronn in Germany, are the best; those made in Belgium are not sufficiently hard-sized. Notwithstanding the high protective duty of 4½*d.* per lb., a considerable quantity of these thin writing-papers is imported into England. The white of the letter-papers of France, Germany, and other foreign countries, is of great purity and beauty; and these papers, being sized in the vat with farina, in addition to rosin-soap, instead of gelatine, they are less greasy under the pen,[*] and consequently can be written on more freely than those which are sized with animal size; they do not, however, bear the ink so well. English printing-papers generally maintain a superiority over those of foreign countries; and in drawing-papers and strong account-book blue-laid papers, England stands unrivalled. Tinted printing and drawing papers, formerly made exclusively in England, are now produced by most foreign paper-makers, who also make the tinted writing post-papers, long out of fashion in this country. M. **Obry**, of Prouzel (334, p. 1193), exhibited well-made black papers, for wrapping, cambrics, lace, &c. Black papers of the same kind were made in Ireland and Manchester more than 25 years ago.

M. **Journet** (619, p. 1207), of the Souche Paper Manufactory, exhibited printing-paper of a good colour, said to be bleached without the use of any acid; rose-colour tissues of great brilliancy, dyed with safflower, and filtering-paper for chemical purposes, which, probably owing to the granitic and silicious soil through which the Souche waters flow, seem to combine all the best qualities of the Swedish paper originally manufactured under Berzelius' directions. A sheet of M. Journet's filtering-paper, weighing 9·6970 grammes, and having a surface of 0·2336 mètres, analysed by M. Bareswil, gave in ashes only 0·0293; so that 100 kilogrammes of this paper would yield only 302 grammes of ashes, being only three parts of ashes from one thousand parts of paper—a very favourable result.

The so-called "fire-proof cartridge-paper," made with animal substances invented by M. Mérimée, and exhibited by MM. **Odent** (938, p. 1225), **Blanchet**, and **Kleber**, of Rives (1090, p. 1230), and by M. **Montgolfier**, of Annonay (324, p. 1192), deserves particular mention. It approaches parchment in strength and solidity, and is valuable when used instead of felt in making gun-cartridges; for should it catch fire, the fire does not spread as in paper, but goes out instantly. M. Odent was the first to apply M. Mérimée's invention under that gentleman's instruction, and he exhibited sheets as a substitute for parchment-binding, or for valuable records; its yellow colour, however, is objectionable, but it may perhaps be improved. M. Montgolfier has also applied this animal paper, instead of parchment, to the use of spinning-mills and to gold and silver beaters' purposes.

Sizing in the vat offers many advantages, but as a gelatine cannot be employed without injury to the felt during the process of manufacturing paper, substitutes for gelatine were desirable; and in 1827 M. Canson made size, of which wax was the base, and M. Delcambre made another, the base of which was rosin: neither seems to have answered the purpose, for Mr. Obry's plan of using alum and rosin, previously dissolved in soda, and combining it with potato-starch, which he adopted in 1827, is the method now generally followed in France for writing and printing papers. In England, for printing-papers, the rosin size is also the one in use; the addition of potato-starch has been attempted, but not very successfully, probably from the quantity of cotton rags used, which seem not readily to take the size made with starch. For writing-papers, gelatine is still preferred in this country, and is an after process.

Glazing of Paper.

High glazing, now universally adopted, was first introduced by the late Mr. Heath, about 35 years ago, at his pasteboard manufactory in Hackney, and for many years the means he adopted were not known. On the introduction of steel pens, there was an increased demand for smooth papers, and a desire to obtain the highest possible finish. Other card and drawing-board makers applied

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[*] Mr. Joynson since the Great Exhibition has remedied this inconvenience by a very ingenious process.

Mr. Heath's process, and it became the custom for wholesale stationers to send post and other writing papers to the card-makers to be glazed or satined. A patent having been granted in 1832 to Mr. De La Rue for "certain improvements in playing-cards," in which he applied printing in oil, instead of the old way of stenciling with water colours, he adopted the mode of passing them between copper sheets through powerful rollers, instead of the usual mode of glazing by friction with a flint, and subsequently he attained a higher finish in fine writing-paper than had hitherto been effected by submitting it to the same process.

Glazing is now carried on at most of the paper-mills, in all countries. Writing-papers have also been glazed in long lengths; but as the naked rollers through which the paper passes become indented after having been only a short time in use, this plan has been abandoned. A better mode is to pass the paper several times through a calender, having an iron roller at the top and bottom, and a paper roller in the middle, the iron rollers being slightly heated by steam. This plan is useful where cheapness is necessary; but it is nevertheless an inferior sort of glazing, and does not long maintain its gloss. It has been practised many years by Mr. Crompton for strong brown packing-papers. The **Wearmouth Paper Company** (149, p. 546) exhibited, through Messrs. Venables, a fine specimen of brown paper glazed in long length; and Messrs. **Drewsen** and Co. (Denmark, 4, p. 1355, 1356), of Silkeborg, in Jutland, Denmark, have exhibited a large roll of cream-laid writing-paper well glazed, *not satined*, in long length. There is no difficulty whatever in glazing paper in long lengths, provided care be taken to obtain very true rollers. A thin ductor-blade should be fixed in a proper position to detach the sheets as they pass through, as the electricity which is developed causes them to adhere to the cylinders, particularly where rosin size has been used.

Paper Bleaching.

At the end of the last century, M. Berthollet's discovery of the means of bleaching with chlorine was successfully applied to paper-making; and by this valuable process coloured rags, ropes, &c., were converted into fine white paper, but the improper use of it deteriorated the quality, and recourse was therefore had to the use of chloride of lime, and to a better system of washing the pulp, for which purpose washing drums were introduced by Mr. Breton, and perfected by Messrs. Blanchet and Kleber. As a further precaution against the deteriorating effects of the use of chlorine or its compounds, some makers use anti-chlor, such as sulphites, to neutralize the small particles which might still remain in the pulp after bleaching and ordinary washing.

The rotatory rag-washing machine, invented by Messrs. Donkin, has the advantage of enabling the boiling operation to be performed under high pressure: the mechanism continually lifting the rags out of the lye and plunging them back insures complete and uniform action. The lye may be used repeatedly by adding fresh doses of alkali. M. Journet has adopted the plan long followed in England of using the waste wash-water of his mills for manuring land.

The chloride of lime is cheaper in England than in France; it is made principally at Glasgow as a secondary product of the soda manufacture; the price is 14*s*. per cwt. (about 30 fr. the 100 kilogrammes), whilst at Rouen or Paris it costs 47 fr. the 100 kilogrammes, being 56 per cent. dearer, a disadvantage to which the French manufacturer is subjected on one of the most important raw materials used in paper-making, as the importation of chemical productions is prohibited in that country. The difference of price is from the great disparity in the cost of fuel; coals are sold in England at an average of 4*s*. per ton (5 fr.); in London 15*s*., or 18 fr. At Rouen, coals cost 33 fr. per 1,000 kilogrammes, to which must be added the cost of cartage to the different mills.

Paper.—Motive Power.

The use of steam as a motive power has become almost universal in England, Holland, and Belgium, where there are fewer waterfalls than in France and other parts of the Continent. Although steam is more expensive than water power, it is more available, and mills using it are not subject to stoppages from floods and shortness of water.

In France and other countries where mills are near large forests, it is cheaper to use wood than coal; but England has great advantages from the cheapness of its fuel, particularly for steam drying. Where mills are in unfavourable situations, without coal, the cost of drying the paper is considerable.

England and France obtain the greater quantity of manganese from Germany; the price of which is therefore about the same in both countries. Rosin is imported from America and Russia, and some is produced near Bordeaux. Alum and potato-starch are about equal in price in England, France, and Germany. Muriatic acid is dearer in England than in France, where the price is now very much reduced.

Paper.—Price of Labour.

Although the price of labour is, in general, higher in England than on the Continent, yet owing to the care and skill of the English workmen, and the great superiority of the machinery employed, it is doubtful whether the cost of the manufacture of paper be not as cheap in England as in other countries. To ascertain the merits of the manufactures, quality and price of the paper being considered, it would be necessary to have exact data as to the rate of labour in different countries, and even in each locality, as the price varies according to the greater or less distance of the mills from the capital; for example, in France the price of labour in the Vosges is much less than near Paris, but this advantage is counterbalanced by the expense of carriage, which is always greater in the case of mills distant from the centre of consumption. These points have been considered by the Jury according to the best information obtained, and they find that mills established where civilization has made little progress are the most favourably circumstanced. The price of rags mainly regulates that of paper, and the value of rags is always in proportion to the degree of civilization and prosperity of the country. Thus Smyrna, which some years ago converted its rags into coarse boards, and sold them to the paper-makers of Europe for making paper, now makes good writing and other papers, the low price of which proves that both the raw materials and the labour must be cheap in that part of the world.

In proportion to the progress of civilization, paper-machines have been introduced into the different parts of the world. North America possesses a great number. South America has now begun to obtain them from the United States. In Africa there is only a small vat-mill at Boulac, near Cairo.

The following is an account of the number of paper-mills in England, Scotland, and Ireland, and the number of beating-engines employed: also the amount of duty charged on paper, the quantity imported from various countries, and the amount exported from Great Britain in the year 1850. (See Table, p. 430.)

By a Parliamentary paper, published March 9, 1852, the number of paper-mills at work in England on the 18th February, 1852, was 304 in England, 48 in Scotland, and 28 in Ireland, making 380. There were 1,616 beating engines at work, and 130 silent.

Sharp, in his "Gazetteer," ed. 1852, p. 977, states the number of paper-mills to be 800, employing 30,000 hands; but the Table (p. 430), obtained officially from the Inland Revenue Office, gives the number of mills as being only 415, including England, Scotland, and Ireland.

The amount of duty charged in the year 1850, shows the enormous amount of 62,960 tons weight of paper produced in Great Britain in one year! The first paper-machine was erected in 1804.*

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* Anderson, in his "History of Commerce," states, that it was in 1690 that paper was first manufactured in England; until that period France exported paper to England to the amount of 100,000*l*. yearly.

		England.	Scotland.	Ireland.
Number of paper-mills		327	51	37
Number of beating-engines		1,374	286	86
Paper charged with duty	lbs.	105,712,953	28,600,019	6,719,502
Amount of duty		£ 693,741	£ 187,687	£ 44,096
Paper Imported, viz.—				
Printed, painted, stained, or hangings	sq. yds.	342,746	470	–
Other kinds	lbs.	267,162	53	–
Amount of duty		£ 5,607	£ 5	–
Paper Exported, viz.—				
Printed, painted, or stained	sq. yds.	1,155,012	163,164	–
Other kinds	lbs.	6,568,268	1,040,555	9,248
Amount of drawback paid		£ 43,934	£ 6,946	£ 60

An Account of the Number of Machines and Vats employed at Paper Mills in the United Kingdom, distinguishing England, Scotland, and Ireland, in the last Ten Years.

Years.	England.		Scotland.		Ireland.		United Kingdom.	
	Number of Machines.	Number of Vats.	Number of Machines.	Number of Vats.	Number of Machines.	Number of Vats.	Number of Machines.	Number of Vats.
1842	292	311	46	21	18	40	356	372
1843	298	300	47	24	22	38	367	362
1844	299	302	48	25	23	32	370	359
1845	310	309	50	25	24	30	384	364
1846	308	328	51	22	25	28	384	378
1847	320	326	54	20	31	27	405	373
1848	321	321	54	21	32	25	407	367
1849	319	310	55	19	32	24	406	353
1850	323	307	57	19	32	18	412	344
1851	322	296	58	19	33	15	413	330

Inland Revenue Office, Old Broad Street,
14th October 1851.

The annual value of paper manufactured in this country is said to be two millions sterling.—*Vide* "Sharp's Gazetteer," 1852.

The following is a list of the principal sizes of writing-paper in English inches, and in French centimètres, to the nearest millimètre or tenth of a centimètre, which will be found useful to stationers and all connected with the paper trade:—

	Inches.	Centimètres.
Double elephant	40 – 26¾	101·6 – 67·9
Atlas	34 – 26	86·4 – 66·0
Colombier	34½ – 23½	87·6 – 59·7
Imperial	30 – 22	76·2 – 55·9
Elephant	28 – 23	71·1 – 58·4
Super-Royal	27 – 19	68·6 – 48·3
Royal	24 – 19	61·0 – 48·3
Medium	22 – 17½	55·9 – 44·4
Demy	20 – 15½	50·8 – 39·4
Large post	21 – 16¾	53·3 – 42·5
Small post	19 – 15½	48·3 – 39·4
Foolscap	16½ – 13¼	41·9 – 33·7

Note.—These are drawing and writing paper sizes—printing-papers are of different dimensions.

With rags produced by a population of 27½ millions of inhabitants in Great Britain and Ireland, and notwithstanding the large quantities of bagging and other descriptions of linen and cotton wrappers, old sails, cordage and old navy stores, &c., England imports from foreign countries a quantity of rags, amounting annually to 8,124 tons, as the following table shows:—

An Account of the Quantity of Old Rags, Old Junk or Ropes, or Old Fishing Nets, fit only for making Paper or Pasteboard, Imported into the United Kingdom in the Year 1850, showing the Countries from which Imported.

Countries from which Imported.	Quantities Imported into the United Kingdom in the Year 1850.
	Tons.
Russia	859
Sweden	61
Norway	101
Denmark	206
Prussia	27
Germany, viz.—	
Mecklenburg Schwerin	78
Hanover	23
Hanseatic Towns	4,449
Channel Islands	282
Italy—	
Duchy of Tuscany	1,352
Papal Territories	305
Naples and Sicily	41
Austrian Territories	43
Malta	91
Egypt	23
British Possessions in South Africa	27
British Possessions in East Indies	29
British Colonies in North America	25
United States of America	32
Brazil	18
Other Ports	52
	8,124

The waste* of the Manchester cotton-mills, and that of the spinning-mills in England, Scotland, and Ireland, produces enormous quantities of material, which is now skilfully applied to paper-making, and, when mixed with rope, bagging, &c., produces strong and good paper for most purposes.

Of the large number of paper-makers in Great Britain and Ireland, a few only have exhibited, namely:—Mr. Joynson, of St. Mary Cray, Kent (42a, p. 540), who exhibited a large assortment of blue wove, blue laid, large bank post, cream laid post, blue laid post, and cream laid foolscaps; the 5½ lbs. thin large bank post, in imitation of the French *pelure*, was not equal to that exhibited by the French manufacturers, although a nearer approach than any yet made in England of that weight. The post and other papers were all of high qualities, fully maintaining Mr. Joynson's reputation as a first-rate manufacturer. Mr. Dewdney, of Collumpton, specimens of excellent cream laid writing-papers, and also some unchangeable blue papers of superior manufacture for the use of starch-makers. Mr. Saunders, of Dartford (36, p. 539), strong parchment paper, for printing shares, and other purposes where great strength and tenacity are required; plain and coloured bank-note papers, of strong texture, with a variety of water-marks of elaborate and complicated designs; white and coloured safety papers, for printing bankers' cheques, letters of credit, &c., detecting the removal of writing by chemical reagents, and some specimens of a new method of making papers with water-marks, giving gradations of light and shade. the whole of these papers were of excellent qualities and make. Messrs. Cowan and Co., of Edinburgh (101, p. 544), a variety of printing, writing, note, and letter papers. Mr. William Wildes, of Snodland, Rochester (102, p. 544), some specimens of writing-papers, with wreaths of flowers in the water-mark. Messrs. Bancks Brothers, Chesham (96, p. 544), patent writing-papers with ornamented water-mark. Mr. Charles Venables, Clifden and Soho Mills (149, p. 546), specimens of well-made and fine quality plate, lithographic, and printing-papers. Mr. George Venables, strong and good wrapping-papers (149, p. 546). Mr. Edward Smith, Gateshead, strong brown paper, manufactured by Messrs. Thomas Gallon and Co. Mr. Lamb, of Newcastle (147, p. 546), pottery tissues, of excellent quality. Mr. Fourdrinier (100, p. 280), also had some pottery tissues, of good quality, in Class VI. Mr. Alfred Hamer, of Horsforth, Leeds, &c. (84, p. 543), press papers, for pressing woollen cloths; and brown papers, rolled and glazed, of good qualities. Messrs. Hastings and Meller (85, p. 543), brown paper, glazed and unglazed; and press papers, of good qualities. Messrs. Whiteley and Sons (98, p. 544), produced some fine specimens of press papers. Messrs. Venables, Wilson, and Tyler, of Queenhithe (149, p. 546), and Messrs. Spicer (42, p. 540), of Bridge Street, wholesale stationers, enabled the Jury to ascertain the state of the paper trade in this country, by the ample and varied specimens which those houses have submitted to public inspection in Class XVII. Messrs. De La Rue and Co. (76), as paper finishers, displayed every description of the best writing-papers produced in England, thus affording the means for judging of the high state of *finish* which this important branch of manufacture has reached in Great Britain.

Writing-Papers in Packets.

Immediately after the introduction of the penny postage* in this country, there was an immense increase in the consumption of letter and note paper, and a total change in the sizes was required. Until 1839, 4to letter-paper was put up only in half reams, and retailed in loose quires or single sheets, at prices varying from 6*d*. to 1*s*. per quire. Very superior letter and note papers are now sold in neat and convenient packets at from 1*s*. to 2*s*. 6*d*. per five quires. The patent cutting-machine of the late Mr. George Wilson proved a powerful auxiliary in enlarging the sphere of this branch of the paper-trade, by accelerating one of its simplest operations, cutting in letter and note size. Without its aid it would have been scarcely possible, by hand labour alone, to supply the daily increasing demands of society for note-papers since the introduction of the cheap postage. This is one of the innumerable common-place instances which show that the full importance of machinery in the commercial progress of the community is not duly appreciated, unless time and quantity are taken into the estimate as well as difficulty. It is to Messrs. De La Rue that the new sizes and improved mode of putting up paper in convenient forms are due. The quantity and variety exhibited by them and others are evidence of the encouragement given by the public to this ornamental mode of packeting letter and note papers, for each size of which envelopes are made to suit.

The following exhibitors also displayed writing-papers in packets, viz.:—

Messrs. Dobbs and Co., London (79, p. 543); Messrs. Cowan, of Edinburgh (101, p. 544); Messrs. Spicer Brothers (42, p. 540); and Messrs. Venables, Wilson, and Tyler (149, p. 546).

Foreign manufacturers have adopted the mode of making up letter and note paper in ornamental packets, and they have exhibited a variety of good specimens, among which were—

France.—M. Marion (609, p. 1207), M. Bertou (1084, p. 1230), and M. Valant, of Paris (1514, p. 1249).

Belgium.—MM. Godin and Son (284, p. 1160), and M. Tardif (281, p. 1160), of Brussels.

Zollverein States.—M.M. Schaeffer, Otto, and Scheibe, of Berlin (1 Zollv., 153); M. C. A. Koch, of Gladbach, near Mulheim, on the Rhine (1 Zollv., 329); MM. Hoesch and Son, Duren (1 Zollv., 392, p. 107); M. L. Schuell, of Duren (1 Zollv., 393, p. 1072); M. Piette, of Dillingen (1 Zollv., 394, p. 1072).

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* The quantity of cotton-wool imported in 1845 was seven hundred and twenty millions and a half pounds weight; above one thousand tons of raw cotton are required for daily consumption. In 1850. one million eight hundred and twenty-two thousand hundredweight of flax was imported. Linen and flax are spun to the value of ten millions sterling annually.—*Vide* "Sharp's New Gazetteer," edit. 1852, p. 976. Chevalier Claussen's discovery of flax-cotton, which promises to extend the growth and manufacture of flax, cannot fail greatly to increase the best description of raw material for paper-making. In 1775, a description was given by Lady Moirn, and published in the Transactions of the Society of Arts in 1783, of a new method of reducing flax to a fine fibre by means of an alkaline solution: the specimens were retained by the Society.

* Penny Postage.—The following is an estimate of the number of chargeable letters delivered in the United Kingdom in each year from 1839 to 1851:—

Years.	Number of Letters.	Annual Increase.	
		Number of Letters.	Percentage reckoned on the Number for 1839.
1839	76,000,000†	–	–
1840	169,000,000	93,000,000	123 per cent.
1841	196,500,000	27,500,000	36 ,,
1842	208,500,000	12,000,000	16 ,,
1843	220,500,000	12,000,000	16 ,,
1844	242,000,000	21,500,000	28 ,,
1845	271,500,000	29,500,000	39 ,,
1846	299,500,000	28,000,000	37 ,,
1847	322,000,000	22,500,000	30 ,,
1848	329,000,000	7,000,000	9 ,,
1849	337,500,000	8,500,000	11 ,,
1850	347,000,000	9,500,000	12½ ,,
1851	360,500,000	13,500,000	18 ,,

† The estimate for 1839 is founded on the ascertained number of letters for one week in the month of November, and, strictly speaking, it is for the year ending December 5, at which time 4*d*. was made the maximum rate. The estimate for each subsequent year is founded on the ascertained number of letters for one week in each calendar month.—(*Vide* Return to the House of Commons, No. 574, 1851.)

Grand Duchy of Wurtemburg.—M. **SCHAEUFFELEN**, Heilbronn (4 Zollv., 41, p. 1117).

Russia.—MM. **VARGOUNIN BROTHERS**, St. Petersburgh (260, p. 1375).

PAPER-MAKING—FRANCE.

France, besides importing yearly from America 125,000,000 lbs. of cotton, and ultimately converting a large portion of this into rags, the export of which commodity is forbidden by the French law, is also in a favourable position with regard to other raw materials, such as hemp and linen rags. Unfortunately, the introduction of strong alkalies, used in washing in large towns, greatly deteriorates, there and elsewhere, the materials for paper-making.

The northern countries, where hemp and flax are abundant, are in general favourably situated with regard to the quality of the rags.

There was in the Exhibition a species of paper made in the Sandwich Islands, from vegetable substances, retaining the original strength and flexibility of the raw material.

Every fibrous plant is capable of being converted into paper. Many attempts have been made in this and other countries to use the bark of trees, straw, and similar substances for that purpose, but the great waste and expense in converting these substances into pulp have hitherto precluded their use in large quantities. Should, however, rags become so scarce as greatly to enhance their price, recourse might be had to the use of raw materials, such as the dwarf banana, the dwarf palm, the aloe, white wood, and even straw. But it would still be necessary to mix these materials with rags to lessen the transparent appearance of paper made entirely of such substances, as was evident in that exhibited by M. **GRATIOT**, made at the Esonnes paper-mill.

At the French Exhibitions of 1839 and 1844, there were specimens of paper made with the leaves of the banana-tree and similar plants, but the experiments then made showed great waste in converting them into paper. With a view of reducing the cost of carriage, by freeing the substances from foreign matter, M. Rocques established powerful works at Havannah, to wash and convert them into pulp for the European markets; but even in this state the absolute necessity of strong bleaching caused a waste of more than one-third of the original weight.

M. **FLECHEY** (24, p. 1261) exhibited in the Algiers Department of the Great Exhibition specimens of paper made of the dwarf palm (*Chamærops humilis*), which abounds in that country, and of which he states that four millions of hundredweights could be obtained every year, at a trifling cost, by causing it to be gathered by women and children, so that it might be had for two francs the two hundred pounds; and he contends that if beaten into half-stuff whilst in its green state, it would yield 36 per cent. of its weight, and dry, 50 per cent.; and that two hours' beating would be sufficient to render this half-stuff fit for making fine paper.

M. Didot states that there are 200 machines in France, producing each 700 kilogrammes per day, or 195 tons each per year, making a total of thirty-nine thousand tons, and 250 vats, producing over two thousand tons more per year, being a gross amount of forty-one thousand tons.*

The first paper-machine was established in France in 1815.

The following is a list of the French paper-makers who have exhibited, viz.:—MM. **LACROIX**, of Angoulême and Paris (1636), superior writing-paper. MM. **ODENT, SON, and Co.**, Courtaline (Seine-et-Marne) (938), machine and vat-made writing and printing papers. MM. **BLANCHET BROTHERS**, and **KLEBER**, Rives (Isère) (1090), white and tinted writing and printing papers. MM. **CALLAUD-BELISLE and Co.**, Angoulême (788), writing papers for ledgers, post paper, drawing and tracing papers; the latter of excellent quality. M. G. **DE SERLAY**, Gueurs, Seine Inferieure (1484), various sorts of paper. M. E. **DOUMERC**, Jony, St. Morin (Seine-et-Marne) (822), printing, lithographic, and plate papers, drawing and writing papers, strong paper for vouchers and bank-notes. M. A. **GRATIOT**, of the Essonnes paper-mills (854), tissue-paper made from the banana-tree; writing-papers. **THE JOINT STOCK COMPANY OF THE SOUCHE** (377), writing, printing, staining, filtering, and imitation India papers: the filtering-paper of superior quality. MM. **MONTGOLFIER**, of Annonay and Paris (324), drawing, writing, and printing papers, animal papers, &c. MM. **OBRY, BERNARD, and Co.**, Prouzel, Amiens (334), drawing, writing, printing, and other papers. M. **FLECHEY**, of Algiers (24), a specimen of paper made from the dwarf palm-tree.

TABLES showing the IMPORT and EXPORT of PAPER, RAGS, &c., in FRANCE.

EXPORTATION 1849.

RAGS FOR PAPER.

	Kilos.
Algiers	465
United States	–
Guadaloupe	300
Other Countries	130
	895

IMPORTATION 1849.

RAGS FOR PAPER.

	Kilos.
Belgium	29,208
England	18,378
Sicily, Kingdom of	22,655
Tuscany	24,714
Switzerland	205,869
Turkey	30,414
Algiers	421,830
Other Countries	57,233
	810,301

PAPER.

	Kilos.
White or ruled, for music:—	
Belgium	85
England	3,889
Spain	804
Sardinia	28
Egypt	–
Other Countries	92
	4,898
Coloured, in reams or quires, for binding:—	
Zollverein	1,199
Netherlands	–
Belgium	70
England	13
	1,282
Envelopes, coloured:—	
Zollverein	848
Hanseatic Towns	–
Sardinia	212
Philippine Isles	530
Other Countries	253
	1,843
Painted in rolls for hangings:—	
Netherlands	–
Hanseatic Towns	–
England	5
Other Countries	120
	125

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* These data are approximate. Paper-hangings and brown paper are included. A paper-machine occupies about sixty persons; one vat about ten.

Silk Paper, India Paper, &c., &c. :—	Kilos.
England	4,866
China	976
Other Countries	241
	6,083

EXPORT OF PAPER FROM FRANCE IN 1849.

PAPER.

White, or ruled for music :—	Kilos.
Russia, M. N.	26,906
,, M. B.	24,657
Denmark	9,019
Zollverein	18,317
Netherlands	10,622
Belgium	32,580
Hanseatic Towns	111,332
England	200,885
Portugal	46,752
Austria	10,814
Sicily	28,559
Spain	43,070
Sardinia	67,051
Tuscany	17,167
Switzerland	91,891
Greece	58,676
Turkey	110,531
Egypt	84,701
Barbary	23,432
Algiers	165,900
Africa, West Coast	8,497
Mauritius	11,058
India	136,540
Batavia, &c.	14,809
United States, O. A.	139,773
,, ,, O. P.	12,096
Hayti	14,047
Cuba and Porto Rico	48,111
St. Thomas's	25,746
Brazil	300,279
Mexico	356,816
Venezuela	16,111
New Grenada	15,972
Peru	132,844
Chili	204,516
River Plate	84,663
Uruguay	13,719
Guadaloupe	23,183
Martinique	51,542
Réunion, Isle	20,753
Sénégal	11,526
Other Countries	23,390
	2,848,853

Coloured, in reams or quires, for binding, &c. :—	Kilos.
Russia, M. B.	5,209
Zollverein	2,350
Belgium	6,375
England	4,703
Portugal	1,030
Spain	3,600
Sardinia	3,403
Switzerland	1,265
Algiers	10,978
United States	8,500
Cuba and Porto Rico	2,473
Brazil	4,214
Peru	4,053
Chili	2,536
Other Countries	7,266
	67,955

Envelopes, in colour :—	Kilos.
Zollverein	5,140
Belgium	4,951
Hanseatic Towns	2,053
England	93,442
Sardinia	79,304
Switzerland	26,934
Greece	25,596
Carried forward	237,420
Brought forward	237,420
Turkey	105,349
Egypt	36,938
Barbary	48,040
Algiers	184,150
United States	6,162
Cuba and Porto Rico	3,066
Brazil	148,326
Mexico	8,370
River Plate	15,119
Other Countries	20,999
	813,939

Printed, in rolls, for hangings :—	Kilos.
Russia, M. B.	9,598
Zollverein	11,304
Belgium	51,306
Hanseatic Towns	27,058
England	69,249
Portugal	28,701
Sicily	16,094
Spain	9,808
Sardinia	16,796
Tuscany	5,790
Roman States	4,219
Switzerland	42,840
Turkey	10,561
Egypt	7,854
Algiers	8,384
Mauritius	23,859
United States	107,122
Cuba and Porto Rico	7,869
Brazil	56,649
Mexico	6,623
New Grenada	9,102
Peru	12,825
Chili	30,522
River Plate	23,699
Uruguay	4,077
Réunion, Isle	14,997
Other Countries	27,525
	644,441

Silk and Chinese, and others of similar kinds :—	Kilos.
England	170
Spain	216
Sardinia	–
Switzerland	419
Other Countries	115
	920

PAPER-MAKING—BELGIUM.

Though several unsuccessful attempts had been made before the seventeenth century to introduce the manufacture of paper into Belgium, it was only towards the end of that period that it was regularly established in several provinces, with exclusive privileges granted by the Government. Its progress was not rapid during the eighteenth century; but during the last thirty years it has been so much developed that Belgium has nearly ceased to import writing-paper from France, and printing-paper from Holland, and has lately considerably increased its exports of first-rate paper.

The following is a statement of the paper exported from Belgium in 1849, with the countries to which it was sent; the total amount being 36,040*l*.

	Francs.
Sweden	13,270
Norway	27,227
Denmark	38,751
Prussia	12,374
Mecklenburg-Schwerin	2,932
Hamburgh	163,452
Bremen	3,535
Lubeck	9,673
Grand Duchy of Luxembourg	310
Netherlands	298,829
England	95,904
France	12,781
Carried forward	679,038

	Francs.
Brought forward - -	679,038
Portugal	500
Turkey - - - - - - - -	2,650
Coast of Guinea - - - - - -	1,400
Morocco - - - - - - -	1,320
Singapore - - - - - - -	10,250
United States - - - - - -	19,950
Mexico - - - - - - - -	12,200
Guatemala - - - - - - -	2,379
Cuba - - - - - - - -	3,350
Brazil - - - - - - - -	146,415
River Plate - - - - - - -	1,820
Chili - - - - - - - - -	19,725
	900,997

The importations of rags and other material for paper-making into Belgium, in 1849, amounted to only fourteen tons and a half.

In 1849, Belgium imported paper from the following countries to the amount of 69,343 francs (2,774*l.*):—

	Francs.
Prussia - - - - - - - - -	16,929
Grand Duchy of Luxembourg - -	1,437
Netherlands - - - - - - -	3,136
England - - - - - - - -	8,681
France - - - - - - - - -	37,483
Other Countries - - - - - -	977
Total - - - - -	69,343

STATISTICS relative to the MANUFACTURE of PAPER in BELGIUM.

Description of Manufacture.	Province.	No. of Manufacturers.	Number of Workpeople of both Sexes, with their Ages.										
			Above 16 Years.		Children.						Number of each Sex.		Total.
					9 Years and below.		From 9 to 12 Years.		From 12 to 16 Years.				
			Men.	Women.	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Male.	Female.	
Paper Mills	Antwerp - -	1	23	11	–	–	4	2	–	–	27	13	40
	Brabant - -	48	481	420	5	1	37	17	133	54	656	492	1,148
	East Flanders	9	76	22	–	–	12	–	16	2	104	24	128
	Hainaut - -	[illegible]	16	1	–	–	3	2	5	3	24	6	30
	Liège - - -	9	151	277	3	5	3	12	11	54	168	348	516
	Limbourg -	1	12	–	–	–	–	–	–	–	12	–	12
	Luxembourg	3	12	7	–	–	–	–	–	–	12	7	19
Total for the Kingdom -		74	771	738	8	6	59	33	165	113	1,003	890	1,893
Paper and Pasteboard	Hainaut - -	2	18	3	–	–	–	–	5	2	23	5	28
	Namur - -	4	78	141	–	–	–	–	6	22	84	163	247
The whole Kingdom -		6	96	144	–	–	–	–	11	24	107	168	275

Description of Manufacture.	Province.	Daily Wages of the Workpeople.																		
		Adults.																		
		Under 50 Cents.		From 50 Cents. to 1 Franc.		From 1 Fr. to 1 Fr. 50 Cents.		From 1 Fr. 50 Cents. to 2 Fr.		From 2 Fr. to 2 Fr. 50 Cents.		From 2 Fr. 50 Cents. to 3 Fr.		From 3 Fr. to 4 Fr.		From 4 Fr. to 5 Fr.		Above 5 Fr.		Total.
		Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	
Paper Mills	Antwerp - -	–	–	10	11	8	–	4	–	1	–	–	–	–	–	–	–	–	–	34
	Brabant - -	4	5	76	413	282	3	102	–	9	–	7	–	1	–	–	–	–	–	902
	East Flanders	–	–	2	14	57	8	11	–	2	–	1	–	–	–	–	–	–	–	98
	Hainaut - -	–	–	2	–	14	1	–	–	–	–	–	–	–	–	–	–	–	–	17
	Liège - - -	–	14	16	292	68	21	53	–	10	–	2	–	–	–	–	–	2	–	478
	Limbourg -	–	–	9	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	12
	Luxembourg	2	5	–	2	10	–	–	–	–	–	–	–	–	–	–	–	–	–	19
Total for the Kingdom -		6	24	115	732	442	33	173	–	22	–	10	–	1	–	–	–	2	–	1560
Paper and Pasteboard	Hainaut - -	–	–	3	3	8	–	7	–	–	–	–	–	–	–	–	–	–	–	21
	Namur - -	–	–	6	133	45	8	19	–	5	–	1	–	–	–	2	–	–	–	219
The whole Kingdom -		–	–	9	136	53	8	26	–	5	–	1	–	–	–	2	–	–	–	240

Statistics relative to the Manufacture of Paper in Belgium—*continued.*

Description of Manufacture.	Province.	Daily Wages of the Workpeople.							Steam Engines.		Horse Mills.		Mills.	
		Children.												
		Under 50 Cents.		From 50 Cents. to 1 Fr.		Above 1 Fr.								
		Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Total.	Number.	Horse-Power.	Number.	Horses employed.	Water.	Wind.
Paper Mills	Antwerp - -	4	2	–	–	–	–	6	–	–	–	–	1	–
	Brabant - -	115	52	56	20	4	–	247	13	142	–	–	47	–
	East Flanders	21	–	7	2	–	–	30	1	12	2	4	4	7
	Hainaut - -	5	2	3	3	–	–	13	–	–	–	–	3	–
	Liège - - -	13	59	4	12	–	–	88	8	100	–	–	10	–
	Limbourg -	–	–	–	–	–	–	–	–	–	–	–	1	–
	Luxembourg	–	–	–	–	–	–	–	–	–	–	–	2	–
Total for the Kingdom -		158	115	70	37	4	–	384	22	254	2	4	68	7
Paper and Pasteboard	Hainaut - -	5	–	–	2	–	–	7	–	–	–	–	2	–
	Namur - -	1	6	5	16	–	–	28	3	70	–	–	4	–
The whole Kingdom -		6	6	5	18	–	–	35	3	70	–	–	6	–

MM. GODIN and SON, of Huy, Liège (284, p. 1160), displayed an extensive collection of every description of drawing, writing, printing, and packing papers; some drawing-papers in long lengths, well made, and hard-sized. They were the only paper manufacturers from Belgium who exhibited. From the Netherlands, MM. HONIG, of Zaandyk (59, p. 1145), exhibited double elephant paper, of excellent quality; and MM. VAN GELDER and SONS, of Wormerveer (61, p. 1145), some specimens of excellent purple and white paper, white inside and purple outside, machine made, for the use of sugar refiners.

Rome.—M. MILIANI (12, p. 1285) exhibited specimens of drawing and plate papers, of excellent quality.

Denmark.—MM. DREWSEN and SONS, of Silkeborg, Jutland (4), exhibited specimens of writing-paper, milled in long lengths, stated to be by a new process. The finish is not equal to the highly-glazed papers called *satined*, but as *mill-glazed* the specimens were good.

PAPER-MAKING—THE ZOLLVEREIN STATES.

The manufacture of paper has rapidly increased in the German Zollverein within the last few years. The States not only now produce paper sufficient for their own consumption, but also for exportation. Rags are largely imported from other countries. The average yearly consumption of rags is said to be four pounds per head of the entire population, as proved by manufacturers who collect their rags within certain districts; this statement seems to be corroborated by its corresponding with the amount of the actual consumption of linen and cotton. The Zollverein, according to the last census, had a population of 29,649,330 souls. In 1850, the weight of rags made into paper in the German Zollverein was between 1,180,000 and 1,190,000 cwts. This shows the great activity in the manufacture of paper in these States. In the Prussian provinces of Silesia, Saxony, Westphalia, the Rhine provinces, and also Brandenburg, both Hesses, the kingdom of Saxony, and many of the other States of the Union, large quantities of paper are produced. There are 794 paper-mills, having 116 paper-machines, which, at an average of 700 kilogrammes of paper per day, give 36,964 tons per year. It is an important fact that in the Zollverein the finer and better sorts of paper are produced, and part exported, whilst the common paper is imported. The proportion, according to the average of the years 1843 to 1845, and 1846 to 1848, will be best understood from the following table:—

	Quantity, per Cwt.					Value, (Prussian Dollars).			
	Price per cwt.	Average of 1846-48.		Average of 1843-45.		Average of 1846-48.		Average of 1843-45.	
	Dollars.	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.
Unsized ordinary printing-paper -	7	–	1,447	–	1,589	–	10,129	–	11,123
Grey blotting and packing-paper -	8	1,142	–	1,006	–	9,136	–	8,048	–
All other sorts of paper - - -	15	–	5,468	–	5,621	–	82,020	–	84,315
Paper-hangings - - - - -	40	–	1,606	–	838	–	64,240	–	33,520
Bookbinders' stationery - - -	100	–	1,142	–	1,276	–	114,200	–	127,600
Total - - - -	–	–	–	–	–	9,136	270,589	8,048	256,558
	Excess of Exports - - -					261,453		248,510	

It appears from the above that stationery forms a large portion of the exports, which consist of numerous small articles, such as porte-monnaies and similar goods, for which Berlin and other Zollverein large cities are celebrated. From 1844 to 1847 the annual amount of rags imported exceeded that of the exports by nearly 11,000 cwts. In 1848 this excess of imports was reduced to 4,500 cwts. In 1849 and 1850 these amounts increased; and in the latter year the imports were 8,386 cwts., and the exports 1,604 cwts., showing an excess of 6,782 cwts. of rags imported more than those exported. The first paper-machine was established in Berlin in 1818.

Printing keeps pace with paper-making. The circulation of periodicals is very considerable. In 1840, Prussia alone had more than 300 newspapers and periodicals, and the number has since greatly increased. In Germany the great number of scientific works form an important branch of the book trade. The catalogue of the Leipsic fair of Easter 1851 gives the titles of upwards of 4,000 new books; and that of Michaelmas 1851 about the same number. In 1850, 16,783 cwts. (Zollverein standard) of books were imported, and 24,897 cwts. exported. In Prussia alone there are 24 type-foundries, in which 244 workmen are employed; in the Zollverein above 50 foundries, employing upwards of 600 workmen.

The number of establishments in Prussia for book printing and music is 574, with 1,154 presses, and 3,585 workmen. Berlin possesses 53, with 198 presses, and 934 workmen. The whole of the Zollverein, with the exception of Wurtemburg, Brunswick, and Frankfort-on-the-Maine, from which States the official accounts are wanting, has 933 establishments, with 2,085 presses, and 7,062 workmen; so that when the returns from those States are ascertained, not less than 1,000 establishments and 8,000 workmen will be the probable numbers. In 1849 there were in the Prussian dominions,—

Establishments for copper, stereoplate printing, and wood-cut printing	35,	employing	112 men.
Establishments for lithography	414	,,	1,173 ,,
Booksellers, print, and music shops	739	,,	885 ,,
Old book shops (*antiquare*)	87	,,	unknown.
Circulating libraries	645	,,	unknown.

Lithographic printing is much more on the increase than the other branches of printing. Leipsic is the centre of the Zollverein book trade, where booksellers from Germany and other countries assemble twice a-year, at Easter and Michaelmas, to confer with each other and balance their accounts. Berlin is the seat of the Royal Academy of Sciences, with its own printing-office for difficult and learned works; the University, with its many scientific establishments; the Royal Library, the great museum of art; and printing establishments are found there in great numbers. There were, in that city alone, in 1849, 8 type-foundries, with 110 workmen; 53 establishments for printing books and music, with 198 presses, and 934 workmen; 17 establishments for copper, steel-plate, and wood-cut printing, with 64 workmen; 41 lithographic establishments, with 265 workmen; 121 book, print, and music shops, with 141 workmen; 17 dealers in old books; 43 circulating libraries.

The following official tables, prepared with great care, furnish valuable information:—

LIST of PAPER-MILLS, specifying the Number of VATS and PAPER-MAKERS, together with the Number of PERSONS employed in the Year 1846.

STATES OF THE ZOLLVEREIN.	PROVINCES.	Number of Mills.	Number of Workmen.	Number of Vats.	Number of Paper Machines.
Prussia	Prussia	16	329	20	2
	West Prussia	23	116	28	–
	Posen	19	85	23	–
	Brandenburg	34	930	41	9
	Pomerania	17	196	21	5
	Silesia	76	893	86	12
	Saxony	69	880	84	9
	Westphalia	68	1,037	83	16
	Rhine Province	72	1,927	117	19
	Total	394	6,393	503	72
Bavaria	Upper Bavaria	17	309	33	2
	Lower Bavaria	10	230	22	2
	Palatinate	22	305	–	–
	Upper Palatinate, Ratisbon	22	139	26	–
	Upper Franconia	22	117	29	–
	Middle Franconia	29	339	39	2
	Lower Franconia, Aschaffenburg	29	173	58	1
	Suabia and Neuburg	25	272	50	4
	Total	176	1,884	257	11
Saxony	Dresden	10	262	12	2
	Leipsic	10	106	8	1
	Zwickau	40	316	43	–
	Bautzen	6	313	5	3
	Total	66	997	68	6
Grand Duchy of Hesse	Starkenburg	8	30	9	–
	Upper Hesse	13	140	18	1
	Total	21	170	27	1
Electorate of Hesse	– – –	28	299	39	6
Baden	– – –	32	624	33	14
Nassau	– – –	27	196	30	6
Parts of other States that partake in the Prussian Zollverein	– – –	10	99	14	–
Thuringian States	– – –	41	274	53	–
	The accounts from Wurtemburg and Brunswick are wanting	–	–	–	–
	Total Zollverein, 1846	795	10,936	1,024	116

IMPORTS and EXPORTS of RAW MATERIALS for PAPER-MAKING in the ZOLLVEREIN in 1850.

STATES OF THE ZOLLVEREIN.	Provinces.	Districts and Manufacturing Places.	Linen, Cotton, and Woollen Rags, Paper-waste.		Fishing Nets, Junk, and Ropes.	
			Import.	Export.	Import.	Export.
			Cwt.	Cwt.	Cwt.	Cwt.
Prussia	Prussia	Memel	–	–	1	106
		Tilsit	474	–	–	–
		Schmalleninghen	591	–	–	–
		Stallupönen	1,342	–	–	–
	West Prussia	Dantzic	–	110	255	–
	Posen	Podzemize	9	–	–	–
		Pogorzelice	1,052	–	–	–
	Pomerania	Cavelpass	–	15	–	–
		Demmin	–	7	–	–
		Swinemünde	–	53	–	–
		Stettin	79	–	–	–
		Tribsees	–	17	–	–
	Silesia	Görlitz	68	–	–	–
		Breslau	2	–	–	–
	Brandenburg	Gransee	2	2	–	–
		Warnow	–	449	–	–
		Wittenberg	–	854	–	–
	Saxony	Heiligenstadt	1	–	–	–
	Westphalia	Minden	92	35	–	–
		Coesfeld	852	–	2	–
		Warburg	89	–	–	–
	Rhine Province	Aix-la-Chapelle	52	–	–	–
		Total	4,705	1,542	258	106
Luxembourg	– – –	– – –	2	–	–	–
Bavaria	– – –	Waldsassen	1	–	–	–
		Waidhaus	22	–	–	–
		Passau	4	–	–	–
		Pfronton	18	–	–	–
		Lindau	55	–	130	–
		Zweibrück	1	–	–	–
		Total	101	–	130	–
Saxony	– – –	Schandau	60	–	–	–
		Pirna	10	–	–	–
		Annaberg	20	–	–	–
		Eibenstock	463	–	7	–
		Leipsic	15	–	–	–
		Total	568	–	7	–
Wurtemburg	– – –	Friederichshafen	59	–	–	–
Baden	– – –	Randegg	32	–	–	–
		Stühlingen	251	–	–	–
		Thiengen	483	–	–	–
		Near Rheinfelden	152	–	–	–
		Near Schusterinsel	1,908	22	–	–
		Total	2,826	22	–	–
Electorate of Hesse	– – –	Rinteln	125	40	–	–
		Total Zollverein, 1850	8,386	1,604	395	106

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TABLE showing the IMPORTS and EXPORTS of PAPER in the ZOLLVEREIN STATES in 1850.

STATES OF THE ZOLLVEREIN.	Provinces.	Custom-houses.	Unsized Printing Paper, ordinary White and Coloured Packing Paper.		Sized Paper, Unsized, Fine, and Coloured.		Grey, Blotting, and Packing Paper.		Gold and Silver Paper.		Paper-hangings.		Bookbinders' Stationery.	
			Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.
			Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Prussia – –	Prussia –	Memel – – –	–	–	170	146	–	–	–	1	–	–	3	–
		Tilsit – – –	–	4	17	124	–	–	–	–	–	–	4	–
		Schmalleninghen –	–	–	–	2	1	–	–	–	–	1	–	–
		Stallupönen – –	–	–	–	153	–	–	–	–	–	1	–	–
		Johannisburg –	–	4	–	2	–	–	–	–	–	1	–	–
		Königsberg – –	–	–	3	–	9	–	–	–	–	–	3	2
	West Prussia.	Dantzic – – –	3	–	5	–	–	–	–	–	–	–	1	–
		Thorn – – –	–	54	–	1	–	–	–	–	–	–	–	–
	Posen –	Podzamize – –	–	32	–	1	–	–	–	–	–	–	–	–
		Skalmierzyce – –	–	43	–	3	–	–	–	–	–	–	–	–
		Posen – – –	–	–	1	–	–	–	–	–	2	–	–	–
	Pomerania.	Cavelpass – –	–	–	–	–	–	–	–	–	–	9	–	4
		Demmin – – –	3	807	–	3	12	–	–	–	–	–	–	–
		Stralsund – –	–	–	41	–	–	–	–	–	–	8	–	–
		Swinemünde – –	–	188	–	43	–	–	–	6	–	10	–	5
		Wolgast – – –	2	–	–	–	–	–	–	–	–	–	–	–
		Stettin – – –	1	–	92	–	–	–	–	–	–	–	3	–
	Silesia –	Landsberg – –	–	–	–	17	–	–	–	–	–	–	–	–
		Mittelwalde – –	4	–	8	1	1	–	4	–	–	–	–	–
		Myslowitz – –	120	108	1	160	317	1	1	1	–	–	–	6
		Neustadt – –	4	3	4	2	17	–	–	–	–	–	–	–
		Görlitz – – –	1	12	–	6	23	–	–	–	–	–	1	–
		Ratibor – – –	94	40	7	169	227	–	–	10	2	5	1	5
		Lieban – – –	–	–	4	–	–	–	–	–	–	–	–	–
		Schweidnitz – –	–	–	–	–	–	–	–	–	–	–	1	–
		Breslau – – –	–	–	7	–	–	–	5	–	–	–	5	–
		In the Interior –	–	–	–	–	–	–	–	–	–	–	1	–
	Brandenburg.	Berlin – – –	60	–	151	–	–	–	10	–	38	–	95	–
		Gransee – – –	10	11	–	318	–	1	–	–	–	76	–	26
		Warnow – – –	–	567	–	4,477	–	38	–	10	–	413	–	567
		Wittenberge – –	–	749	5	676	–	10	–	46	–	1	2	20
		Prenzlau – –	–	9	–	26	–	–	–	–	–	–	–	–
		Potsdam – –	–	–	1	–	–	–	–	–	–	–	4	–
		Frankfort-on-the-Oder.	–	–	–	–	–	–	–	–	–	–	–	–
	Saxony –	Heiligenstadt –	1	12	–	13	–	–	–	–	–	–	–	2
		Salzwedel – –	–	30	1	3	–	1	–	–	–	–	–	–
		Halberstadt – –	1	–	–	–	–	–	–	–	–	–	1	–
		Nordhausen – –	–	1	–	–	–	–	–	–	1	–	–	–
		Halle – – –	–	–	4	–	–	–	–	–	–	–	3	–
		Magdeburg – –	16	–	9	–	–	–	–	–	6	–	3	–
		Rosslau – – –	–	–	1	–	–	–	–	–	–	–	–	–
	Westphalia.	Minden – – –	–	2,073	18	10,180	–	–	–	7	–	738	2	15
		Rheine – – –	1	33	–	4	–	–	–	–	–	6	–	7
		Telgte – – –	–	81	–	5	–	–	–	–	–	–	2	–
		Coesfeld – – –	4	23	14	1	37	–	–	–	–	–	–	–
		Lemgo – – –	–	72	1	37	–	–	–	–	–	–	1	–
		Warburg – –	–	388	–	35	–	–	–	–	–	–	–	–
		Münster – – –	–	–	7	–	–	–	4	–	–	–	1	–
		Paderborn – –	–	–	–	–	–	–	–	–	–	1	–	–
		In the Interior –	–	–	3	–	–	–	–	–	–	–	–	–
	Rhine Province.	Aix-la-Chapelle	101	161	40	1,101	17	13	5	–	[illegible]	16	30	17
		Cranenberg – –	1	–	2	–	1	–	–	–	–	–	–	–
		Emmerich – –	1	87	10	1,348	1	1	–	12	–	2,412	1	240
		Kaldenkirchen –	–	6	1	51	–	–	–	–	–	–	–	–
		Malmedy – –	–	–	–	63	–	–	–	–	–	–	–	–
		Saarbrücken – –	2	1	11	14	2	–	–	–	1	–	4	150
		Treves – – –	–	–	5	5	–	–	–	–	–	–	2	–
		Coblentz – –	–	–	10	–	–	–	1	–	–	–	1	–
		Cologne – – –	94	–	77	1,273	–	–	9	–	24	–	54	849
		Duisburg – –	–	–	1	–	–	–	–	–	–	–	–	–
		Düsseldorf – –	3	–	11	–	–	–	–	–	[illegible]	–	2	–
		Wesel – – –	–	–	–	–	1	–	–	–	–	–	[illegible]	–
		In the Interior –	–	–	4	–	–	–	2	–	–	–	–	–
		Wassenberg – –	–	–	–	–	–	30	–	–	–	–	–	–
		Total – –	527	5,599	747	20,363	666	105	41	93	78	3,698	234	1,915

Table showing the Imports and Exports of Paper in the Zollverein States in 1850—*continued.*

STATES OF THE ZOLLVEREIN.	Provinces.	Custom-houses.	Unsized Printing Paper, ordinary White and Coloured Packing Paper.		Sized Paper, Unsized, Fine, and Coloured.		Grey, Blotting, and Packing Paper.		Gold and Silver Paper.		Paper-hangings.		Bookbinders' Stationery.	
			Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.
			Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Luxembourg	– –	– –	8	104	18	40	–	–	2	–	3	322	11	–
Bavaria	– –	Hof	–	18	1	1	–	–	–	–	–	–	1	–
		Waldsassen	–	2	–	–	–	–	–	1	–	–	6	–
		Waidhaus	–	25	–	22	–	–	1	–	–	–	1	–
		Eschlkam	–	–	2	7	–	–	1	1	–	–	1	2
		Passau	1	57	2	94	–	–	–	3	–	–	–	1
		Simbach	9	2	–	1	16	–	–	2	–	–	–	–
		Freilassing	–	1	–	5	–	–	–	10	–	–	–	–
		Reichenhall	1	–	1	–	27	–	–	–	–	–	–	2
		Rosenheim	–	–	2	–	–	–	–	–	–	–	–	–
		Mitterwalde	–	7	1	46	–	–	–	–	–	20	–	–
		Pfronten	–	3	1	32	–	–	–	–	–	–	–	2
		Lindau	–	62	27	20	–	–	–	11	1	1	–	5
		Neuburg-on-the Main	–	–	102	11	–	–	–	–	–	–	2	7
		Zweibrück	–	–	2	2	–	–	–	–	–	–	–	1
		Aschaffenburg	–	–	8	–	–	–	2	–	–	–	–	–
		Augsburg	–	–	5	–	–	–	–	–	1	–	1	–
		Bamberg	–	–	2	–	–	–	–	–	–	–	–	–
		Fürth	–	–	11	–	–	–	–	–	–	–	–	–
		Kempten	–	–	4	–	–	–	–	–	–	–	–	–
		Munich	–	–	67	–	–	–	–	–	9	–	11	–
		Nürremberg	–	–	13	–	–	–	4	–	1	–	2	–
		Ratisbon	–	–	5	–	–	–	–	–	–	–	–	–
		Waldmünster	–	–	–	64	–	–	–	–	–	–	–	–
		Speyer	–	–	1	–	–	–	–	–	–	–	–	–
		Würzburg	–	–	2	–	–	–	3	–	–	–	–	–
		Total	11	177	259	305	43	–	11	28	12	21	25	20
Saxony	– –	Zittau	136	395	2	4	108	–	–	–	–	13	8	2
		Schandau	45	–	7	16	420	–	1	–	1	–	1	–
		Pirna	32	–	6	3	11	–	1	1	–	1	1	–
		Marienberg	1	–	–	–	3	–	–	–	–	–	–	–
		Annaberg	16	28	3	2	36	–	1	–	1	–	–	–
		Eibenstock	31	1	–	3	156	–	–	–	–	–	4	1
		Dresden	–	–	46	–	–	–	3	–	16	–	19	–
		Chemnitz	–	–	6	–	–	–	–	–	–	–	1	–
		Plauen	–	38	–	–	–	–	–	–	–	–	–	–
		Leipzic	14	–	76	–	–	–	6	–	9	–	26	–
		In the Interior	–	–	1	–	–	–	–	–	–	–	–	–
		Total	275	462	147	28	734	–	12	1	27	14	60	3
Wurtemburg	– –	Friedrichshafen	1	32	8	164	1	2	–	21	–	8	1	23
		Heilbronn	–	–	–	–	–	–	–	–	–	–	1	–
		Canstadt	–	–	1	–	–	–	–	–	–	–	–	–
		Stuttgardt	–	–	18	–	–	–	–	–	3	–	9	–
		Ulm	–	–	10	–	–	–	–	–	–	–	6	–
		Total	1	32	37	164	1	2	–	21	3	8	17	23
Baden	– –	Ludwigshafen	–	25	–	49	–	–	–	–	–	1	–	9
		Constance	–	–	5	4	–	3	–	–	–	27	–	–
		Randegg	34	2	5	40	6	–	–	–	–	2	1	31
		Stühlingen	–	–	2	20	–	–	–	–	–	2	3	29
		Near Rheinfelden	159	–	8	80	1	–	–	2	–	2	–	48
		Near Schusterinsel	119	160	20	469	3	11	–	5	–	62	2	89
		Old Breisach	12	–	1	–	–	–	–	–	–	–	–	–
		Kehl	3	–	37	149	6	–	1	1	1	2	11	9
		New Freistett	–	–	2	–	–	–	–	–	1	–	1	–
		Heidelberg	–	–	2	–	–	–	–	–	–	–	–	–
		Mannheim	–	–	15	–	–	–	–	–	3	–	7	–
		Carlsruhe	–	–	9	–	–	–	1	–	1	–	3	–
		Lahr	–	–	7	–	–	–	2	–	–	–	8	–
		Freiburg	–	–	5	–	–	–	–	–	–	–	–	–
		Thiengen	2	–	–	8	–	–	–	–	–	–	–	3
		Total	329	187	118	819	16	14	4	8	6	98	36	218

Table showing the Imports and Exports of Paper in the Zollverein States in 1850—*continued.*

STATES OF THE ZOLLVEREIN.	Provinces.	Custom-houses.	Unsized Printing Paper, ordinary White and Coloured Packing Paper.		Sized Paper, Unsized, Fine, and Coloured.		Grey, Blotting, and Packing Paper.		Gold and Silver Paper.		Paper-hangings.		Bookbinders' Stationery.	
			Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.	Import.	Export.
			Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Electorate of Hesse.	– –	Cassel – – –	167	346	17	838	5	275	–	–	3	111	3	108
		Carlshafen – –	–	–	1	108	–	–	–	–	–	–	–	–
		Witzenhausen –	–	69	–	27	–	–	–	–	–	–	–	10
		Rinteln – – –	2	518	3	25	–	100	–	–	1	–	1	–
		Hanau – – –	–	–	1	–	–	–	–	–	–	–	–	–
		Total – –	169	933	22	998	5	375	–	–	4	111	4	118
Grand Duchy of Hesse.	– –	Mayence – –	–	–	12	–	–	–	–	–	4	–	4	–
		Offenbach –	–	–	2	–	–	–	–	–	1	–	2	–
		Total – –	–	–	14	–	–	–	–	–	5	–	6	–
Thuringian States.	– –	Saxe-Altenburg –	–	–	1	–	–	–	1	–	–	–	–	–
		Schwarzburg, Rudolstadt.	–	–	1	–	–	–	–	–	–	–	–	–
		Total – –	–	–	2	–	–	–	1	–	–	–	–	–
Brunswick –	– –	Brunswick – –	43	203	12	303	–	95	–	1	6	102	15	146
		Wolfenbüttel –	79	–	184	–	147	–	–	–	–	–	–	–
		Holzminden – –	2	475	5	1	42	213	–	–	–	–	2	1
		Total – –	124	678	201	304	189	308	–	1	6	102	17	147
Nassau – –	– –	Biebrich – –	–	–	1	–	–	–	–	–	1	–	1	–
Frankfort-on-the-Maine.	– –	– –	16	–	219	–	–	–	2	–	7	–	40	–
		Total Zollverein, 1850 – –	1,460	8,172	1,785	23,021	1,654	796	73	152	152	4,374	451	2,444

TABLE showing the Weight of BOOKS Imported into, and Exported from, the ZOLLVEREIN STATES in 1850.

STATES AND PROVINCES OF THE ZOLLVEREIN.	Custom-houses.	Books Printed, Bound, and not Bound, Maps, and Prints.	
		Exported.	Imported.
		Cwt.	Cwt.
PRUSSIA:—			
Prussia – –	Pillau – – –	–	6
	Memel – – –	24	7
	Tilsit – – –	6	87
	Stallupönen – –	17	3
	Johannisburg –	37	2
	Königsberg – –	3	24
West Prussia	Dantzic – –	–	31
	Thorn – – –	28	8
	Elbing – – –	–	2
Posen – –	Podzamize – –	34	–
	Skalmierzyce –	–	4
	Strzalkowo – –	–	1
	Bromberg – –	–	1
	Posen – – –	–	16
	In the Interior –	–	2
Pomerania –	Kolbergermünde	–	1
	Demmin – –	20	15
	Greifswald – –	–	8
	Stolpemünde –	–	1
	Stralsund – –	29	3
	Carried forward	198	222
	Brought forward	198	222
Pomerania –	Swinemünde –	1,342	1
	Tribsees – –	–	4
	Stettin – – –	–	216
Silesia – –	Landsberg – –	12	1
	Liebau – – –	1	6
	Mittelwalde – –	1	48
	Myslowitz – –	1,131	124
	Neustadt – –	–	6
	Ratibor – –	286	35
	Breslau – –	–	322
	Glogau – – –	–	3
	In the Interior –	–	1
Brandenburg	Gransee – –	159	127
	Warnow – –	6,411	3
	Wittenberge –	19	302
	Berlin – – –	–	1,164
	Prenzlau – –	–	4
	Potsdam – –	–	8
	In the Interior –	–	7
	Frankfort-on-the Oder.	–	4
	Carried forward	9,560	2,608

Table showing the Weight of Books Imported into, and Exported from, the Zollverein States in 1850—*continued.*

STATES AND PROVINCES OF THE ZOLLVEREIN.	Custom-houses.	Books Printed, Bound, and not Bound, Maps, and Prints.	
		Exported.	Imported.
		Cwt.	Cwt.
PRUSSIA—*continued.*	Brought forward	9,560	2,608
Saxony - -	Heiligenstadt -	69	76
	Salzwedel - -	1	3
	Halberstadt - -	–	4
	Nordhausen - -	–	32
	Halle - - -	–	22
	Magdeburg - -	–	181
	Naumburg - -	–	1
	Rosslau - -	–	5
	In the Interior -	–	6
Westphalia -	Minden - -	958	96
	Rheine - - -	–	4
	Telgte - - -	10	7
	Coesfeld - -	2	3
	Lemgo - - -	–	24
	Warburg - -	1	4
	Münster - -	11	19
	In the Interior -	–	7
Rhine Provinces.	Aix-la-Chapelle -	210	856
	Cranenburg - -	31	7
	Emmerich - -	1,395	75
	Kaldenkirchen -	12	4
	Malmedy - -	–	12
	Saarbrücken -	6	60
	Wassenberg -	–	1
	Treves - - -	1	6
	Coblentz - -	–	4
	Cologne - -	2,399	2,085
	Duisburg - -	–	9
	Düsseldorf - -	–	–
	Neuss - - -	–	–
	Wesel - - -	–	9
	Uerdingen - -	–	2
	In the Interior -	–	14
	Total - -	14,666	6,246
LUXEMBOURG - -	- -	2	118
BAVARIA - -	Hof - - -	1	2
	Waldsassen - -	2	1
	Waidhaus - -	28	–
	Waldmünchen -	13	–
	Eschlkam - -	37	4
	Passau - - -	367	55
	Limbach - -	28	–
	Freilassing - -	218	109
	Reichenhall -	8	1
	Rosenheim - -	4	21
	Mitterwalde -	282	48
	Pfronten - -	23	14
	Lindau - - -	565	737
	Neuburg-on-the-Maine.	28	8
	Zweibrück - -	3	5
	In the Interior -	–	273
	Total - -	1,607	1,278
SAXONY - - -	Zittau - - -	16	3
	Schandau - -	233	36
	Pirna - - -	6	246
	Marienburg -	1	5
	Elbenstock - -	34	6
	Bautzen - -	–	1
	Dresden - -	–	51
	Leipzic - - -	–	5,633
	In the Interior -	–	1
	Total - -	290	5,982

STATES AND PROVINCES OF THE ZOLLVEREIN.	Custom-houses.	Books Printed, Bound, and not Bound, Maps, and Prints.	
		Exported.	Imported.
		Cwt.	Cwt.
WURTEMBURG -	Friedricshafen -	434	249
	Stuttgart - -	–	57
	Ulm - - -	–	63
	Total - -	434	369
BADEN - - -	Ludwigshafen -	8	15
	Constance - -	4	18
	Rondegg - -	486	263
	Stühlingen - -	42	85
	Thiengen - -	7	21
	Near Rheinfelden	140	269
	Near Schusterinsel	1,637	546
	Old Breisach -	–	1
	Kehl - - -	644	222
	New Freistatt -	–	11
	Heidelberg - -	–	9
	Mannheim - -	–	64
	Carlsruh - -	–	19
	Lahr - - -	–	1
	Freiburg - -	–	9
	Total - -	2,968	1,553
ELECTORATE OF HESSE.	Cassel - - -	438	153
	Carlshafen - -	–	8
	Witzenhausen -	7	1
	Rinteln - -	5	6
	Hanau - - -	–	1
	Marburg - -	–	1
	Total - -	450	170
GRAND DUCHY OF HESSE.	Mayence - -	–	34
	Offenbach - -	–	19
	Giessen - -	–	1
	Total - -	–	54
THURINGIA - -	Prussian - -	–	7
	Hessian - -	–	–
	Saxe-Weimar -	–	[illegible]
	Saxe-Meiningen -	–	5
	Saxe-Altenburg -	–	1
	Saxe-Coburg -	–	66
	Saxe-Gotha - -	–	6
	Schwarzburg, Rudolstadt.	–	1
	Total - -	–	92
BRUNSWICK - -	Brunswick - -	105	533
	Wolfenbuttel -	4	16
	Holzminden -	–	16
	Total - -	109	565
NASSAU - - -	Bieberich - -	–	42
FRANKFORT-ON-THE-MAINE.	- -	–	151
	Total Zollverein, 1850 - -	20,456	16,620

TABLE showing the Number of TYPE-FOUNDRIES, &c., in the ZOLLVEREIN STATES in 1846.

STATES OF THE ZOLLVEREIN.	Provinces and Districts.	Type-Foundries.		Establishments for Printing Books and Music.		
		Number of Foundries.	Number of Workmen.	Number of Establishments.	Number of Presses.	Number of Workmen.
PRUSSIA	Prussia	1	4	28	52	158
	West Prussia	–	–	25	38	141
	Posen	–	–	24	43	158
	Brandenburg	13	168	98	243	889
	Pomerania	–	–	31	56	129
	Silesia	2	28	89	150	541
	Saxony	3	16	91	200	627
	Westphalia	–	–	58	109	270
	Rhine	5	28	130	263	672
	Total	24	244	574	1,154	3,585
BAVARIA	Upper Bavaria	3	47	17	40	205
	Lower Bavaria	–	–	7	16	46
	Palatinate	–	–	15	23	48
	Upper Palatinate, Ratisbon	1	3	13	29	98
	Upper Franconia	–	–	11	23	67
	Middle Franconia	2	9	21	36	128
	Lower Franconia, Aschaffenburg.	1	1	14	26	71
	Suabia, Neuburg	1	5	28	81	202
	Total	8	65	126	274	865
SAXONY	Dresden	2	19	14	40	227
	Leipsic	10	193	47	199	1,227
	Zwickau	–	–	20	40	124
	Bautzen	–	–	11	23	88
	Total	12	212	92	302	1,666
ELECTORATE OF HESSE	– – –	1	4	23	49	113
BADEN	– – –	–	–	46	102	314
GRAND DUCHY OF HESSE	– – –	4	46	40	91	313
NASSAU	– – –	–	–	11	17	39
THURINGIAN STATES	– – –	–	–	9	24	100
Parts of other States belonging to the Union.	– – –	1	1	12	22	67
	There are no accounts from Wurtemburg, Brunswick, and Frankfort-on-the-Maine.					
	Total Zollverein, 1846	50	572	933	2,035	7,062

The Jury with pleasure acknowledge their obligations to Professor Dieterici, Chief of the Bureau of Statistics at Berlin, for the valuable Statistics of the Zollverein.

The following is a list of paper-makers from the Zollverein who exhibited at the Great Exhibition:—

MM. **EBART BROTHERS**, Berlin (1 Zollv., p. 1056).—Excellent writing and printing papers, bank-note paper, with superior water-mark; glazing-boards of good quality; and carton-pierre, for roofing.

M. **WUTTIG**, of Pulverkrug, Frankfort-on-the-Oder (1 Zollv., p. 1056).—Tinted printing-papers of ordinary quality.

M. C. A. **KOCH**, Gladbach (1 Zollv., 329, p. 1069).—Samples of excellent plate, writing, and printing papers; good colour, and well sized.

MM. **HOESCH and SON**, Duren (1 Zollv., 392, p. 1072).—Specimens of writing and printing papers; well-made coloured post papers, coloured tissues—black and rose colour, bright and good.

M. **SCHÜLL**, of Duren (1 Zollv., 393, p. 1072).—Laid writing-papers and printing-papers of fair quality.

L. **PIETTE**, of Dillengen (1 Zollv., 394, p. 1072).—Writing-papers of excellent qualities and good colour, but rather too soft sized.

M. **FISCHER**, of Bautzen (3 Zollv., 168, p. 1112).—Printing, plate, lithographic, and writing papers, of excellent qualities.

MM. **RAUCH BROTHERS**, of Wurtemburg (4 Zollv., 44, p. 1117).—Writing-papers of superior quality; thin *pelure*, well made and hard sized; veneered paper, blotting on one side, the other sized for writing.

MM. **Schaeuffelen**, of Heilbronn (4 Zollv., 41, p. 1117), displayed a large assortment of well-made and good papers of every description, thin *pelure*, or thin post writing-paper, of good colour, well sized and clean, the folio ream 11*s.*; white tissues of good quality at 4s. 3*d.* or 5*s.* the ream; coloured tissues, bright tints, 10*s.* the ream; fine and well-made plate-paper, 8*d.* per pound; second quality plate 6½*d.* per pound.

UNITED STATES OF AMERICA.

About the year 1730, a paper-mill was erected in Massachusetts, and, about the same time, another in Pennsylvania; but prior to the American Revolution the progress in this important branch of manufacture was very slow. It appears, however, that before 1768, Christopher Leffingwell began to make paper at Norwich, in Connecticut, and received a bounty from the treasury of the colony of "twopence the quire on all good writing-paper that he made, and one penny the quire on all printing and common paper." At the end of the first year, in May 1770, he received the bounty for 4,020 quires of writing-paper, and 10,600 quires of printing and coarser paper, after which the bounty was discontinued. Messrs. Watson and Ledyard set up a paper-mill in East Hartford, in the same colony; and this one mill, in 1776 and 1777, wholly supplied the press of Hartford, which published weekly above 8,000 newspapers, and also the greater part of the writing-paper used in Connecticut, as well as much of that used by the continental army. Shortly after this, paper-mills sprang up in every part of the country, and continued to increase with extraordinary rapidity, as did also the number of newspapers and cheap books. Prior to 1810, the materials for paper-making were procured in the country; but, since that period, they have been largely imported from Europe. Nearly all the linen rags are imported, and are in great request in the United States for the purpose of mixing with the domestic cotton rags. It is estimated that the Italian rags used to contain about 80 per cent. of linen; but it is found that, as cotton for clothing is increasing in all parts of the world, the proportion of linen in the foreign rags is decreasing from 5 to 10 per cent. annually. This fact at first created some alarm; but it is ascertained that raw cotton, where it can be had on the spot for 3*d.* or 3½*d.* per pound, answers as a very good substitute for linen. In the United States, the best qualities of writing paper contain from 30 to 50 per cent. of linen rags. The import duty on rags is 5 per cent. In the year ending June 1850, the quantity of rags imported into the United States was 20,696,875 lbs., of which about one-half, or 10,277,337 lbs. were from Italy; 3,964,815 lbs. from Trieste and other Austrian ports; 1,621,692 from England, Scotland, and Ireland; 14,540,042 from the Hanse Towns; and 1,619,114 from Sicily. The remainder were chiefly from Turkey and Canada.

About 1820, machinery began to be imported into the United States from England and France; but, being found expensive, this was not much encouraged. It was not till about 1830, that Messrs. Phelps and Spafford, of Connecticut, succeeded in manufacturing their machines, which are said to work well. They were much patronised, and they soon greatly enlarged their manufactory. Not long after Messrs. How and Goddard, of Worcester, Massachusetts, began to manufacture in great numbers machines for paper-making. At the present time, these two manufacturers produce nearly all the machines employed in the United States, and have besides begun to export them to South America and Mexico. The machines made by these two firms are those known as the Fourdrinier Machines, with some modifications. A cheaper kind, known as the *Cylinder* Machine, is used extensively for making the coarser and cheaper sorts of paper. These machines are also made in many other parts of the country.

It is only since 1830 that any real impulse has been given to the manufacture of paper in the United States; and this is owing, not more to the introduction of machinery than to the great changes in the mode of manufacture, as well as in the raw materials. Various articles are now extensively used which were not thought of before the introduction of chlorine and other means of cleansing and bleaching. Old junk, rope, hemp, tow, bagging, raw cotton, cotton waste, coloured or filthy rags, &c., are now extensively used even for superior papers. These materials, which were previously only used in the making of coarser papers, have risen 300 per cent. in value; in the United States, they are particularly useful, and consequently in great demand, where no linen is produced for mixing with, and imparting strength to, the cotton materials.

Since the beginning of the present century, the quantity of paper imported into the United States has been constantly decreasing, so that at the present day the proportion of foreign paper is only between two and three per cent. on the whole amount consumed. The paper imported is now almost exclusively of the superior qualities of writing and fancy papers, and is chiefly brought from England and France, each country exporting about equal quantities. Belgium and Italy also contribute a portion. The import duty on all kinds of paper is 30 per cent. *ad valorem*. There is no excise or stamp duty.

The Reporters regret that they have been unable to obtain from the United States the statistics of paper-making, which were so fully collected for the Census of 1850, but which have not yet been published. We are, however, officially informed, that the number of engines and paper-mills have recently very rapidly increased, especially in the southern and western States. It is estimated that the cost of manufacturing paper at the present day, with all the improvements in machinery, and the increase in the variety of the raw materials, when compared with the old process and materials, is reduced fully 800 per cent. Hence the old-fashioned mode of making hand-made or laid paper is almost entirely abandoned in the United States, there being now only two mills of any note engaged in its manufacture. Even these only make paper of particular sorts, such as bank-note paper, letter, deed, parchment, and such others as require great strength and firmness.

The general diffusion of knowledge, and the consequent demand for newspapers and cheap literature, has rendered the United States the country which, it is said, consumes more paper per head for its population than any other. But the great aim of the manufacturer is rather at cheapness than excellence in quality, though within the last five years improvements in the strength and quality of paper have been made. Recently, the finish of writing and printing papers has been much improved by the introduction of iron and paper calenders.

PAPER-MAKING—AUSTRIA.

The principal mills are in Lombardy, Lower Austria, and Bohemia; there are also some in Venice, and in the Tyrol. Lower Austria contains the most extensive mills. The whole amount of paper produced per annum is now stated to be 650,000 cwts., 250,000 cwts. being common writing, and 60,000 cwts. fine paper; 150,000 cwts. printing, 100,000 cwts. packing, and 60,000 cwts. paper of other descriptions. Steam-power is applied in a few instances, but the mills are chiefly driven by water-power; three-fifths of the whole produce is by vat-mills, and two-fifths by machines. On a population of 38,000,000, it is stated that three pounds of linen rags are produced per head. There are, besides, quantities of old rope, &c., used for paper-making. According to Messrs. Dernier and Mayer d'Anemarr, French Commissioners at the Austrian Exhibition of 1845, the number of paper-machines in that State was 40, the number of vats 940; producing nearly 314,000 quintals (15,011 tons) of paper, valued at 20,500,000 francs, being an average of 6½*d.* per lb. The number of persons employed was 12,000, besides rag-sorters.

The number of machines is now 49, and 900 vats. Austria exports paper to the amount of 150,000*l.* per year.

PAPER-MAKING—DENMARK.

In Denmark there are six machines, besides one in Holstein, and 20 vats, producing altogether about 1,312 tons per year. In 1847, Denmark imported about 300 tons of paper from Belgium, France, and other countries. The first paper-mill was established at Fredericsburg, by order of Christian III., and the first machine for making paper was made by Messrs. Donkin, and put up for Mr. J. C. Drewsen, in 1826.

Paper-making—Sweden.

In Sweden there are five paper-mills, employing seven machines, and eight vat-mills.

Paper-making—Spain.

In Spain there are 17 machines: 1 in Old Castile, 2 in Valencia, 3 in New Castile, 1 in Estramadura, 2 in Catalonia, 2 in Arragon, 1 in Andalusia, 3 in Guipuscoa, and 1 in Nonane. The principal mills are at Burgos; at Rascafria, near Madrid; at Candelario, near Begor; and at de Coppellades, near Barcelona. The machines have been imported from England, France, and Belgium; the first was established near Manzanarès, in La Mancha, by Don Thomas Jordan. There are also 250 vats. The whole produce is 4,741 tons yearly. Of 3,400,000 kilogrammes of paper made in Spain, Catalonia produces 700,000 reams. The weight of rags used in this province is said to be 16,071 tons yearly. One hundred and forty thousand reams of paper were exported from Spain in 1848, to the following countries:—to Cuba, 94,000 reams; to Chili, 16,000 reams; to Porto Rico, 10,000 reams; to other countries, 20,000 reams.

Paper-making—Netherlands.

The importation of paper in the Netherlands, in 1847, was 219 tons, valued at 17,919 florins, chiefly from Belgium and the Zollverein. The importation of rags was 700 lbs. only. The exportation of paper, in the same year was 148 tons; its principal destination was Java. The exportation of rags was only 1,200 pounds weight.

Paper-making—Sardinia. Tuscany.

In the kingdom of Sardinia there are 12 paper-machines and 60 vats. The first machine was established at Borgo Sesia for Mr. Molino. In 1848, the paper produced, none of which was exported, amounted in value to 6,000,000 florins; whilst in 1846, 1,178 tons of paper was exported from Genoa to Mexico, Spain, and the Brazils.

In Tuscany there are 20 paper-mills, and two Donkin machines, at the mill near Florence. In 1848, the exportation of rags and paper from Leghorn amounted to 30,000 lbs.—about half to England, and the other half to the United States.

Paper-making—Hamburgh.

The importation of paper in Hamburgh, in 1848, was of the estimated value of 1,288,000 francs (51,250*l.*)

Paper-making—Switzerland.

In Switzerland there are 26 machines and 40 vat-mills, producing together 11,607 tons annually. The men's wages are 90 centimes per day (about 8½*d.*), and the women 60 centimes (5¼*d.*). No paper is exported.

Paper-making—Saxony.

In the kingdom of Saxony, in 1847, there were 66 paper-mills, with 6 machines, employing 992 persons. The exports and imports are trifling.

Paper-making—Italy.

In Italy, Lombardo-Venetian Kingdom, six machines are distributed among four mills.

Paper Making—Sicily.

In the kingdom of the Two Sicilies there are 12 paper-machines. In 1827, MM. Firmin Didot Brothers and Lefèvre established the first machine, under a patent of importation in the Mill of Fibrène (Isola di Sora). The number of persons employed is 1,200. There are about 12 vats, employing 300 persons. The whole produce amounts to 306 tons annually, and paper is exported to Sicily, Rome, Leghorn, Malta, the Ionian Isles, and Greece.

Paper Making—Roman States.

In the Roman States there are three machines; at Anatrella, at Fiume, and in the neighbourhood of Rome.

Paper Making—Turkey.

In Turkey there is one mill at Smyrna, and one paper-machine, besides one vat-mill at Constantinople.

Paper Making—Egypt.

In Egypt, one vat-mill at Boulac, near Cairo.

Paper Making—Price of Rags.

The following is the present price of white rags:—

	Per Ton. £.	s.	d.	For 100 kilos. or 220½ lbs.
In America – – – –	28	2	0	70 fr.
In England – – – –	25	6	0	63 fr.
In France (in 1840 and following years, it was from 60 fr. to 62 fr.) – –	18	0	0	45 fr.
In the Zollverein – –				
In Austria – – – –	12	0	0	30 fr.

The principal depôts are at Pesth and at Agram.

	£.	s.	d.	
In Switzerland – – –		——		
In Belgium – – – –		——		
In Holland – – – –		——		
In Italy – – – – –		——		
In Lombardy – – –	14	8	0	36 fr.
In the Two Sicilies (until 1850, the price was 24 fr.)	12	3	0	31 fr. 50 c.
In the Roman States – –	11	12	0	29 fr.
In Sardinia – – – –	17	12	0	44 fr.
In Spain – – – –	17	4	0	43 fr.
In Russia – – – –				
In Denmark – – – –	19	5	0	48 fr.
In Sweden – – – –				

IV. PLAYING-CARDS.

The country in which playing-cards were invented has never been ascertained with any certainty, neither are we acquainted with the precise time of their introduction into Europe. Numerous speculative opinions have been put forth in order to prove that the art of wood-engraving originated from the manufacture of playing-cards, it being supposed that the outlines of the figures or court-cards were cut on wood, and that from this was obtained the first idea of wood-engraving. The most ancient cards we have seen appear to us to have been stencilled, and this method seems to have been employed for the outline of the figures, as well as for the filling in of the different colours; therefore, as stencilling* was probably known long before wood-engraving, we are inclined to believe that the figures were not taken from wood-engravings until at a later period, as an *improvement* on the former mode. Some card-makers of the present day manage stencilling with great skill, and the method is a favourite one, as it leaves no impression to show through on the back of the card, a fault sometimes difficult to avoid in white-backed playing-cards, when the outline has been printed on the card-board with a printing-press.

The cards mentioned as the oldest cards we have seen belonged formerly to Mr. Tutet, who has written the following remarks on one of the fly-leaves of the volume in which they are collected:—"The ancient cards* in "this volume, with others, duplicate, and the drawings in "the second volume, were purchased by me out of the "collection of Dr. Stukeley; the drawings were produced "by the Doctor on the 9th of November 1720, to the "Society of Antiquaries, observing that the cards had "been given him by Thomas Rawlinson, Esq., being two "pieces of the cover of an old book, supposed to be "'Claudian,' printed before 1500; and then there was a "leaf or two of an old edition of Erasmus's Adages, "pasted between the layers of the cards, which being "laid stratum upon stratum, composed two pasteboards, "and made the cover of the book. The Doctor took the "pains to separate the cards, out of which I have chosen "a complete pack, and the better to preserve so singular "a curiosity, have had it bound, together with the draw- "ings, and some modern French cards. It is observable "in the ancient cards that there are no aces nor queens; "but instead of the latter, are knights." The marks of the suits are hearts, bells, bones, and acorns, and the court-cards are the king, knight, and knave. The size is 3 inches long by 2¼ inches wide. They are very rudely coloured. The figures on the French card above mentioned are the same as those still preferred in this country. It is curious to observe that while the honours of modern French cards have undergone a complete change, those preferred in England retain the costumes and outlines of the oldest French cards, every attempt made to modernize the English court-cards having invariably failed. Some years ago Messrs. De La Rue introduced some improvements, and endeavoured to induce the public to adopt a more modern and defined costume in the court-cards, but they were compelled to abandon the attempt, and return to the old style, after having incurred heavy losses in their endeavours to create a more elegant taste.

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* A playing-card stencil is a sheet of strong paper, covered with several layers of oil paint on both sides, and kept for a long time until thoroughly well seasoned, when the form of any figure required is carefully cut out so as to leave sharp edges. The colouring matter, mixed with paste, is brushed over with a large circular brush, and enters into the cut-out parts of the stencil, and thus imparts the design to the card-board placed under it. If this operation is skilfully performed, much better and sharper outlines are obtained than would be generally supposed. Most of the card manufacturers still continue this mode of painting the pips of playing-cards, as well as the filling in of the outline of the figures, which are cut on pear-tree wood. The manner of taking the impression of the outline of the figures was done by rubbing, until some few years ago, when Mr. Creswick first employed a press for the purpose.

In 1392 or 1393, there is the following entry in the accounts of Paupart, treasurer to Charles VI. of France, that monarch having lost his reason in 1392:—"Given to Jacquemin Gringonneur, painter, for three packs of cards, gilt and coloured, fifty-six sols of Paris." The tenor of this passage seems to imply that cards were already known, therefore it is highly improbable that Gringonneur was the inventor, as has been asserted.

It is not known when the manufacture of playing-cards was established in England. As early as 1463 there were card-makers in this country, the importation of playing-cards having been prohibited by Act of Parliament in that year, as injurious to the interests of native manufacturers. No cards of English manufacture, of so early a date, have, however, been discovered.

The Abbé Rives ascribes the invention of playing-cards to the Spaniards before 1332. Mr. Anstes conjectures that cards were known at the end of the thirteenth century. They appear to have been known to the Italians in 1378, for Covelluzo states that the game of cards was brought into Viterbo, from the country of the Saracens, in that year.

In 1397, the labouring classes of Paris were forbidden to play at cards on working days.

Playing-cards appear to have been known in China at an early period. It is said that they were invented in the reign of Leun-ho (1120), and were common in 1131. They are called che-pae, which signifies *paper-ticket*. The Chinese cards in the Exhibition measured 2¼ inches long by 1⅛ inch in width.

In the Museum of the Royal Asiatic Society there are three packs of Hindostan cards; they are circular, and measure 2¾ inches in diameter, and some smaller, 2½ inches. They appear to be made with canvass. In the Indian Department of the Great Exhibition there were also circular cards, which were strongly varnished on both sides. It is supposed that card-making among the Hindostanees is a regular profession, though possibly combined with some other branch of manufacture, as card-painting was combined with wood-engraving in the fifteenth century. The marks of the suits of Hindostanee cards appear to be identified with the customs, manners, and opinions of the people. They coincide with the earliest European cards in having no queen, the two court-cards being a king and his minister or attendant, and the suits being distinguished by the colour as well as by the form of the mark or emblem.

Early in the fifteenth century card-making appears to have become a regular trade in Germany. Nuremberg, Augsburg, and Ulm were the chief towns for the manufacture of playing-cards. Besides supplying the home markets, considerable quantities were exported into Italy, Sicily, and over sea, and bartered for spices and other wares; and at the present day much larger quantities of cards are exported from Germany than from any other country. Their cheapness is, no doubt, the principal cause, for the German cards are generally inferior to those made in England, although some are well made since they have adopted the method of printing the pips and honours, as patented in England in 1832.

At an early period the Netherlands seem to have been famed for the manufacture of cards, for Albert Durer states that he bought half a dozen packs for seven stivers.

From a passage in Ascham's Toxophilus, 1545, cards were then about twopence per pack. This may appear very low to us now, when the duty alone is one shilling per pack for all cards used in England, but cards can be bought for half-a-crown a dozen in Hamburgh; and if a sufficient demand could be had for export, cards could be produced in this country and sold at these prices.

Edward Darcy obtained a patent for the manufacture of playing-cards at the end of the reign of Queen Elizabeth, who, as well as her sister Mary, was partial to card-playing. The importation of cards was prohibited after the 20th July 1615, during the reign of James I., "as the art of making them was then brought to perfection in this country." The Company of Card-makers was first incorporated by letters patent of Charles I., in 1629. By a proclamation in June 1638, it was ordered that all foreign cards should be sealed in London, and packed in new bindings or covers. A few years later, 1643, the importation of cards was *absolutely* prohibited on the complaint of several poor card-makers, stating "that they were likely to perish by reason of divers merchants bringing cards into the kingdom." This prohibition continues up to the present day, except on payment of *a very high duty*, tantamount to the same thing.

During the reign of Charles II. card-making greatly increased in England.

Card-playing seems to have attained its full tide in every part of civilized Europe in the reign of Queen Anne, and was both fashionable and popular in England. Ombre was the favourite game for the ladies, and picquet for gentlemen; clergymen and country squires played whist, and the commoners played at all-fours, put, cribbage, and contraloo. At no other time, before or since, was card-playing so prevalent. Kind landlords used to send a string of hog's puddings and a pack of cards, as a Christmas gift, to every poor family in the parish.

During this reign the card-makers petitioned the House of Commons on the occasion of a proposal to lay a tax of sixpence per pack on cards. "Nine parts in ten of the cards now made," they said, "are sold from 6*s.* to 24*s.* per gross, and even those at 6*s.* will, by this duty, be subjected to 3*l.* 12*s.* tax. This, with submission, will destroy nine parts in ten of the manufacture; for those cards which are now bought for 3*d.* per pack can't then be afforded under 10*d.* or 1*s.* If any of your Honours hope by this tax to suppress expensive card-playing, it is answered, that the common sort, who play for innocent diversion, will only be hindered; the sharp gamesters who play for money will not be hindered by 12*d.* a-pack." It is stated that "40,000 reams of Genoa white paper were annually imported chiefly for the purpose of making cards. The business was in the hands of small masters, mostly poor, of whom there were no less than a hundred in and about London. Their price to retailers, one sort with another, was three-half-pence a pack, and their profit not above a halfpenny."

We doubt whether so large a quantity as 40,000 reams of Genoa paper was ever consumed in manufacturing playing-cards; if so, the sale must have been far greater than within the last 50 or 60 years, for that quantity of paper would have produced 5,000,000 packs of cards, whereas the amount was only 507,672 packs for the home and export trade in 1851. And as five or six card-makers supply the demand, it appears doubtful whether so large a number as a hundred masters could ever have obtained a living by the trade. Genoa paper was preferred by card-makers up to a late period, for its silkiness, for its power of receiving the colour freely, and for *taking* the *flint* or glazing better than the harsh English paper. At present there may be a few reams still consumed by the old-fashioned makers; but the bulk of the paper is now made here, cards being almost all glazed by passing them between copper-plates through rollers, instead of glazing them with a flint, as formerly.

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* Now in the possession of Mr. De La Rue.

In the early part of the reign of George III. card-playing was very prevalent.

Until lately the importation of cards was prohibited in Russia, where the manufacture of cards is a royal monopoly. The whole income derived from their sale is applied towards the maintenance of the Foundling Hospital. The manufacture of playing-cards is carried on, on a very large scale, at Alexandroffski, near St. Petersburgh. The machinery applied to the manufacture of cards in the Imperial Manufactory is the invention of Mr. Applegath, and is under the direction of General Wilson. All the modern improvements for the manufacture of cards are to be found in that establishment, many having been furnished by Mr. De La Rue. His patent process was adopted for a superior description of cards many years since. The cards printed at Applegath's machine are in water-colours; and although upwards of 14,000 packs are manufactured daily, the supply is not equal to the demand. The best Russian playing-cards are excellent, surpassing most continental cards in the glaze and all the essential qualities of good cards.

The demand for playing-cards has not kept pace with the increased population of this country; the duty of one shilling per pack* operating, with other circumstances, such as musical evenings, reading societies, &c., against their greater use.

No person is allowed to manufacture playing-cards in this country except in the cities of London and Westminster, and in the city of Dublin, in Ireland. Their manufacture is prohibited in Scotland. The duty is upwards of two hundred per cent. on the cost of manufacture, besides the duty on paper, which amounts to about 6*d*. on a dozen packs.

In consequence of the re-issue of second-hand playing-cards being allowed, forged aces, with the London makers' names, have been introduced from abroad, and used for spurious cards, which are sold for second-hand, thus causing detriment to the English manufacturer and loss to the revenue. The permission to re-issue second-hand cards seems to have been retained in deference to those by whom club-houses are supplied, the cards when once played with, becoming the perquisites of the servants, who obtain a certain price from the original vendor, by whom they are again sold. This opens the door for the contraband cards with forged aces, and is undoubtedly a grievance that Government ought to remove. If the duty were reduced from one shilling to three pence per pack, it would put an end to smuggling, forgery, and perjury, as regards cards; the sale would increase, a larger quantity of paper would be consumed, and employment given to a number of extra hands.

The duty and export aces are printed at Somerset House on paper furnished by the card-makers, who have also to pay thirty pounds for every ace-plate, engraved by Messrs. Perkins and Co., and sent by them to the Inland Revenue Office. If the ace-plate, on which there are twenty aces, be engraved on steel, it will last for a considerable time, but it is notwithstanding a heavy charge on the manufacturer of playing cards, as *two* different aces are required, one for the home trade, the other for exportation. Every card manufacturer is required to give two securities in 500*l*. each before a licence can be obtained. When aces are wanted by the card-maker, a requisition is sent to Somerset House, and a ream, containing 9,600, is usually drawn at one time. An officer is sent round to the different card-makers with seals, one of which is affixed to each pack required for immediate sale. According to the number of seals furnished to each maker by the officer, the amount of duty of 1*s*. per pack must be paid on the first of each month. The aces remain in stock at the manufacturer's, the quantity in hand being ascertained by officers sent from time to time to inspect them. Should any deficiency be found, the duty must be paid on such deficiency, and the manufacturer is called to account for the irregularity. When playing-cards are required for exportation, the manufacturer has to enter into a heavy bond, with security, to insure the *bonâ fide* landing of the cards at the port named in such bond, and a drawback of three halfpence per pound is allowed on all cards exported; but it often happens that the expense of the bond for small parcels is such as to make it a matter of indifference whether the drawback be obtained or not; and it certainly checks the sale of cards for exportation, for many persons would buy two or three dozen, when they do not wish to take grosses, to form an assortment of stationery for exportation.

The amount of duty paid on playing cards in 1850 was 11,782*l*. 10*s*., sterling, being on 235,650 packs. The number exported, on which there was no duty, amounted in the same year to 329,888 packs.

In the last year, 1851, there was a diminution of duty-paid cards, as well as exports. The number of duty cards sold was 226,576, being 9,000 less than in 1850, and 281,106 packs for exports, being 48,782 packs less than in 1850.

The general mode of painting playing-cards is by stencilling with water-colours mixed with paste. The card-board used in England consists of four sheets of paper; two strong sheets of cartridge are first pasted for the inside of the board: they are hung up to dry, well pressed, and afterwards covered on each side with a sheet of paper, which should be strong and well sized. The outlines of the honours, as well as the ornamental backs, are printed with a letter-printing press. The pips are stencilled, 20 cards being the usual quantity on a sheet of foolscap. They are packed in what is technically called works; each work should yield 16 dozen and 8 packs of cards. They are well dried and aired, and then rubbed over with Castile soap, that the flint with which they are glazed may pass smoothly over without tearing the card-board. The operation of glazing with a flint is tedious, and causes much waste. When glazed, they are taken to the cutter, and from him to the women-sorters; they are carefully looked over, all defective cards being put aside for a cheaper description. All the picked cards are laid at what is called the head of the table, and constitute those denominated "Moguls" (best quality); the seconds, or slightly defective, come next, and are called "Harrys;" the last and most defective are the "Highlanders." A work of 16 dozen that turns out well should yield the following proportions: from 8 to 10 dozen of Moguls, 3 or 4 dozen Harrys, and the remainder Highlanders. They are put in wrappers, with a *thread* tied round each pack, sealed by a revenue officer when required, and put up in parcels of six packs, which are called sixaines.*

There was little or no improvement in the manufacture of playing-cards until 1832, when Mr. De La Rue obtained a patent for certain improvements, which consisted in substituting printing with oil colours, in lithography or letter-press, from wood or metal blocks, and using a superior description of quick-drying printing-ink, not liable to set-off in glazing. By this process a much sharper impression is obtained, the colours are more vivid, and the backs better ornamented than could be effected by stencilling with water-colours. The patent mode of manufacturing playing-cards has been adopted by many of the German manufacturers, and by the Imperial Government of Russia.

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* Cut-corner cards are the waste of card-makers, and are not allowed to be sold in regular packs, although they may be sold as waste, provided half an inch be cut off one corner. The wording of the Act of Parliament relative to this subject is so imperfect, that for two or three years cut-corner cards were regularly manufactured and sold; but the Commissioners of Stamps and Taxes declared the sale illegal, and took proceedings for certain penalties against the retailers. There are still manufacturers who sell these illegal cut-corner cards, to the injury of the fair trader, notwithstanding the threat of heavy penalties.

* It is a curious fact that the *technical terms* used in the workshops of playing card-manufacturers in this country are *French* words, such as *sizens* (sixaines), brief, *bref* (short), &c., &c.: this seems to imply that practical card-making was introduced by the French into England.

In his work on playing-cards, Mr. Chatto says, that "no other game was ever so generally played by people of both sexes—young, old, rich, and poor. It is, perhaps, as extensively diffused as the use of tobacco, and is certainly indulged in by a greater variety of persons." We are much indebted to Mr. Chatto's "*Facts and Speculations on Playing Cards*" for the valuable information it has afforded us, and of which we have made free use.

The following is a list of the playing-card manufacturers who exhibited:—

England.—Messrs. De La Rue and Co. 76, pp. 541, 542) exhibited some beautifully-manufactured packs of playing-cards, with ornamental backs of flowers, fruits, and ornaments, from drawings by Mr. Owen Jones; among them a series of four, with interwoven monograms of Her Majesty, His Royal Highness Prince Albert, His Royal Highness the Prince of Wales, and Her Royal Highness the Princess Royal; the monograms in each are surrounded with groups of flowers exquisitely executed in chromolithography. The rose and hawthorn, typical of youth and beauty, surrounds the monogram of Her Majesty; H.R.H. Prince Albert is appropriately represented by the holly, the ivy, and the oak; the fuschia and daisy express the beautiful childhood of H.R.H. the Prince of Wales; the primrose, violet, and lily, the innocence, modesty, and beauty of the Princess Royal.

Messrs. De La Rue had also some cards adapted for near-sighted people, the pips being in different colours—the spades in black, the clubs in green, the hearts in red, and the diamonds in pale blue. These coloured cards were suggested by Sir Frankland Lewis. Messrs. De La Rue's playing-cards, called Victoria cards, surpass all others in finish, quality of paper, perfection of printing, and ornaments on the backs.

Mr. Whittaker, of London (49, p. 541), contributed some single cards, of various patterns, as examples of playing cards in gold and colours; the designs of these are commendable, but as none were exhibited made up in packs, the Jury could not ascertain the degree of merit which would be due to them in a manufactured state.

There were several exhibitors of playing-cards from foreign countries, viz.:—

France.—M. Blaquière, of Paris (1552, p. 1251), who had some with the pips in different colours. M. Hulot (882, p. 1222) had some court-card forms electrotyped.

Belgium.—Mr. Daveluy d'Elhoungne, of Bruges (448, p. 1165), specimens said to be printed by a new process, but the Jury could not discover any particular merit.

Frankfort-on-the-Maine.—M. C. L. Wuest (5 Zollv., 14, p. 1122), who appears to have adopted De La Rue's patent process, exhibited some cards with defined pattern backs printed in register, well executed; and he deserves mention as having produced good specimens of that particular style.

Grand Duchy of Hesse.—MM. Frommann, of Darmstadt (6 Zollv., 39, p. 1128), had good and well-made specimens. Mr. Reuter, of Darmstadt (6 Zollv., 40), had some printed with oil colours. Mr. H. L. Schnapper, of Offenbach (6 Zollv., 42), displayed some well-manufactured specimens.

Austria.—Mr. G. Steiger, Vienna (374, p. 1028), exhibited very well-made cards.

Sweden.—Mr. Heurlin, of Stockholm (113, p. 1354), well-made and well-glazed playing-cards.

Denmark.—Mr. L. P. Holmblad, of Copenhagen (27, p. 1357), had also some good playing-cards.

The playing-cards exhibited by these different countries indicate a marked advance in the manufacture of that article.

V. MESSAGE CARDS.

Above thirty-five years since, the late Mr. W. Creswick, paper-maker, introduced a superior description of blank visiting and message cards, which until that period had been supplied by playing-card makers from their refuse boards. The great encouragement given by engravers, printers, and the public to the superiority of Mr. Creswick's cards, induced other persons to embark in this branch of the paper trade. New and important manufactories have risen, and there are now several in this country. The English blank cards are made of excellent paper; the best are made with drawing-paper; they are generally superior to those of any other country. It does not appear that any foreign manufacturers have paid as much attention to their production as the English.

VI. DRAWING-BOARDS.

Drawing-boards should be manufactured of the best hand-made drawing-papers. Messrs. Hollingworth, of Turkey Mill; Messrs. Balston (under the well-known name of J. Whatman); Richard Turner, of Chafford; Mr. Wilmot; Messrs. Evans, of Derby, and one or two others, are the principal makers of vat-papers fit for the purpose. When two or more sheets are pasted together, well rolled and pressed, they become London drawing-boards, best quality; Bristol boards are an inferior sort. There are several manufacturers of drawing-boards in London. Only two exhibited, Messrs. Turnbull, of Holywell Mount, Shoreditch (45, p. 540), and Messrs. De La Rue, of Bunhill Row (76, p. 542). Messrs. Godin, of Liège (284, Belgium, p. 1160), and one or two French paper-makers, also sent samples, but none were equal to the best London boards.

VII. ENVELOPES.

The number of English exhibitors in this now important branch of the paper trade was nine; the most prominent of whom, Messrs. De La Rue (76, pp. 541—543), had a patent folding-machine at work, in the Main Avenue, during the whole period of the Exhibition, which attracted the public in such crowds that many were disappointed in their endeavours to see it. An idea may be formed of the magnitude to which this new trade has already grown, when we state that twelve of these machines fold and gum weekly nearly two millions of envelopes. The number of exhibitors from France was three. From other countries, there were none of any importance.

The use of envelopes was common in France before their introduction into England. It was not till 1839, in consequence of Mr. Rowland Hill's postage reform, that any important consumption took place in this country, yet little progress was made in the manufacture of envelopes until March 1845, when Mr. Edwin Hill and Mr. Warren De La Rue obtained a patent for cutting and folding them by machinery. Until this period envelopes were imperfectly folded by hand with a bookbinder's folding-stick, 3,000 per day being about the quantity an experienced workwoman could produce.

Before the penny postage, 26,000,000 letters passed annually through the Post Office. In 1850, 347,000,000 letters were posted; of this large number nearly 300,000,000 were enclosed in envelopes! Besides the plain envelopes for commercial purposes, there is a large consumption of fancy and ornamented envelopes, a considerable quantity of which are exported to most parts of the world.

The manufacture of envelopes gives employment to great numbers of young boys and girls, whose wages range, in England, from six to nine shillings per week.

Messrs. Waterlow (46, p. 540) also had a folding-machine at work in the Machinery Department. It was patented by M. Rémond some years after that of Messrs. De La Rue and Co.

Messrs. Pinches, Oxendon Street (33, p. 539); Mr. Jeremiah Smith, Rathbone Place (41, pp. 539, 540); Mr. J. Mansell, Red Lion Square (27, p. 539); Messrs. Dobbs and Co., Fleet Street (79, p. 543); Messrs. Cowan and Co., Edinburgh (101, p. 544); Mr. F. Ralph, Throgmorton Street (142, p. 546): all exhibited good and well-made envelopes. A collection of envelopes with embossed seal flaps, tastefully designed and appropriate for the use of the several colleges, were exhibited by Messrs. Spiers and Son, of Oxford, (p. 208 552).

Mr. James Dudman, Camberwell Place, New Road (137, p. 545), exhibited three sorts of self-sealing envelopes; very ingenious, but presenting no commercial advantages over the adhesive envelopes already in use.

France.—M. Bertou, Rue Faubourg St. Martin, Paris, exhibited a quantity of envelopes of ordinary make. M. Marion, Cité Bergère, Paris, a large variety of envelopes, well manufactured. This exhibitor stated that he had a folding-machine for envelopes; every inquiry was made for it, but it could not be found. M. T. P. Valant, Faubourg St. Antoine, Paris, exhibited envelopes of ordinary qualities, said to be cut by machinery.

Belgium.—M. E. Tardif, of Brussels, exhibited a quantity of mourning and other envelopes of ordinary qualities and make.

Zollverein.—M. P. Ruhl and Sons, Hesse Cassel, displayed a series of embossed and printed envelopes.

America.—The Belvidere Company, Richmond, Virginia, exhibited a peculiar description of buff paper for envelopes, which is in great demand in the United States.

VIII. FANCY STATIONERY, &c.

It is almost impossible to enumerate the various descriptions of articles belonging to this class of goods. They comprise albums, scrap-books, portfolios, music-books, manuscript-books, writing-desks, cabinets, envelope-cases, portefeuilles, pocket-books, metallic memorandum-books, card-cases, blotting-books, lace-papers, gold printed papers, valentines, embossed boards, wedding envelopes, gold and silver medallions, fancy wafers, porte-monnaies, and numberless similar articles. There were several English and foreign contributors of fancy stationery, which will be noticed under the following heads:—

Lace-Papers.—This is a description of pierced paper and cardboard in imitation of lace, the improved manufacture of which took place in England about 1831. Long before this period *thin* pierced lace-papers had been made in France, chiefly for ornamenting fruit packed in card-board boxes. This particular description of thin perforated papers continues to be made for ornaments, such as lamp-shades, of which M. Devrange, jun., 257 Rue St. Denis (1188, p. 1234), and M. Arrault, 136 Rue St. Denis (9, p. 1170), contributed numerous fine specimens; and for borders to mount small religious engravings, of which Madame Bouasse, 9 Rue du Palais de Bourbon, St. Sulpice (1102, p. 1230), exhibited some pretty varieties, carefully and neatly got up. The mode of perforating thick paper and card-board by machinery was first applied by M. Marc La Rivière, a Swiss watchmaker, who obtained a patent above twenty years ago, for perforating zinc and other metallic plates, and established a manufactory at Hackney, near London. Mr. De La Rue having been invited to see this manufactory, suggested its application to paper and card-board, and entered into arrangements with M. La Rivière to carry out this beautiful and novel paper ornament. Very large quantities of perforated card-boards have been, and still continue to be, exported. They are used for embroidering on with silk and coloured beads. Another and more beautiful imitation of lace is obtained by a process now extensively in use, which was invented by Mr. Addenbrook, of London, and applied to the lace bordering of note and other paper. Some specimens, applied to pretty valentines, were exhibited by Mrs. Hider (17, p. 537) and by Mr. Mosman (204, p. 832), and for other purposes by Messrs. De La Rue and Co. (76, p. 541), Messrs. Dobbs and Co. (79, p. 543), Mr. J. Mansell, Red Lion Square (27, p. 539), and Mr. Meek, Crown Court, Fleet Street (190, p. 550).

France.—M. Marion (609, p. 1207), M. B. Devrange (p. 1234), and M. Arrault of Paris (p. 1170), exhibited various specimens of well-perforated fancy and letter papers.

Fancy Papers.—These consist of numerous varieties of papers, printed in gold, silver, and colours; some by lithography, chromolithography, surface printing, block printing, in the manner of calico printing, from woven wire, as patented by Mr. De La Rue, and also of papers covered over with real gold and silver, and imitation gold and bronze, embossed or grained by means of engraved rollers, dies, and plates, of varnished papers to imitate morocco, and numerous other descriptions. They are used for the card-board boxes now so generally adopted for packing goods, for wrapping and ornamenting superior fabrics, and for many other purposes. There were several English and foreign exhibitors: the principal were M. Angrand (7, pp. 1169, 1170), M. Guesnu (250, p. 1188), and Mr. Vanderdorpel, of Paris (712, p. 1213); M. A. Dessaur, of Aschaffenburg, Bavaria (2 Zollv., 68, p. 1101); M. Freund (6 Zollv., 38, p. 1128), M. J. B. Weber (6 Zollv., 43, p. 1128), and Wuest Brothers, of Offenbach (6 Zollv., 44, p. 1128); M. Fechner, of Guben (1 Zollv., 266, p. 1063); M. E. Moniac, of Berlin (1 Zollv., 249, p. 1061); and Messrs. De La Rue and Co., of London (pp. 541—543), at whose stall pattern-books containing many hundred specimens of chaste and elegant designs, were exhibited.

Plain Surface Coloured Papers.—This description of paper is coloured by means of brushes similar to those employed by paper-stainers for decorating houses, but requires more care in laying on, smoothing, and finishing, as well as colours of a finer description. It is used by bookbinders, printers, button-makers, confectioners, and numerous other branches of trade, giving employment to hundreds of men, women, and children. The contributors were Messrs. De La Rue and Co., who displayed a beautiful assortment of coloured papers arranged systematically on the plan of Chevreuil, to show the effects of contrasting colours; these papers were placed in two rows, about one foot distant, so that as the observer moved they shifted their apparent position with regard to each other, a number of different effects of contrast being thus brought out.

Messrs. J. and R. Newberry, Hemlock Street, Carey Street (148, p. 546), had well-manufactured gold and coloured papers in great variety.

Enamelled Papers.—The advance of chemistry as applied to colour-making is exemplified in the beautiful white glossy colour with which enamelled papers are prepared. Artificial sulphate of barytes, made from the native carbonate, was for many years manufactured and sold by Mr. Hume, of Long Acre, at one guinea per lb., under the name of *permanent white*, and used by water-colour painters, who prized it for its unchangeable qualities. It was subsequently applied by Mr. De La Rue to enamelling paper, when the price was reduced from one guinea to *sixpence* per pound. It is extensively used by paper-stainers, both in England and France, for the ground of their fine satin paper-hangings. Enamelled paper is used for printing in gold, bronze, and other metals, and from its delicate and glossy surface it is also used for wrapping superior articles of manufacture. There is another and more expensive description of enamel colour, with which the highly glazed invitation and visiting cards are manufactured. These cards were introduced in England about twenty years since, by Mr. Sturz, on his return from Frankfort, in which city they were first made. Mr. Sturz obtained a patent for improvements in copper-plate printing, and described the material he used as the "best and purest white lead." This proved fatal to his patent, for having obtained an injunction against Messrs. De La Rue, who manufactured enamel cards with barytes, Lord Chancellor Lyndhurst held that the specification was too vague, and that the commercial name should have been given, namely, "Kremnitz white lead." The injunction was dissolved, with costs, and the manufacture of enamel cards thrown open.

The enamelled boards, cards, and paper of M. Bondon, of Paris (63, p. 1174), were of excellent quality.

Zollverein.—M. Schreiber, of Merseburg (1 Zollv., 783, p. 1094), displayed an assortment of enamelled card-boards of great beauty. M. Veil and Co., of Stuttgard (4 Zollv., 45, p. 1117), had enamelled card-boards of excellent quality; and M. Weber, of Offenbach, Grand Duchy of Hesse (6 Zollv., 43, p. 1128), exhibited enamelled card-boards of average quality.

Messrs. De La Rue and Co., of London (p. 541), had beautiful specimens of enamelled card-board, prepared with Newton's thin film, under the name of opaline enamel.

Metallic Memorandum-Books.—The paper for this description of books is prepared on the surface, and when written upon with a pencil, the point of which is composed of certain metallic alloys, the writing becomes almost as permanent as if it were in ink. The method of preparing the paper for this purpose is not new, but its various and useful applications are of recent date. The contributors of metallic books were Messrs. De La Rue and Co., who had a variety bound in Russia leather, morocco, calf, roan, and velvet. They had also indelible diaries, neatly printed and ruled, in two colours. Mr. Charles Penny, of the Old Bailey, had numerous good specimens in a variety of elegant and useful bindings. M. Schlessinger had also metallic memorandum-books, with flexible backs to admit loose documents.

Scrap-Books.—Messrs. Ackermann & Co. (1, p. 537) contributed a large imperial folio, elegantly bound; Messrs. De La Rue and Co. (p. 541), a variety of scrap-books in suitable bindings; Mr. George Cross, of New Coventry Street, (88, p. 543), exhibited specimens of a new mode for fastening the leaves of scrap-books on oval wooden backs, without guards, enabling prints and drawings to be placed close to the back with less risk of injury to the edges. Messrs. Rock and Co. (108, p. 544) exhibited three large scrap-books with numerous lithographed English views. M. Antoine Maitre, of Dijon, Côte d'Or, France (318, p. 1192), had scrap-books of an average quality.

Portfolios.—There were twenty manufacturers of fancy leather goods, who contributed portfolios. The numerous specimens in papier-maché covers did not belong to Class XVII.

The manufacture of portfolios has reached a high degree of perfection in Germany, both as regards the outward appearance and the excellence of the workmanship. Offenbach is the principal seat of this manufacture in Germany. In the establishment of Messrs. Jacob Mönch and Co., 500 persons are employed. There is also a steam-engine of twelve-horse power. All kinds of small wares in leather goods are manufactured by Messrs. Mönch and Co. Messrs. De La Rue and Co., of London (p. 543), exhibited portfolios, registered under the name of "McCabe's," in a variety of sizes suitable for "The Times," "Athenæum," "Illustrated News," "Household Words," and other similar works. By means of this contrivance, single sheets, pamphlets, and books published in parts can be fastened in an easy manner, consecutively or otherwise, to form a compact mass as if bound, although they can be removed and again inserted at pleasure—an improvement on the ordinary files intended to contain newspapers and sheets of a similar description. Mr. T. Hood, of Red Lion Square (157, p. 547), had a handsomely-bound folio of a large size, and Mr. Rickman, of Wexford, Ireland (No. 194, p. 550), exhibited a folio to be attached to the wall; an ingenious plan, for the purpose of showing prints and drawings to advantage.

France.—M. Laurent, Rue Chapon (594, p. 1205), and Widow Schloss and Brother, of Paris (1480, p. 1247), had each some good specimens.

Zollverein.—M. C. Gebhart, of Berlin (1 Zollv., 248, p. 1061), had a portfolio in morocco and velvet, stamped in gold, and in relief, of excellent workmanship. M. Kuhn and Son (1 Zollv., 152, p. 1056), M. Mosmer (1 Zollv., 251, p. 1063), and M. Schmerbauch, of Berlin (1 Zollv., 264, p. 1063), and M. I. Selenka, of Brunswick (1 Zollv., 800, p. 1094), had all samples of an average quality. From Wurtemburg, M. G. Reichhold, of Stuttgard (39, p. 1117), deserves mention for a very fine specimen of good workmanship. MM. Shenk and Co., also of Stuttgard (177, p. 549), had a folio of fair quality. From Bavaria, M. Escherisch, of Munich (2 Zollv., 48, p. 1100), exhibited a folio of ordinary description. From the Grand Duchy of Hesse, M. H. Naenny, of Bergen (6 Zollv., 67, p. 1129), had a large folio in red morocco, beautifully finished and gilt: and from Offenbach the following makers, in addition to those already named, deserve mention as showing the advanced progress of this branch of manufacture: MM. Berge Brothers (6 Zollv., 60, p. 1129); MM. Haas and Co. (6 Zollv., 62, p. 1129); MM. Klein and Co. (6 Zollv., 86, p. 1129); M. Luettringhaus (6 Zollv., 65, p. 1129); and MM. Seeling and Becker (6 Zollv., 69, p. 1129).

Albums.—The manufacture of albums form an important item of fancy stationery, and admits of every variety of ornamental display in the bindings, from the cheapest to the most costly and elaborate descriptions. M. Habenicht, of Vienna (376, p. 1029), contributed three specimens, which were in the Queen's bookcase in M. Leisler's Austrian rooms. One in dark-blue velvet, with silver mountings; one in green, with delicately pierced work in ivory; and one in tortoiseshell, with gilt and silver inlaid embellishments. These very beautiful covers are from designs by Professor Raesner, and are of superior workmanship. The other exhibitors from Vienna were M. Rauh (369, p. 1028), M. H. F. Müller (372, p. 1028), and M. Neumann (373, p. 1028), who all had albums deserving commendation. From Berlin, M. Leisegang (1 Zollv., 149, p. 1056) exhibited an album in velvet, neatly gilt. M. Gebhart (1 Zollv., (248, p. 1061), M. Schoening (1 Zollv., 154, p. 1057), and M. Kuhn and Son (1 Zollv., 152, p. 1056) had specimens deserving mention, M. W. Beisser, of Kothen (1 Zollv., 748, p. 1091). had an album of coloured drawing-papers and a blotting-paper case, beautifully worked in velvet and gold. From Belgium, M. Parent (278, p. 1159) displayed Bevort's Album de Pomologie, containing written and illustrated descriptions of the most remarkable fruits. From Switzerland, M. Spolinger, of Schaffhausen (253, p. 1282), an album of wood-cuts, the designs by Swiss artists. From France, M. Godefroy, of Paris (1722, p. 1258), exhibited a beautiful album of the Society of Literary Men, containing a collection of drawings and autographs, and M. Pillaut had an album with neatly embroidered covers.

In the English Department Messrs. De La Rue and Co. (p. 543) displayed an assortment of albums in carved wood and in morocco, Russia leather, and velvet bindings. The tooling and gilding were produced by the combination of four hundred tools, engraved in a new style expressly for the purpose from designs by Mr. Owen Jones.

Pocket-Books.—This branch of trade was confined in London to some few makers of writing and dressing cases, ladies' work-boxes, plain blotting-cases, and pocket-books, till the year 1828, when a great stimulus was imparted to every branch of fancy stationery by Mr. De La Rue, who introduced many novelties and improvements, which created a demand for all descriptions of fancy leather goods, including many new varieties. There is now a considerable export trade* in these articles. The solidity of English workmanship in leather goods is proverbial; the men in the principal workshops take a pride in their work, securing good pay to themselves, and to their employers unrivalled superiority in the execution of their productions. The number of hands employed is now 468 men and 258 girls, in the following 14 towns, viz.: in London there are 308 men and 20 girls; in Sheffield, 47 men and 200 girls; in Birmingham, 50 men and 30 girls; in Manchester, 9 men; in Liverpool, 10 men; in Edinburgh, 15 men; in Aberdeen, 3 men; in Newcastle, 2 men; in Leeds, 9 men; in Halifax, 2 men; in Bradford, 3 men; in Dublin, 5 men; in Bristol, 3 men; and in Bath, 2 men. The principal English manufacturers in Class XVII. were Messrs. **DE LA RUE** and Co. (pp. 541—543), who contributed every variety of pocket-books, envelope-cases, card-cases, writing-desks in leather, velvet, and oak, solid sketch-books and drawing-blocks, despatch-boxes, wallets, blotting-cases, indelible diaries, and numerous other articles belonging to the trade of pocket-book manufacturers. Mr. **MECHI** (45, p. 791), in Class XXIX., contributed a large and elegant variety of dressing-cases, blotting-cases, and every description of goods appertaining to this branch. Mr. **SMITH**, Class X., had a case in the Main Avenue filled with a complete and elegant assortment of leather goods, consisting of desks, envelope-cases, blotting-cases, &c. &c. Mrs. **SCHLESSINGER**, of the Old Jewry, had some pocket-books, letter-clips, &c.

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* The English exports of stationery in 1851 amounted to 401,304*l.* This includes numerous small articles of manufactured leather goods.

France.—Widow **SCHLOSS** and **BROTHER** (No. 1480, p. 1247), whose manufactory in Paris is replete with presses, tools, and other appliances necessary for the production of porte-monnaies and similar leather articles, had a splendid assortment of well-manufactured goods in their *spécialité*.

CARTONNAGE-PAPER BOXES.—It is only within a few years that manufacturers in this country have adopted the mode of packing their goods in paper boxes. There is now a very large quantity of boxes manufactured in England, and although generally inferior in point of elegance to those made in France, some sorts are cheaper in England, notwithstanding the very high paper duty of 1½*d.* per lb. They are made principally in London, Manchester, Birmingham, Nottingham, Leicester, and other manufacturing towns, and, in Belfast, giving employment to a large number of hands.

In Paris four thousand persons are employed in the manufacture of paper boxes. The trade is divided into six distinct branches. The first comprises the most elaborately-finished and ornamental boxes, for the display of artificial flowers, rich velvets, ribbons, satins, silk trimmings, medals, miniatures, and *corbeilles* for wedding presents. The second class consists of boxes and small ornaments for confectioners. The third description is used for packing glasses, trinkets, and such goods as are sold at 25 sous (1*s.* 0½*d.*) Boxes for perfumery, for fans, gloves, &c., constitute the fourth branch. The fifth is chiefly applied to the manufacture of boxes for counting-houses, and large boxes for shawls and ribbons for exportation. The sixth and last comprises pill-boxes, wafer-boxes, and boxes for small wares. The *Cartonnerie* of Paris is superior to that of any other country, both as regards the neatness of execution, and the light and elegant style of ornamentation. There is also a description of *cartonnerie* manufactured at Bordeaux for fruit-boxes. The principal exhibitors from Paris were Madame **MAYERS** and Mr. **DOPTER**. From England, Mr. **TAYLOR**, of Nottingham, had a stall in the Machinery Department, where he exhibited a variety of paper boxes.

BLACK-LEAD PENCILS.—Plumbago (carburet of iron) is the substance known under the name of black-lead, although it contains no lead, the popular name having no other foundation than the lead colour which it imparts when traced upon paper. Beckmann states that black-lead pencils were in use in 1565. The best plumbago is produced from the Cumberland mines. The pits are situated on the Borrowdale mountains, ten miles from the town of Keswick. The whole produce of these mines is sent up to London, where it is sold at an auction held once a month, at a house in Essex Street, Strand. The produce of six weeks' annual working of these mines is said to be from 30,000*l.* to 40,000*l.*

Plumbago is found in the neighbourhood of Ronda, in Grenada, and near Malaga, in Spain, but it is hard and difficult to grind. The best substitute for Cumberland plumbago is that of Bohemia and Bavaria. It is also found at Rhodez (Aveyron), France. An inferior kind of plumbago is imported from Ceylon and Mexico.

In 1822 the late Mr. Mordan patented the application of plumbago in the form of very small cylinders, projecting from a cylindrical cone fitted to a pencil-case, which soon became in general use, and of which there are now many inferior imitations. Mr. Brockendon, of London, has since patented a mode of compressing the dust of plumbago, imparting to it nearly the same firmness and quality as when in its original state from the Cumberland mines.

The manufacture of black-lead pencils has been considerably improved within the last ten years. Partly by the purification of good plumbago, and partly by the admixture of other substances, good black-lead pencils are produced without Cumberland plumbago, at considerably reduced prices. The qualities necessary in a good lead pencil differ very much according to the purpose for which it is to be used; a deep black mark, combined with great softness, being required for some uses, and for others the greatest hardness, with the power of pressing lightly. The articles exhibited prove how completely manufacturers have met these requisitions, by the numerous fine specimens in more or less elegant settings.

Among the best English makers who exhibited were Messrs. **BANKS, SON**, and Co., of Keswick (96, p. 544), who had specimens of pure Cumberland lead and composition used in the manufacture of black-lead pencils, specimens of the various stages of manufacture, from the raw material to the complete pencil, and pencils in various style of finish. Mr. **MORELL** (58, p. 199A) exhibited combined mechanical appliances for the preparation of lead pencils. Messrs. **WOLFF** and **SON** (68, p. 128) had specimens of pure Cumberland lead; specimens of compressed Cumberland lead; specimens of Ceylon plumbago, as produced from the mine, and some prepared and compressed; specimens of Malaga plumbago, as produced from the mines, and also some prepared and compressed. Messrs. **ROWNEY** and **SON**, of Rathbone Place (Class I., No. 64, p. 128), Messrs. **BROOKMAN** and **LANGDON**, of Great Russell Street (Class I., 64, p. 128), Mr. R. **ADAIR**, of Maryport (Class I., 66, p. 128), and Messrs. **REEVES** and **SON** (Class I., 66, p. 128), also exhibited black-lead pencils. Mr. **BROCKENDON**, of Queen Square (Class I., No. 65, p. 128), exhibited plumbago from Cumberland, Ceylon, Davis' Straits, Spain, Bohemia, Greenland, California, and France.

France.—The well-known establishment of **GILBERT** and Co., in Giret (238, p. 1188), deserves mention. Sixty workmen, with an eight-horse steam-power engine, are employed in this establishment.

Zollverein.—The pencils exhibited by Messrs. A. W. **FABER** and **STEIN**, of Nuremberg (2 Zollv., 81, p. 1102), were of the best description, and the prices extremely low. They employ upwards of 300 workmen. They export their pencils to Italy, Paris, Vienna, America, Russia, Great Britain, and other places, the demand being created by cheapness and good quality. MM. J. J. **REHBACH**, in Regersburg (2 Zollv., 82, p. 1102), exhibited specimens of their pencils, well-known under the name of *Regersburg pencils*, fully maintaining their well-founded reputation. M. **BIRKMANN**, of Nuremberg (2 Zollv., 79, p. 1102), had some black-lead pencils of fair quality.

Austria.—MM. L. and C. **HARDMUTH** had some specimens of pencils of excellent quality.

The English exhibitors of black-lead pencils were not in Class XVII., and it was not until the Jury had nearly finished their labours that they were requested to examine these productions.

SEALING-WAX.—Wax appears to have been used in Europe for sealing since the earliest ages. It has been asserted that sealing-wax was invented by a Frenchman in 1640. Beckmann quotes that Francis Rousseau, having during the latter year of the reign of Louis XIII. lost all his property by a fire, in order to maintain his family, prepared sealing-wax from shell-lac, as he had seen it manufactured in India. By this article Rousseau is said to have gained 50,000 livres in a year.

Mr. Jonas, known under the name of Jones, was the first manufacturer of sealing-wax in England. He had an apprentice about 1780, called Champante, who much improved sealing-wax, and became known at the beginning of the present century as a celebrated sealing-wax maker. Messrs. Champante and Whitrow were long known as wholesale stationers and sealing-wax makers in Jewry Street, Aldgate, even within the last 40 years. All fine wax was then called "Dutch wax," and although made in England, it was stamped with a Dutch brand. Some sorts are still called Dutch wax, but this name denotes an inferior description. Sealing-wax is composed of the best shell-lac and Venice turpentine; the red is coloured with vermilion, and the black with the best ivory-black. Other colours are obtained by mixing with it different metallic oxides. The wax used for the Great Seal of England is made up according to a recipe kept in the Lord Chancellor's office. It appears to be composed of a compound of oils and balsams, and has a whitish appearance. The wax of the Great Seal and Privy Seal of Scotland has been manufactured by Mr. Waterston, of Edinburgh, for many years. It is made from resin and bees'-wax, coloured with vermilion. The Exchequer Seal is green. Seals made of soft wax, like that now used for the purpose, do not last, nor does this soft wax yield so good and clear an impression as if it were made with the best shell-lac. There was, in a small case in the Portuguese Court at the Great Exhibition, some sealing-wax bearing a close resemblance to that from India. Sealing-wax was common in Portugal about 1560, and is supposed to have found its way there from India. Neither the French nor the German sealing-wax is so strong in shell-lac as the English. Camphor does not appear to have been added in the manufacture of sealing-wax until the middle of the last century: there is only a small portion of camphor in the India wax. If camphor be used in the manufacture of wax, although it much improves the burning, it renders it unfit for use in foreign climates. Good impressions can be made with the finest red wax at a temperature of 140° Fahrenheit, whilst 170° is required for India wax. Charter wax, like that of the Great Seal of Scotland, can be sealed at 118°.

Shell-lac is bleached to a cream colour by chemical means, and sealing-wax is made with it of a variety of delicate shades. In the Great Exhibition the French and Belgian cases contained a variety in the most beautiful colours, got up with great care and taste. Mr. WATERSTON, of Edinburgh, exhibited the Charter wax, red and green, India and bottle-wax, and every variety of shell-lac wax, bleached, unbleached, embossed, and plain. The English manufacturers of sealing-wax have made great improvements within the last 15 years. The English vermilion being bright enables manufacturers of sealing-wax to impart great brilliancy to their wax. Messrs. HYDE, of Fleet Street, had some beautiful specimens in great variety. Mr. HENRY MORRELL, Fleet Street, exhibited various specimens illustrating the manufacture of sealing-wax, rough sealing-wax, sticks of sealing-wax moulded and partly polished, finished, and stamped; sealing-wax in packages and of various qualities. Messrs. COOKE and SONS, of Cannon Street, had specimens of coloured, embossed, and transparent sealing-wax, with various impressions. The EAST INDIA COMPANY had some specimens of India wax.

France.—MM. VINCENT and TISSERANT, Rue Michel-le-Comte, Paris (730, p. 1215), exhibited specimens of sealing-wax of good quality.

Belgium.—M. ZEGELAER (280, p. 1160) exhibited various coloured sealing-wax.

Portugal.—M. MANOEL RODRIGUEZ LATA, of Lisbon (p. 1314), had some sealing-wax of different colours, closely resembling India wax.

Zollverein.—M. T. MANUEL KOHN, of Main-Bernheim, Bavaria (49, p. 1100), exhibited specimens of sealing-wax.

Most of these exhibitors were not in Class XVII.; the Jury had nearly completed their examination when they were requested to examine sealing-wax exhibited by contributors out of their Class.

AWARDS.

The Jury have awarded a Council Medal to the IMPERIAL COURT AND GOVERNMENT PRINTING OFFICE OF VIENNA (Austria, 362, pp. 1025-1028), for their new processes in typography, galvano-plastic, and chemitypic printing: for the variety of their Oriental types, and perfect execution of the punches, as well as for the general excellence of the numerous specimens exhibited in stereotyping, electrotyping, printing, and bookbinding.[*]

Prize Medals are awarded to the following Exhibitors in the various departments of Class XVII.:—

ANGRAND, 59 Rue Meslay, Paris (France, 7, pp. 1169-1170), for general excellence in ornamental, coloured, and fancy papers.

ATKINSON, WILLIAM, dyer, Lamb's Passage, Finsbury, London (56, p. 541), for his superior finish of bookbinder's cloth.

BARRITT and Co., bookbinders, Fleet Street, London (196, p. 550), for excellence in binding Bibles and Prayer-books, and for the neatness with which every leaf of a folio Bible is ornamented with blue edging.

BARÈRE, B., engraver, 62 Rue Mazarin, Paris (France, 40, p. 1173), for his superior engravings by Collas' tracing-machine.

BESLEY, R., and Co., Fann Street, Aldersgate Street, London (195, p. 550), for the variety, beauty, and originality of their types.

BLANCHET BROTHERS and **KLEBER**, paper manufacturers, Rives (Isère), (France, 1090, p. 1230), for general excellence in their white and coloured papers.

BONE and **SON**, Fleet Street, London (62, p. 541), for cheapness and excellence in cloth bookbinding.

BROCKHAUS, F. A., printer and publisher, Leipzig (Saxony, 178, p. 1112), for his collection of three hundred and fifty-six volumes, the whole printed at his own establishment in the year 1850.

BRADBURY and **EVANS**, printers, Whitefriars, London (136, p. 545), for general excellence in various specimens of printing.

CALLAUD-BELISLE, NOUEL DE TINAN and Co., paper manufacturers, Angoulême (France, 788, p. 1218), for the good quality of various papers.

CASLON and Co., type-founders, Chiswell Street, Finsbury, London (78, p. 543), for the beauty and great variety of well-finished types.

CHIRIO and **MINA**, Turin, Sardinia (Sardinia, 89, p. 1305), for superior workmanship in a folio volume, the "History of Hautcombe Abbey," with woodcuts and other borders, also for some printing materials.

CLARKE, J., Frith Street, Soho, London (68, p. 541), for various specimens of bookbinding; the hand-tooling of which is well-executed, with great solidity in the forwarding. Some tree-marbling on calf leather is carried to great perfection.

CLAYE, J., printer, 7 Rue St. Benoit, Paris (France, 798, pp. 1218, 1219), for superior workmanship in woodcut and other surface printing.

CROSS, G., 2 New Coventry Street, Leicester Square, London (88, p. 543), for a new mode of fastening the leaves of scrap-books without guards.

CUSSONS and Co., dyers, Bunhill Row, Finsbury, London (69, p. 541), for their bookbinders' cloth; the crimson and ultramarine blue are bright and beautiful, and show a marked advance within a few years in this important branch of manufacture.

DEWDNEY, J., Collumpton, Devonshire (143, p. 546), for the excellence of his writing papers, and also for the permanent dye of his blue papers for the use of starch manufacturers.

DERRIEY, M., type-founder, 8 Rue Notre-Dame-des-Champs (185, p. 1183), for his improved music types and flourishes, and for the perfection of various founts exhibited.

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[*] The following resolution was moved by M. Didot, seconded, and unanimously passed by the Jury, at the sitting of the 21st of June 1851:—

"That the following paragraph be inserted in their Report—

> "That the Jury regrets that the position of Mr. DE LA RUE, as a Juror, has not allowed this Jury to recommend that the Council Medal be awarded to him, which in their opinion he so justly deserves, both as an inventor of acknowledged distinction, and for having exhibited a great number of specimens of general stationery and playing cards, among which the Jury has specially noticed the papers of Mr. Richard Turner, of Chafford, Kent."

Decker, R. L., printer, Berlin (Prussia, 148, p. 1056), for his Oriental and other types; for the excellence of his printing, as exemplified in a large folio New Testament, and in the works of Frederick the Great, all of which are well got up, the paper, type, and ink, being of the best quality.

Drewsen and Sons, Silkeborg, Jutland, Denmark (Denmark, 4, pp. 1355, 1356), for a specimen of cream-laid writing-paper, well-glazed, in long lengths.

Desrosiers, A., printer, Moulins (Allier), (France, 817, p. 1219), for general excellence, as exemplified in six volumes exhibited; a remarkable specimen of good printing, considering the disadvantages a printer labours under in a country town.

Doumerc, E., the Joint-Stock Paper-making Company of the Marais and Ste. Marie Paper-Mills, Jouy, St. Morin, Seine-et-Marne (France, 822, p. 1220); depôt, 3 Rue du Pont de Lodi, Paris; for the excellence of printing, writing, and drawing machine-made papers.

Dowling, H., Van Diemen's Land (Van Diemen's Land, 331 and 333, p. 999), for a specimen of Tasmanian printing, as shown in the Tasmanian Calendar and Tasmanian Journal.

Dupont, P., 55 Rue de Grenelle-St.-Honoré, Paris (France, 181, p. 1182) for superior skill in producing fac-similes of old books, and for general excellence in printing.

Duzoglou, Messrs., Smyrna (Turkey), for excellence in writing-papers.

The East India Company (p. 917), for their valuable collections of India paper.

Ebart Brothers, paper manufacturers, Berlin (Prussia, 145, p. 1056), for general excellence in papers, glazing-boards, carton-pierre for roofing, and paper with water-marks for bank-notes.

Egypt, His Highness the Viceroy of (Egypt, 248, 374, pp. 1410, 1411), for a collection of one hundred and sixty-five volumes of books, printed in the Arabic, Persian, and Turkish languages, at Boulac, near Cairo, and likewise for a catalogue of all the books published in Egypt.

Evans, J. S., bookbinder, Berwick Street (8, p. 537), for the clean and superior finish of his binding in white vellum, and the general excellence of the various specimens exhibited.

Faber, A. W., pencil-maker, Stein, Bavaria (Bavaria, 81, p. 1102), for the perfection of his black-lead pencils, for sketching, engineering, and architectural purposes.

Fisher, J. H., Hoxton (10, p. 537), for a new and ingenious mode of printing from copper-plate in two colours at one operation, with a peculiar ink, which resists water, but is altered by the usual chemical reagents, and which may be usefully applied to the printing of bank-notes and cheques.

Figgins, V. and J., type-founders, West Street, Smithfield, London, (124, p. 545), for the excellense and beauty of their types, and for the care bestowed in the finishing to insure correct justification.

Fischer, C. F. A., paper-maker, Bautzen, Saxony (Saxony, 168, p. 1112), for the excellent quality of his plate, lithographic, printing, and writing papers; the engine-sizing of the writing-papers is very superior. A specimen of a large machine-made millboard, 1 inch thick, 3 feet wide, and 6 feet long, deserves special notice.

Gaymard and Gérault, 10 Rue Montmorency, Paris (France, 518, p. 1203), for their specimen of ledger binding. The large ledger in rough calf contains no less than one thousand ruled leaves, is well bound, opens very freely, and is a specimen of excellent work.

Gilbert and Co., pencil-makers, Givet, Ardennes (France, 238, p. 1188), for the excellence of their pencils.

Godin, I. L., and Son, paper manufacturers, Huy (Liège), (Belgium, 284, p. 1160), for a large variety of printing, writing, and drawing papers, in all of which great perfection is attained.

Habenicht, A., bookbinder, Vienna (Austria, 376, p. 1029), for general excellence in bookbinding and in porte-monnaies, and leather goods of a similar description.

Hardtmuth, L. and C., pencil-makers, Vienna (Austria, 381, p. 1029), for the good quality of their pencils.

Hanicq, P. J., Mechlin (Belgium, 285, p. 1160), for his large collection of printed books, combining cheapness with good workmanship. His liturgies in red and black deserve notice.

Haase, G., and Sons, printers and type-founders, Prague (Austria, 367, p. 1028), for the general excellence of their types and printing.

Hayday, James, bookbinder, Little Queen Street, London (106, p. 544), for his superior workmanship, exemplified in the books exhibited by Messrs. Cundall and Addey.

Herrick, J. K., stationer, New York (United States, 502, p. 1466), for his superior ruling of account-books.

Honig, B. C. and I., Zaandyk, Netherlands (Netherlands, 59, 60), for specimens of superior parchment, and the excellence of their double elephant writing paper.

Howe, S. G., Boston, United States (United States, 439, p. 1463), for superior characters for the blind, of an angular form, without capitals; this system is more simple than any hitherto attempted, and easier to distinguish by the touch.

Hosch and Sons, paper manufacturers, Duren (Prussia, 392, p. 1072), for the cheapness and perfection of their white and coloured writing and tissue papers, among which the black and rose-colour are of peculiar brightness.

Hyde and Co., sealing-wax manufacturers, Fleet Street, London (21, p. 537), for the general excellence of their wax, some of which is said not to soften under a temperature of 120° Fahrenheit, and is therefore adapted for hot countries, as at this temperature it still retains the seal impression.

Joynson, William, paper-maker, St. Mary Cray, Kent (42a, p. 540), for the superior quality and finish of his writing papers.

Ionghaus and Venator, Darmstadt, Grand Duchy of Hesse (Hesse, 6, p. 1126), for letter-press relief coloured maps. The different minerals of each district are shown by appropriate colouring. (Medal awarded in Class I.)

Lamb, J., paper-maker, Newcastle-under-Lyne, Staffordshire (147, p. 546), for excellence in the manufacture of pottery tissues.

Laboulaye, C., and Co., type-founders, 30 Rue Madame, Paris (France, 895, p. 1223), for great skill exhibited in the finish of their printing types.

Legrand, Marcellin, type-founder, 99 Rue du Cherche-Midi, Paris (France, 584, p. 1206), for the general excellence of his types; for his specimen of casting, wherein one hundred and forty letters are cast at once; for his collection of Chinese types; and for the beauty of various specimens exhibited.

Lacroix Brothers, paper-makers, Angoulême, and Rue Mazarin, Paris (France, 1636, p. 1255), for the great perfection of their writing papers.

Leighton, J. and J., bookbinders, Brewer Street, London (24, p. 538), for specimens of good binding in various stages; for the perfection with which they make fac-similes of missing pages to valuable works; and the care and finish which are conspicuous in all they have exhibited.

Lewis, Mrs., Duke Street, St. James's (163, p. 547), for excellence in bookbinding.

Lortic, P. M., bookbinder, 199 Rue St. Honoré, Paris (France, 1652, p. 1256), for the taste and execution displayed in the finish of several works, among which a folio volume, "Balbus de Janua," in an illuminated style, deserves particular mention. The firmness of the forwarding throughout the whole series of books exhibited by Mr. Lortic merits high praise.

Mauban and Vincent Journet, managers of the Joint Stock Paper-Making Company of the Souche, Vosges, and 5 Rue du Pont de Lodi, Paris (France, 377, p. 1195 and 619, p. 1207), for the general excellence of their printing-papers, and more particularly for the purity of their filtering-paper for chemical purposes, hitherto a great desideratum.

Mame and Co., Tours (France, 321, p. 1192), for the extreme cheapness and great variety of books printed, bound, and published by them. Amongst others, "Le Paroissien Romain," 18mo, 636 pages, in Latin and French, neatly printed, with a vignette border to every page, in boards, is published at "one shilling."

Mayer, Madame T. (France, 624, p. 1207), manufacturer of fancy ornaments for confectioners, 22 Rue de la Vieille Monnaie, Paris, for general excellence.

Miliani, P., Rome (Rome, 12, p. 1285), for the high quality of his hand-made plate and writing papers.

Mönch and Co., Offenbach, Grand Duchy of Hesse (Grand Duchy of Hesse, 66, p. 1129), for general excellence in porte-monnaies, pocket-books, and dressing-cases.

Montgolfier, paper manufacturers, Paris (France, 324, p. 1192), for the general excellence of their paper, and for their imitation of parchment, adapted, among a variety of other useful purposes, to gold-beating, instead of the skin usually employed by gold-beaters.

National Printing Office (France, 544, p. 1204), for the variety of Oriental and other types, and for the beautiful execution of their specimen book, in which great taste is displayed: also for the elegance of the three Oriental volumes—"Le Premier Livre des Rois," the first volume of "L'Histoire des Mongols," and the first volume of "Bhagavata Purana," with border round every page in gold and colours. The ultramarine blue, printed as an ink, direct from the type, is pure and bright.

Niédrée, J. E., Passage Dauphine, Paris (France, 665, p. 1211), for his beautiful specimens of bookbinding, in which taste, elegant finish, and solidity are combined.

Odent, Sons, and Co., Courtalin, Seine-et-Marne (France, 938, p. 1225), for general excellence in a variety of papers, and also for their paper called animal parchment.

Palsgrave, J. T., Montreal, Canada (Canada, 189, p. 968), for a large and well-formed collection of printing types, cast at Montreal.

Plon Brothers, printers, 36 Rue de Vangirard, Paris (France, 1395, p. 1243), for superior execution in different descriptions of woodcut and other printing.

Rauch Brothers, paper-makers, Heilbronn, Wurtemburg (Wurtemburg, 44, p. 1117), for the excellence, good colour, and strong sizing of their writing-papers, and for their two-sided veneered opaque papers.

Remnant, Edmonds, and Remnant, Paternoster Row, London (5, p. 537), for general excellence in design and workmanship, and novel application of materials in bookbinding.

Riviere, R., bookbinder, Great Queen Street, London (89, p. 543), for superior workmanship and finish in bookbinding.

The Rubeland Ducal Foundry Inspection at Prussia (780, pp. 1093, 1094), for specimens of stereotype plates in iron, and for the Bible printed therefrom.

Saunders, T. H., of Dartford, Kent (36, p. 539), for a novel style of ornamental water-mark on paper, the water-mark giving gradations of shades. It was suggested by Mr. Oldham, of the Bank of England, at whose request Mr. Saunders applied it in the manufacture of paper.

Schaeuffelen, G., paper-maker, Heilbronn, Wurtemburg (Wurtemburg, 41, p. 1117), for the cheapness and good quality of his plate, printing, writing, and tissue papers. The water-mark is said to be put on dry, by a peculiar process, after the paper is made.

Schloss, Widow and Brother, 15 Rue Chapon, Paris (France, 1480, p. 1247), for superiority in a large collection of porte-folios, porte-monnaies, porte-cigars, and other leather articles.

Schreiber, J. C. G., paper manufacturer, Merseburgh (Prussia, 783, p. 1194), for his enamelled cardboards and paper, and for the general excellence of the various articles exhibited.

Sinclair, Duncan, and Son, Edinburgh (92, p. 543), for the general excellence of their specimen of printing types.

Silbermann, G., Strasbourg (France, 374, pp. 1194, 1195), for his specimens of surface printing in colours, and general excellence in the various productions exhibited by him. (Medal awarded in Class XXX.)

Smith and Meynier, Fiume, Austria (Austria, 360, p. 1024), for their specimens of well-made writing-papers.

Sœhnée Brothers, Paris (France, 580, p. 1195), for their superior bookbinders' varnish.

Spicer Brothers, wholesale stationers, New Bridge Street, London (42, p. 540), for their collection of papers, showing the present state of the paper manufacture of England.

Stephenson, Blake, and Co., type-founders, Sheffield (182, p. 549), for general excellence.

Thomas and Sons, Cornhill, London (44, p. 540), for account-books, combining great solidity and excellence in paper, ruling, and binding.

Vargounin and Brothers, paper-makers, St. Petersburgh (Russia, 260, 302, p. 1375), for the excellence of their writing-papers.

Venables, Charles, Clifden and Soho Mills (with 149, p. 546, Class XVII.), for the superior quality of plate, lithographic, and other printing papers.

Venables, Wilson, and Tyler, Queenhithe, London (149, p. 546), for the assistance they have afforded the Jury by their ample collection of specimens of paper from the principal manufacturers of the United Kingdom, and for the cheapness of the printing papers of their own manufacture.

Venables, George, paper-maker, Cookham Mills, near Maidenhead (with 149, p. 546, Class XVII.), for the good quality and strength of his wrapping-papers, more particularly that which is used for paper bags.

Vieweg and Son, printers, paper-makers, and type-founders, Brunswick (Prussia, 822, p. 1095), for the great variety of useful publications.

Waterston, George, sealing-wax manufacturer, Edinburgh (93, p. 543), for the great excellence and brightness of his sealing-wax.

Westleys and Co., bookbinders, Friar Street, London (111, p. 544), for superior workmanship in the finishing of a folio Bible, in green morocco, illuminated edges.

Westley, J., bookbinder, Playhouse Yard, London (48, p. 540), for general excellence in bookbinding.

Williams, J., account-book manufacturer, Bucklersbury (53, p. 541), for the solidity and superior manufacture of a large ledger with iron back.

Wright, J., bookbinder, Noel Street, Soho, London (139, p. 545), for beauty of execution in vellum and morocco, in blind-tooling and gold, and for superiority in forwarding.

The Jury desire to make Honourable Mention of the following Exhibitors:—

Bancks Brothers, paper-makers, Chesham (96, p. 544) for an improvement in the water-mark in paper.

Banks, Son, and Co., pencil-makers, Keswick, Cumberland (Class I., 69, p. 129), for black-lead pencils.

Barker, J., Bexley Heath, Kent (189, p. 550), for specimens of type-metal casts from wooden matrices, applicable to calico and other printing.

Barbat, M., Châlons-sur-Marne (France, 1067, p. 1229), for letter-press and lithographic printing.

Batten, D., Clapham Common (59, p. 541), for various specimens of bookbinding.

Battagia, G., Venice (Austria, 366, p. 1028), for some specimens of typography, with simple and convenient binding.

Bemand, R., parchment-maker, Courtrai, Belgium (Belgium, 478, p. 1166) for various specimens of white and coloured parchment.

Berthault, M., parchment manufacturer, Issoudun (Indre), (France, 56, p. 1174), for specimens of various descriptions of vellum and parchment. (Prize Medal awarded in Class XVI.)

Berge Brothers, Offenbach, Grand Duchy of Hesse (Hesse, 60, p. 1129), for cigar cases, leather purses, and other articles of a similar description.

Berger, C. H., Vienna (Austria, 380, p. 1029), for the great variety of wafers in paper and gelatine.

Bondon, L., 5 Rue Grange-aux-Belles, Impasse St. Opportune, Paris (France, 63, p. 1174), for specimens of enamelled paper.

Bradley, B., and Co., bookbinders, Boston, United States (United States, 473, p. 1465), for cloth binding and block gilding.

Briard, J. H., Ixelles, Belgium (Belgium, 277, p. 1159), for printed Bibles and Testaments.

Callaghan, Mr., Attorney-General, New South Wales (4, p. 989), for a volume printed from types cut and cast in Sydney, and printed by John Rowe.

Cundall and **Addey**, booksellers, 21 Old Bond Street (106, p. 545), for a specimen book cover in pierced metal.

De Serlay, C. G., paper-maker, Gueurs, Seine-Inférieure (France, 1484, p. 1247), for a variety of tinted papers.

Dufour, L., Boulevard Beaumarchais, Paris (France, 483, p. 1201), for his specimens of gold, silver, and other fancy papers.

Dopter, J. V. M., 58 Rue de la Harpe, Paris (France, 1194, p. 1234), for his specimens of lace and other fancy papers.

Enschede and **Sons**, Haarlem, Netherlands (Netherlands, 79 and 109, p. 1146), for printing-types and stereotype plates.

Farina, A., Turin, Sardinia (Sardinia, 47, p. 1304), for small punches and types.

Flechey, J. B., paper-maker, Algiers (Algiers, 24, p. 1261), for cigarette and other papers manufactured from the leaves of the dwarf palm-tree.

Freund, E. A., Offenbach, Grand Duchy of Hesse (Hesse, 38, for a variety of enamelled card-boards and paper.

Gassett, H., Boston, United States (United States, 420, p. 1462), for vellum bindings and ruling.

Gauthier, jun., 14 Rue de la Parcheminerie, Paris (France, 234, p. 1187), for brass letters for the use of bookbinders.

Gillot, M., 8 and 10 Rue du Chevalier du Guet, Paris (France, 522, p. 1204), for a new method of etching plates for surface printing.

Glenisson and **Vangenechten**, Turnhout, Belgium (Belgium, 286, p. 1160), for cheapness in cardboards, and marbled and surface-coloured papers.

Graf, H., bookbinder, Altenburg (Prussia, 746, p. 1091), for block gilding on the covers of a large folio altar Bible.

Grangoir, J. M. (France, 1256, p. 1237), for locks for pocket-books.

Gruel, Madame, 10 Rue de la Concorde, Paris (France, 857, p. 1221), for bookbinding with carved ivory and wood, and inlaid morocco, &c.

Guesnu, M., 70 Rue du Temple, Paris (France, 250, p. 1188) for numerous specimens of ornamented paper and stationery.

Haas and Co., Offenbach, Grand Duchy of Hesse (Hesse, 62, p. 1129), for pocket-books, porte-monnaies, and other leather goods.

Haenle, L., Munich, Bavaria (Bavaria, 47, p. 1100), for burnished gold and other ornamental papers.

Haënel, E., Berlin (Prussia, 284, p. 1065), for various matrices, types, and printing.

Heyl, J. F., and Co., Berlin (Prussia, 44, p. 1050), for transparent wafers.

Hider, **Elizabeth**, 15 Manor Place, King's Road, Chelsea (17, p. 537), for fancy floral ornaments, as applied to valentines.

Hirschfeld, J. B., Leipsic, Saxony (Saxony, 180, p. 1113), for coloured surface printing.

Hulot, A., Hotel des Monnaies, Paris (France, 882, p. 1222), for impressions from relievo engraved plates.

Jamar, A., Brussels (Belgium, 444, p. 1165), for his specimens of illustrated books and for woodcuts.

King, T. and J. H., Bartlett's Buildings, Holborn Hill, London (22, pp. 537, 538), for their new type music.

Knight and **Hawkes**, 13 Clerkenwell Green, London (107, p. 544), for stereotyping.

Koch, C. A., Gladbach (Prussia, 329), for writing and plate papers.

Kuhn, C. and **Sons**, Berlin (Prussia, 152, p. 1056), for a collection of portfolios, pocket-books, albums, and porte-monnaies; and also for ruling for account-books.

Lebrun, L. J., 126 Rue de Grenelle St. Germain, Paris, (France, 906, p. 1223), for bookbinding.

Leisegang, W., bookbinder, Berlin (Prussia, 149, p. 1056), for a specimen of block-gilding on velvet.

Leighton and **Son**, Harp Alley, Shoe Lane (158, p. 547), for bookbinding.

Liepmann, J., Berlin (Prussia, 147, p. 1056), for an ingenious mode of producing several impressions from a mass of colour in which the various gradations of tint are an inch or more in thickness, and which, on being moistened with oil and subjected to pressure, yields successive copies of the subject represented.

Macomie, A., and Co., bookbinders, 6 Percy Street, Bedford Square (26), for their specimens of binding.

M'Adams, J. and W., Boston (United States, 482, p. 1465), for ruling account-books, and for some circular ruling.

Manchin and **Morel**, 8 Wilson Street, Gray's Inn Road (128, p. 545), for novelty in the application of bitumen to the purpose of stereotype.

Martin, J., London (29, p. 539), for a new mode of sizing paper, by which it is stated to be rendered waterproof.

Marion, A., stationer, 14 Cité Bergère, Paris (France, 609, p. 1207), for a general assortment of fancy, ornamental, and plain paper and stationery.

Meillet and **Pichot**, Poitiers (France, 629, p. 1208), for their postage and other stamps. They exhibit a paper which they state precludes the possibility of forgery.

Meyer, E., 2 Rue de l'Abbaye, Paris (France, 637, p. 1208), for his specimens of printed designs in fifty colours, from surface-blocks, in imitation of Berlin patterns.

Miller and **Richard**, letter-founders, Edinburgh (150, p. 546), for a specimen of ruby type, in which "Gray's Elegy" is printed, thirty-two verses in two columns, occupying only three and three-quarter inches in length.

Morell, H., Fleet Street (Class IV., 58, p. 199*), for wax and wafers.

Néraudeau, J. A., 16 Rue des Fossés Montmartre, Paris (France, 661, p. 1209), for ledger binding.

Obry, **Bernard**, and Co., Prouzel, near Amiens (France, 334, p. 1193), for black and other papers.

Piette, L., paper-maker, Dillingen (Prussia, 394, p. 1072), for various papers.

Pinches and Co., 27 Oxendon Street, London (33, p. 539), for specimens of stamping in relief on envelopes and writing-paper.

Piques, —, Velars-sur-Ouche, Côte d'Or, (France, 1393, p. 1243), for pasteboards.

Rehbach, J. J., Regensburg, Bavaria (Bavaria, 82, p. 1102), for black-lead pencils.

Reichhold, G., Stuttgard, Wurtemburg (Wurtemburg, 39, p. 1117), for fancy leather goods, porte-monnaies, &c.

Regeer, H. J., Rotterdam (Netherlands, 112, p. 1149), for bookbinding.

Révillion, letter-founder, St. Petersburgh (Russia, 361, p. 1383), for a specimen of printing, and also for his Greek, Oriental, and other types.

Rometsch, C., Stuttgard, Wurtemburg (Wurtemburg, 73, p. 1109), for a substitute for writing slates.

Royston and **Brown**, Old Broad Street, London (34, p. 539), for ledgers and other account-books.

Schüll, L., paper-maker, Duren (Prussia, 393, p. 1456), for white and tinted papers.

Sibell and **Mott**, New York (United States, 339, p. 1212), for their specimens of account-books.

Simier, J., 38 Rue de l'Arbre Sec (France, 693, p. 1212), for bookbinding.

Starke and Co., Montreal, Canada (Canada, 191, p. 968), for specimens of ornamental printing.

Starr, C., New York (United States, 88, p. 1438), for binding works for the blind, with thickened margins to prevent the embossing from being pressed out. The specimens exhibited are said to have been bound by the machines, 88, United States Department.

Turnbull, J. L. and J., Holywell Mount, Shoreditch, London (45, p. 540) for drawing-boards.

VANDERDORPEL and SON, 3 Rue Chapon, Paris (France, 712, p. 1213), for various articles of fancy stationery.

VINCENT and TISSERANT, 21 Rue Michel le Comte, Paris (France, 730, p. 1215), for sealing-wax, fancy wafers, and writing-inks.

WALKER, E., and Co., New York (United States, 123, p. 1441), for a Bible elaborately bound and ornamented, with a recess for a family register inside the covers.

WATERLOW and Sons, 66 London Wall (46, p. 540), for specimens of account-books.

WEBER, J. B., Offenbach, Grand Duchy of Hesse (Grand Duchy of Hesse, 43, p. 1128), for specimens of marbled papers.

WODDERSPOON, J., Portugal Street, Lincoln's Inn Fields, London (159, p. 547), for improvements in ledger binding, by the introduction of patent vellum cloth bands.

WOLFF, E., and SON, pencil manufacturers, 23 Church Street, Spitalfields, London (Class I., 68, p. 128), for crayons and pencils.

MONEY AWARDS.

The Jury have awarded the sum of 10*l.* each to the undermentioned workmen, as the most appropriate recognition of their skill and taste.

BUDDEN, E., bookbinder, Cambridge, exhibitor, (97, p. 544). The workman who bound an album, elaborately ornamented, in which taste and good work were displayed.

NEIL, R., journeyman bookbinder, North Bank Street, Edinburgh (91, p. 543), for the care, industry, and perseverance displayed in binding an imperial 4to Bible in cream morocco, under great disadvantages. The work was executed at his own home, after his daily occupation, by gas-light, in the winter; and notwithstanding these difficulties, a degree of excellence was attained.

A. FIRMIN DIDOT, JOINT REPORTER.
C. WHITTINGHAM, REPORTER.
T. DE LA RUE, JOINT REPORTER.

London, March 1852.

CLASS XVIII.

REPORT ON WOVEN, SPUN, FELTED AND LAID FABRICS, WHEN SHOWN AS SPECIMENS OF PRINTING OR DYEING.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers, and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

HENRY TUCKER, *Chairman*, 30 Gresham Street; Silk Manufacturer.
J. PERSOZ, *Deputy Chairman*, France; Professor of Chemistry at Paris; Member of Central Jury.
EDMUND POTTER, *Reporter*, Manchester; Calico Printer.
J. M. BEEBE, United States.
E. E. CHEVREUL, France; Member of the Institute; Professor and Director to the Museum of Natural History.
JOHN HARGREAVES, Accrington, Lancashire; Calico Printer.
ALEXANDER HARVEY, Glasgow; Dyer.
HENRY PAHUD,* Switzerland; Merchant.
C. SWAISLAND, Crayford, Kent; Printer.
Dr. W. SCHWARZ, Austria; Board of Trade, Vienna.

* **CHARLES BOVET**, Proxy for Mr. Pahud.

Associate Jurors.

— **MARNAS**, Lyons, France.　**SAMUEL SMITH**, Bradford.

THE Jury of Class XVIII., in accordance with their instructions, report as follows on the various specimens of printed goods placed in the Exhibition, the whole of which they have carefully and minutely examined. The productions of the English and Scotch printers came first under their observation. Ireland has now only one or two small print-works: she had some rather extensive ones within the last twenty years, but during that time they have been gradually closed. Before remarking on the present productions of the English and Scotch printers, the Jury can hardly help referring to the changes in the trade within the last-named period, dating from the repeal, in the spring of 1831, of the very heavy duty on printed cottons. The entire production of the trade in England and Scotland (Ireland paid no duty for home-consumption) was then, as shown by Parliamentary returns, rather more than eight million pieces per annum. The reduction of a duty amounting on the average to fifty per cent. gave an immediate impulse to the trade, and within ten years from that date it appears that the production of Great Britain was doubled. Since that period no materials exist which afford sufficient data for an accurate account of its progress; but it is calculated that the trade, which in 1830 produced eight million pieces per annum, now probably produces not less than twenty millions yearly. Great changes in style and taste would necessarily be consequent upon such an increase in quantity. Very great improvements have been effected in the material printed upon. The regularity and evenness of fabric, in calicos made by the power-loom, of all qualities down to the very cheapest, give the English printer a fabric for the use of the middle classes, which places him decidedly above the competition of the whole world in this most essential branch of his trade.

The impulse given to the trade, followed perhaps by excess of supply and strong competition, caused a great reduction in price. To meet this, machine-work was generally substituted for block-printing. The engraver was stimulated (here, too, machinery lent its aid), chemical discovery (English and foreign) was not wanting, and the result was a large and cheap supply, chiefly of fine class plate-work, beautifully and exactly executed; or in one, two, three, or four colours, in permanent madder-work; as well as in a larger number of colours, printed at once in more showy and fugitive steam-colours.

These changes led to the encouragement of a less showy taste than that for chintz block productions, and to a preference for goods of a more elegant and quiet character. Some of the staple productions, such as the navy-blue print, largely consumed for domestic wear throughout the country, almost entirely disappeared, being superseded by the very general use of the purple madder prints.

It should be observed that at this date the English printer borrowed extensively from the style of his French competitors. The printers of the then called Swiss prints (really French goods, produced in Alsace) were unrivalled in their pink and purple machine work. These articles, even for years afterwards, were imitated successfully by a few only of the first-class English printers; whereas now the progress of the trade in scientific knowledge, so patent to all, has enabled almost every printer in England and Scotland to produce them more or less successfully.

These goods, which were exported by the French, and met with in almost every capital city of the world, are now supplied in much larger quantities by the English printer, and to them has been added the supply of a new and increased variety of low-priced prints of a similar class. It is an interesting and curious fact, that the taste in almost every market has changed and improved with the reduction of price.

The English printer has also drawn largely upon his French rival during the same period, for another trade which he has likewise, by the aid of the manufacturer and his machinery, done much to make his own. France has long been famous for her beautiful fabrics in fine wool, in wool and silk challés, and in delaines. These expensive and costly goods, made of the finest wool, and requiring great care in execution, have been produced with a taste in colouring and design worthy of the beauty and elegance of the material. With them, France supplied and led the taste of all the civilized markets of the world. An article so costly was naturally of limited demand. The capital and machinery of the English printer have, then, been brought to bear on this branch of the business. Cotton has been introduced into the fabric, and a beautiful substitute, at a low price, replaces the more costly all-wool material of our neighbours; thus obtaining the desired cheapness and beauty. Block-printing on this material (the English wool and cotton-de-laine) was for some time the only mode adopted; but machinery has since been adapted to it; and the English printer now offers it at a low price, in every market, and creates a demand which the high-priced one would never have known. The cheaper article has brought with it no corresponding declension in taste: quite the contrary, the greater demand, and the increased power of execution obtained by machinery, have led to various novelties in style.

The English printers have naturally exhibited such articles as they thought would look best in an Exhibition, and be best appreciated by the public. This in a great degree accounts for the absence of the large variety of those cheaper printed goods which form, after all, the great bulk of the English print trade—the staple one, by which she commands almost exclusively all neutral markets, and maintains her position for superiority and cheapness of produce.

Some opinion will be expected from the Jury as to the causes of superiority in the *finer* classes of French goods.

England received the art of calico-printing from France at the end of the seventeenth century, derived previously by the latter from Central Germany, which had been for some time the seat of the art, originally obtained from Egypt and the East. The trade was first introduced into the neighbourhood of London; but after a period of about sixty or seventy years it gradually decreased there, and yielded to the competition from the then newly-established works in Lancashire, which were aided by cheaper fuel and labour. These assumed an importance as they extended themselves, in printing on the newly-discovered fabric of cotton calico, just becoming the staple manufacture of that county. A few print-works yet remain in the neighbourhood of London, employed chiefly on very fine shawl and silk-handkerchief printing. The English printer, encouraged by his abundance of fuel, cheap labour, and facility for obtaining the largest supply of calico, has naturally fostered a trade suited to his machinery and capital, which is a complete contrast to the very different class best suiting the French printer to produce. The more limited and costly branch of the trade has naturally found its chief market in France. Paris has ever led the fashion of the world in female dress, and fashion has only a remote influence on inferior classes of goods. France is well supplied with cheap and skilful hands, well practised in the manipulation of fine and delicate fabrics upon which machinery cannot so well be brought to bear—in some measure, perhaps, because the demand does not repay a large outlay. Singularly enough, that country having the superiority in production in fine goods, possesses also an advantage over the British printer in demand, having our market *free* for her goods, whilst the English is prohibited from hers, and is denied the advantage of manufacturing for French taste and consumption.

The French, in proportion to their productions, supply much more largely for the highest class—a class, be it remembered, influenced by fashion, eager for novelty, and tempted by variety. The English supply, in proportion to their production, much more largely for the wear of the middle and lower classes all over the world, many of whom have conventional and national peculiarities of garb not easily affected by novelty. Hence arises the very natural distinction between the tastes of the two nations. It will be admitted, perhaps, that in every article owning the influence of taste, much greater advance has been made of late in the productions suited for the use of middle class-consumption, and upon which the beautiful accuracy of mechanical skill has been brought to bear, than in the higher class of goods, in which manual labour is still chiefly used. The blocked muslin of to-day is no better in taste, and but little so in execution, than the specimens of a hundred years ago.

Without referring to the samples shown by any particular British Exhibitor, the Jury consider that there are to be found amongst them very fine specimens of work and taste in barèges, in woollen fabrics of different kinds, and in muslin goods,—very good first-class work in blocked de-laine goods (the woollen and cotton fabric), equalling, perhaps, in brilliancy of colour, any specimens (either of British and foreign goods) printed on wool alone, showing a triumph of art justly due to the English printer, viz., the giving an equally sound colour on a mixed fabric, composed of vegetable and animal substances. Choice specimens of machine-work on de-laine, in four, five, and six colours, are shown in some of the collections,—various assortments of the staple calico print trade, in madder-work, permanent and bright in colour, together with specimens of garancine dyed goods, in variety of machine work, all displaying considerable advance in taste, neatness of pattern, and execution; being fine specimens both of engraving and printing, and well representing the regular and standard productions of the houses exhibiting them. In the lower class of cheap machine-work, though an equally valuable branch of manufacture, as supplying a most extensive trade both for home and export, the Jury regret (owing to reasons they have before assigned) that no specimens are exhibited.

Some few good samples of English furniture-prints are shown. Perhaps it may be affirmed that this is a decreasing trade (except in very low goods for export, of which there are no specimens); and that woven damasks of considerable beauty, and comparatively cheap in price, have in some degree superseded the use of calico printed furniture.

A fact indicating the change in the English print-trade, before alluded to, may here be noted as further corroborating its progress in chemical science and machinery within the last twenty years. It will be admitted by the older members of the trade, that had there been an Exhibition in 1831 of English prints, it would have consisted chiefly of fine first-class blocked madder-work, and been confined to the productions of a few printers, who at that time stood far in advance of their brethren. In 1851 the Exhibition shows scarcely a specimen of block-work on calico, but a great variety of ingenious machine-work by a number of first-class printers.

Special reference is made to the variety of specimens of Turkey-red printed and dyed fabrics, in the English, French, and almost all the continental assortments. Originally, as the name implies, it was a Turkish red, produced at Adrianople. Its brilliant and permanent colour secures for it a steady consumption in many markets, and a high average of excellence is shown in its production.

Another branch of the print trade, which has its chief seat in the neighbourhood of London, though also pursued in Lancashire, Cheshire, and Scotland, is that of printed silk handkerchiefs. This, too, is originally of eastern origin, and is still an article of considerable import, both in the Corah cloth (the grey for printing upon), and in the finished printed Choppah and dyed Bandanna. Great changes have taken place in the relative imports: that of the printed handkerchief having gradually decreased in the last sixteen years to about one-fifth, whilst the import of the Corah has nearly trebled, an equal quality of the same description of cloth, and also an inferior one, being largely made in England—showing in this article, also, a progressively-increasing print manufacture.

This trade has been carried on for some years in Germany; but that country consumes chiefly English goods. France, too, within the last few years, has striven to establish a trade in printing these goods, and has made some progress in the inferior descriptions: previously she was indebted to this country (from which she still continues to import) for them. Selections are shown in the British department, excellent alike in fabric and execution, and embracing every variety of style in a trade demanding a regular supply, from the old imitation oriental colouring and patterns, to the fancy picture handkerchief, delineating in the present instance, as its latest novelty, variously-tinted representations of the Crystal Palace.

The remarks of the Jury on the English print-trade naturally include so many references to the state of the

French, as to limit very materially the separate notice which, from its importance, the latter demands.

The Jury have alluded to the high excellence shown in the finer goods of France. The absence of all middle and lower class French prints in the Exhibition, in fact of any specimens of the productions of the city of Rouen, is remarkable, as confirming the views already expressed. The French printer has not the advantage of cheap and well-made calico: he is debarred by cost from the advantages of extended foreign markets.

The Jury refer with pleasure to the contributions made by the French printers to the Exhibition, and commend the superior taste with which they are arranged—a taste doubtless improved by the experience they have acquired at the periodical French Exhibitions.

The character of the French goods, of course, differs from that of the English, as, being more confined to the expensive class, the taste is necessarily of a higher order, and therefore presents a display more striking to the general observer. The Jury refer especially to the very fine printed furnitures, exquisite alike in taste and execution; to some very beautiful dresses of difficult and elaborate block-work on all-woollen fabrics; and to the general assortment of finer cotton prints, varying in some degree from similar English prints of the same class, because produced on finer and more costly cloth. Here, as in the English department, the entire absence of all lower-class goods, suitable to the wear of the artizan and peasant, is to be regretted.

The Jury notice beautiful specimens of *yarn-printed silks*, printed on the warp thread before weaving—an article among the finer silk goods which is well adapted for displaying that beautiful arrangement of colour and design, for which France is so justly celebrated. One or two specimens of printed silk handkerchiefs are shown, more especially referred to in the report on English goods of the same class.

Some statistical remarks on the progress of the French print-trade would have been introduced here, but the Jury regret that they have not been able to obtain any official information on the subject. Holding the first rank in taste, and second in amount of production, of the European nations, the progress and state of the French trade must form an interesting subject of inquiry.

The Jury would next allude to the interesting contributions from Switzerland, presenting excellent specimens of muslin and calico work, block and machine, some of them unsurpassed in execution by any in the Exhibition. They are specially worthy of notice as the manufactures of a country which first ventured to rely upon natural protection alone. Till within the last twelve months, Switzerland had no duties on imported prints; latterly, however, she has imposed a small fiscal one of about 2½ per cent. There is reason to believe that the houses producing these goods have successfully introduced them, for years past, in competition with French and English, into various neighbouring markets in Central Europe.

The printed goods from Russia, Prussia, Austria, the Zollverein, Hamburg, Sardinia, Portugal, Turkey, and the United States of America, exhibit fewer varieties of production, of unequal merit, and each prepared chiefly for their respective markets.

The Egyptian contribution of printed goods is curious, as presenting nearly the rudest modern manufactures, the products of English machinery, and partly of English workmen; exhibiting the germs of the revival of a trade in a country which certainly possessed the art of printing and dyeing mordanted colours 1800 years ago.

The last and most inferior specimens of printing are those of Central India, exhibited by the East India Company. They deserve attention as the productions of a country the most ancient in the history of the print-trade, and which, 130 years ago, contributed nearly all the fine printed chintzes then worn by the higher classes, which so much superseded the use of other fabrics, as to excite a popular feeling against them and all printed goods; so that the Government of the day, yielding to the clamour, actually passed an Act through Parliament, prohibiting the wear of all printed calicos whatever,—an Act which disgraced the statute-book for ten years.

One fact, highly creditable to the character of the Exhibition, and the Exhibitors of printed fabrics, the Jury would wish to state. They believe that amongst the variety of British and foreign printed goods, there are not to be found any specimens prepared specially for the Exhibition, or for show merely, but only such selections from the work of each house as honestly represent its average produce.

The decisions of the Jury, on the merits of the articles exhibited, have been arrived at from a consideration of the wants of the consumer alone, always remembering that it is his taste in its highest form, and not any critical standard, which it is necessary for the printer to consult and supply. The chief object of the Exhibition is to bring together the finest articles already produced, and by presenting these side by side for comparison, to suggest new forms and varieties, and to induce an increased demand from various countries.

In their report on the specimens of dyed goods placed before them, the Jury will remark, first, on those of Great Britain (India included).

Here will be found dyed woollen articles, as well as numerous specimens of mixed fabrics (woollen and cotton, woollen and linen) in piece-goods of great variety and purity of colour. Specimens of silk and wool in the hank, equally diversified in colour and in gradation of shade. The silks used in the manufacture of Spitalfields, Macclesfield, Manchester, Coventry, &c. The wools for the manufacture of carpets and woollen and mixed fabrics, in Kidderminster, Glasgow, Bradford, Leeds, Halifax, Norwich, and elsewhere.

The French collection of dyed goods presents a beautiful variety of merinos, but none of mixed cotton and woollen fabrics. Varieties of dyed wools for the manufacture of Parisian shawls, and of silk in the hank, showing that purity of colour, especially in the lighter shades, which contributes so greatly to the success of the Lyonese manufactures.

Saxony, Prussia, Austria, and Russia, have sent many varieties of dyed yarns.

In their respective compartments will be found the merinos of Saxony and Russia.

Numberless varieties of woollen dyed yarns for the Berlin carpets; and from Vienna, for the manufacture of shawls and damasks.

Switzerland exhibits numerous specimens of the dyed silk used in the extensive manufactures of Bâle and Zurich.

China, one of the earliest known silk manufacturing nations in the world, is represented on this occasion by a complete assortment of the dyed silks used in her manufactures.

Having briefly referred to the specimens of dyeing, it may be remarked that this art has participated in the great industrial movement of the last twenty-five years; and of this, the dyeing of mixed fabrics composed of animal and vegetable substances affords a striking proof. The great difficulty of presenting a bright, sound, and uniform colour, on fibres having different affinities, has been overcome. In the various modes of dyeing silk and wool, Prussian-blue, with a tin mordant, has been substituted for indigo with complete success. The colours extracted from various dye-woods, have, by a judicious application of oxidizing agents, been rendered brighter and more permanent. Preparations of tin, formerly employed for fine colours only, are now in general use, and furnish the means of multiplying the shades of bright and permanent colours.

Particular reference ought to be made to the great improvement in the bleaching or whitening the silk fibre intended for the dye-bath. It is well known that the paler shades of colour cannot be produced bright and clear unless on a silk of pure white.

In presenting a list of the names of Exhibitors to whom the Jury award the Prize Medal, in woven, spun, felted, and laid fabrics, when shown as specimens of printing or dyeing, it appears inexpedient to mention, otherwise than in general terms, the points of excellence upon which these awards are founded.

The greater number of Exhibitors show specimens of printing on a variety of cotton, woollen, and mixed fabrics: reference however is made to those only which appear most remarkable.

In printing.—The Prize Medal is awarded for various degrees of excellence, in design, execution, and brilliancy or permanency of colour, or both.

In dyeing.—The Prize Medal is awarded for brilliancy, permanency, and uniformity of colour. The Jury make these awards to printers and dyers only.

Printing.

The Jury award Prize Medals in this department to the following Exhibitors:—

Bernoville, Larsonnier, and **Chenest,** Paris (1548, France, pp. 1250, 1251), for fancy fabrics printed in steam colours for dresses.

Black, James, and Co., Glasgow (51, p. 556), for printed muslins, jaconots, and fancy fabrics.

Blech, Steinbach, and **Mantz,** Mulhouse (29, France, p. 1172), for printed mousseline-de-laines (all wool), calicos and jaconots, in madder colours.

Bockmühl Brothers, Schlieper, and **Hecker,** Elberfeld (606, Prussia, p. 1084), for printed calicos.

Bossi, J., St. Veit, near Vienna (239, Austria, p. 1019), for fancy fabrics printed in steam colours for dresses.

Chocqueel, Louis, Labriche (90, France, p. 1175), for fancy fabrics printed in steam colours for dresses.

Dalgleish, Falconer, and Co., Glasgow and Manchester (27, p. 555), for machine-printed calicos.

De la Morinière, Gonin, and **Michelet,** Paris (1583, France, p. 1252), for fancy fabrics printed in steam colours for dresses.

Dollfus, Mieg, and Co., Mulhouse (1191, France, p. 1234), for printed muslins and jaconots, madder, and other colours; printed mousseline-de-laines (all wool).

Evans, David, and Co., London (1, p. 554), for printed silk handkerchiefs, and printed table-covers.

Godefroy, L., Puteaux (Seine) (1252, France, p. 1237), for fancy fabrics printed in steam colours for dresses.

Gros Odier, Roman, and Co., Wesserling (248, France, p. 1188), for printed muslins and jaconots in madder and other colours; and printed mousseline-de-laines (all wool).

Hartmann and **Son,** Munster (Haut-Rhin) (256, France, p. 1189), for various fabrics printed in madder colours.

Hoyle, Thomas, and **Sons,** Manchester (36, p. 555), for machine-printed calicos.

Inglis and **Wakefield,** Glasgow (4, p. 554), for machine-printed mousseline-de-laines and barèges.

Japuis, J. B., and **Sons,** Claye (274, France, p. 1190), for printed cottons and chintz colours for furnitures.

Koechlin Brothers, Mulhouse (1634, France, p. 1255), for printed mousseline-de-laines (all wool), printed calicos, in madder colours.

Leitenberger, Franz, Cosmanos, Bohemia (187, Austria, p. 1017), for printed calicos, in madder colours.

Littler, Mary Ann, Merton Abbey (8, p. 554, as exhibited by Mr. Wilkinson; and 282, p. 500, Classes XII. and XV.), for printed silk handkerchiefs.

Sale, J. N., Manchester (39, p. 556), for printed cotton shirtings.

Schlumberger, jun., and Co., Haut-Rhin (1481, France, p. 1247), for calicos and jaconots printed by cylinder.

Schwabe and Co., Manchester (41, p. 556), for printed calicos, madder, and garancine work.

Schwartz and **Huguenin,** Mulhouse, Haut-Rhin (1003, France, p. 1227), for printed cotton chintz colours for furnitures.

Simpson and **Young,** Manchester (47, p. 556), for mousseline-de-laines (cotton warps), printed by cylinder in six and seven colours; and calicos printed in steam colours.

Steiner, C., Ribeauvillé (383, France, p. 1195), for Turkey red, plain dye and printed.

Steiner, T. and Co., Church, near Accrington (37, p. 555), for Turkey red, plain dye and printed.

Thomson Brothers, and **Sons,** Manchester (25, p. 554), for printed mousseline-de-laines (cotton warps).

Vaucher, Du Pasquier, and Co., Cortaillod (36, Switzerland, p. 1268), for calicos and jaconots printed by cylinder.

Welch, Margetson, and Co., London (7, p. 554), for printed silk handkerchiefs.

Welch, Thomas, Merton Abbey (18, p. 554), for printed table-covers.

Zeigler and Co., Winterthur (146, Switzerland, p. 1275), for plain Turkey red dye.

Dyeing.

The Jury award Prize Medals to the following Exhibitors in this department:—

Armitage, G., and Co., Bradford (146, Classes XII. and XV., p. 492), for Orleans and Cobourg cloths, mixed of cotton and wool.

Bergmann and Co., Berlin (106, Prussia, p. 1054), for Berlin woollen yarns, dyed in various colours.

Feau-Béchard, V. A., Passy-près-Paris (Seine), (198, France, p. 1183), for skein-dyed fine woollen yarns for shawls.

Francillon, —, Paris for merinos, exhibited by Paturle-Lupin, Seydoux, Sieber, and Co., manufacturers, Coteau (1381, France, p. 1242).

Guinon, A. P., Lyons (1263, France, p. 1237), for skein-dyed silk in various colours; bleaching silk and the application of picrique acid.

Howe, J., and Co., Coventry (36, Class IV., p. 197*), for skein-dyed silk in various colours.

Le Lievre, H., London (60, p. 557), for skein-dyed black silk.

Partridge, N., Stroud (212, Classes XII. and XV., p. 496), for dyeing broad cloths of different colours on each side.

Ripley and **Sons,** Bradford, Yorkshire (148, Classes XII. and XV., p. 493), for Orleans and Cobourg cloths, mixed of cotton and wool.

Vessiere, A., Puteaux, near Paris (720, France, p. 1213), for merinos.

Wegner, T. R., Bâle (155, Switzerland, p. 1276), for skein-dyed silk in various colours.

The Jury award the Prize Medal to Mr. **John Mercer,** Accrington (48, p. 556), for the beautiful application of a scientific principle in preparing various textile fabrics, strengthening the material, and at the same time wonderfully increasing the brilliancy and intensity of the colour when dyed or printed. The results are exhibited in the goods shown by Mr. Mercer. A Council Medal has been awarded in Class II.

The Jury would have felt it a duty to recommend this inventor for the Council Medal, if his discovery had been extensively applied in manufacture.

EDMUND POTTER, Reporter.

June 1851.

CLASS XIX.

REPORT ON TAPESTRY, INCLUDING CARPETS, FLOOR-CLOTHS, &c., LACE, FANCY EMBROIDERY, AND INDUSTRIAL WORKS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Dr. Pompeius Bolley, *Chairman*, Switzerland; Commissioner.
Peter Graham, *Deputy Chairman*, 37 Oxford Street; Carpet Manufacturer.
Richard Birkin, *Reporter*, Nottingham; Lace Manufacturer.
D. Biddle, 81 Oxford Street; Laceman.
Antony Fessler, Switzerland.
Thomas Simcox Lea, J. P., Astley Hall, Stourport; retired Carpet Manufacturer.
Robert Lindsay, Belfast; Sewed and Embroidered Muslin Manufacturer.
Francois A. Washer, Belgium; Merchant at Brussels.

M. Ellisen, Frankfort-on-the-Maine; Merchant. (Proxy for M. Falk, Zollverein; Manufacturer.)
Felix Aubray, Paris; Merchant. (Proxy for M. Lainel, France; Inspector of Manufactures; Member of Central Jury.)

The Jury appointed by the Royal Commissioners for Class XIX. having completed their inspection of the various articles, and awarded the prizes placed at their disposal, beg to append to their awards some facts and observations relative to the rise, progress, and present condition of the branches of industry that have come more immediately under their notice.

The Jury are of opinion that the products included in Class XIX., from many countries, are more numerous and various, and differ more widely in price, than those comprised in any other Class. Their task has, consequently, been one of much labour and difficulty, having occupied two months of unceasing attention in seeking out and examining everything said to belong to this Class (the goods from foreign countries not being classified in the Catalogue), and in many cases having to seek for them in other Classes, being most anxious that no omission on their part should be made, and that ample justice should be done to the Exhibitors.

The great variety of products before referred to will account for what may at first sight appear too great a degree of liberality in the awards.

In deciding upon the merits of the articles exhibited, they have taken into consideration novelty of invention, novelty and beauty of design, excellence of manufacture or execution, cheapness, durability, and usefulness.

They have recompensed those Exhibitors who have displayed one or other of those qualities by Honourable Mention, and have awarded Medals to those who, in their productions, have combined several of them.

The Council of Chairmen having confirmed the recommendation of a Council Medal in the case where the fabric was new, and of great beauty and utility, but not in those cases where great beauty of design was united with the highest degree of excellence in execution, and applied to articles of commercial importance: the names of those Exhibitors whose productions were peculiarly distinguished are referred to in the Report.

Having made these preliminary remarks, the Jury proceed with their observations upon the various branches of industry that have come under their notice.

British Lace.

Bobbin-Net Machinery.—Nottingham, long celebrated for her machine-made lace, has, on this occasion, furnished indubitable proofs that her manufacturers and artizans have been progressing in the same ratio as those in most other branches of industry, during the last half-century. Fifty years ago, lace made by machinery was mostly from the point-net and warp-machines (both modifications of the original stocking-frame); since that period, there have been incredible sums of money expended, many valuable lives sacrificed by intense study, hundreds of patents taken out, and nearly as many differently-constructed machines built for the production of plain and ornamental lace of every description. It has been matter of astonishment to see how quickly one inventor has succeeded another, and by simplifying or modifying his machines rendered useless those of his predecessor. It may be stated, that in none of the textile fabrics have there been so many combinations of machinery used to effect the purpose as in the making of lace, commencing with the stocking-frame, to which was added a Tickler machine, then the point-net machine, warp machine, Mechlin plait machine, and many others. All of these (except the warp machine), disappeared for the purpose of making lace when the bobbin-net machine was introduced, and its capabilities for making both plain and ornamental lace became developed. The bobbin-net machine is so called from the thread that makes the lace being partly supplied from bobbins, and partly from a warp, the bobbins being made to pass from front to back, and back to front, while a lateral motion is imparted to the warp threads, thus causing one series of threads to wrap round the other. After innumerable attempts to make bobbin-lace, the first successful machine was made and patented by John Heathcoat, in 1809. This machine, although novel in its construction, and the first enabling one series of threads to pass round the other, was complex in its arrangements, and required sixty motions to complete one hole, the same being now made with six. The cost, also, of the production was such as to circumscribe its use, for we find in 1815, when the machines of this description had increased to 140, one square yard of the produce was worth 30*s.*; the same quantity can now be purchased for *threepence*.

But so rapidly, from this period, did the machinery increase and trade extend, that in 1831 the capital employed in the bobbin-net trade, from careful inquiries made by a townsman, W. Felkin, Esq., was 2,310,000*l.*, giving permanent employment to 211,000 persons. It is desirable to state that, up to this time, little less than plain net and quillings had been produced by the bobbin-net machine. After repeated efforts on the Leaver, circular, pusher, and traverse warp machines, in 1831 and 1832, plans were adopted to purl and bullet-hole the edges of narrow laces, finishing them afterwards with a gimp-thread with the needle; the same was done on the pusher machine, and shortly after on the circular. The rapidity with which new articles were brought out, first by one machine and then by another, was astonishing, each discovery leading the way to something more novel. At this period, also, a patent was taken out by William Sneath, of Hyson Green, and sold to James Fisher, Esq., of Radford, for spotting on the circular machine; soon after another was taken out by Mr. Freeman, of Tewkesbury, for spotting on the traverse warp; and shortly after a third by R. Birkin, of Basford, for the same thing on the Leaver machine.

Many efforts were made by Draper, and others, to apply the Jacquard machine to the bobbin-net for the purpose of ornament. Several patents had been taken out for this purpose, but no successful arrangement had been effected till about 1839, when a pusher machine was worked with cards the width of the net, by Mr. Wright, of Radford: the same application was made to the circular machine by Mr. Crofts, who has taken out several patents for various improvements in nearly every description of bobbin-net machinery.

The application of the Jacquard still progressed slowly till 1841, when a plan discovered by Hooton Deverill was bought and patented by Messrs. Biddle and Birkin, for applying the Jacquard to the guide bars; and so rapid has been the application of the Jacquard since that period, that at the present time there is scarcely a machine at work without it (except those adapted purposely for plain net), either applied to the bars, or along the width of the machine, and from that period the trade commenced anew, producing every description of pattern on all the various descriptions of net known, particularly on the plain-net, that had been made and patented in 1838 by Mr. Crofts, but was not extensively manufactured till the successful application of the Jacquard. Such an impetus did the trade receive from this, that hundreds of machines which were useless, or "worked up," as the trade termed them, were brought into active and profitable use; many of their owners, after spending from 80*l*. to 100*l*., being able to realize this outlay in three or four weeks (if put on with a saleable pattern). No sooner was the Jacquard machine successfully adapted to the bobbin-net machine, than new sources of manufacture gradually developed themselves, such as flounces, scarfs, shawls, window-curtains, &c., &c.; but, to succeed in these articles, tasteful and elaborate patterns were required, equal to the French and other foreign productions of the same kind: manufacturers had in many instances to resort to those places for designs. This want of clever local designers caused the same anxiety to be manifested by the makers of machine-made lace that other manufacturing districts had evinced; and the same cordial assistance from the Government was afforded in establishing a school of design in Nottingham.

Though many for the first two or three years thought this school comparatively useless, it has proved that it was only sowing the seeds for extended usefulness, as several young men, that have had no other means of learning designing, and creating a taste for the fine arts, are now filling important situations, and receiving liberal salaries; and there is no doubt that at the present time our local artists are capable of producing designs equal to the French, Swiss, &c.

We may be told, the display of lace goods in the Great Exhibition does not demonstrate this statement; but it must be borne in mind that the manufacturer of machine-made lace has to have his patterns adapted to suit the various markets; and they know from experience, that patterns that would suit the French would not be saleable to any large extent in the English market (and English-made lace being prohibited in the French market, it is useless to adapt our patterns to their taste). In fact, there requires one style for the London market, another for the provinces; one for North America, a different one for South America, and so of all the various markets to which we export our produce.

It will, therefore, be perceived, that the French are rarely employed in designing, except for the Parisian taste, where our designers have to suit the tastes of nearly all the markets in the world.

Judging, therefore, from the beautiful patterns now produced, their suitability to the markets for which they are specially designed, and the rapid manner in which this part of the trade has extended, we think it right to state here that the Government School of Design has materially assisted the enterprising manufacturer and artisan.

At the present time, amongst the infinite variety of articles manufactured by the bobbin-net machines, are—

1st. Black silk piece net ornamented, shawls, scarfs, flounces, trimming laces, blondes in white and colours, some wholly finished on the machines, others partly by machinery, and embroidered afterwards.

(Up to 1845, Saxony exported largely the lower class of these, and France the more expensive into this country; but so perfect are they made, so much improved in design, so effective for useful purposes, and lower by from 75 to 90 per cent. than the class of hand-made articles they represent, that we not only supply our home market, but have exported 150,000*l*. worth annually, during the last four years, to foreign markets, principally the American, and not a few find their way into France, although wholly prohibited by that country.)

2nd. Cotton edgings, laces, and insertions, linen laces in imitation of white pillow lace, muslin edging and laces, fancy piece net, spotted net, plait net, in imitation of the costly Valenciennes lace.

3rd. The third class is of curtains in imitation of the Swiss curtains, bed-covers, and blinds; and although this branch of trade is new, having only been introduced in 1846, yet from the extent it has already attained, employing above 100 machines, and from the display of goods exhibited, excellent in design and good in texture, it promises not only to be an important but an improving department of the lace trade.

4th. The fourth class includes silk and cotton, plain net Mechlin grounds, blonde, Brussels, or extra twist: this is a branch of much importance, employing regularly upwards of 2,000 machines; one owner, J. Heathcoat, Esq., M.P., having 300, principally making silk net, or Paris blonde. To this gentleman the trade owes much for his zeal and perseverance in discovering the method of imparting that dress or finish to his nets, formerly known only to the French, and the accomplishment of which is now giving permanent employment to many thousands of workpeople.

The numerous and various specimens of Nottingham manufactures in the Great Exhibition, their generally useful character and extraordinary cheapness, combined with very considerable taste in design and excellence in execution, must tend to still further develop the ingenuity and extend the trade of the locality.

The description of machines at present in use are the following:—

1st. The "*Leavers*," so called after John Leavers, the original constructor of this machine; a specimen of which, belonging to Mr. Birkin of Nottingham, is at work in the Exhibition.

Most of the articles included in the first and second class productions are made from this description of machinery.

2nd. The "*Pusher*" machine, so called from having independent pushers to propel the bobbins and carriages from front to back, instead of pulling or hooking them, as in other arrangements.

From this description of machine are made shawls, scarfs, flounces, &c., of a superior quality, which require to have the pattern traced afterwards with a thick thread by women.

3rd. The "*Circular*," so called from bolts or combs on which the carriages pass being made circular, instead of straight, as in the straight-bolt machines, originally constructed by Mr. Morley, of Derby (late of Nottingham). From these machines are made the curtains mentioned in Class III., and the various descriptions of plain, spotted, and fancy nets.

4th. A few "*Traverse Warp Machines*," so called from the warp "traversing" instead of the carriages, as in the circular and pusher machines. These machines principally make spotted lace, blond edgings, and imitation thread laces.

There is a smaller number of machines now than in

1836, owing to many of the old narrow ones having been broken up and replaced by others, wider, more speedy, and of a superior construction. Though numerically less, the power of production is materially increased: in addition to this, arrangements are now made in many of the machines for completely "finishing" their produce, *i. e.*, embroidering; thus dispensing with a great number of "lace-runners," which will account, in a great measure, for the apparent diminution in the number of hands employed in 1836.

There are now in full operation 3,200 bobbin-net machines; the total number of quarters 34,382, giving employment to 5,556 men, 6,859 women and children, representing a capital of 1,329,445*l*. This is exclusive of buildings and requisite machinery for working the same; and also of machinery and stock for silk-throwing, cotton-spinning, dyeing, bleaching, and dressing; for Smiths' bobbin and carriage guide, comb and point makers, embroidering, carding, mending, &c., estimated at 1,616,500*l*., in which occupations about 113,300 hands are regularly employed.

Total capital 2,965,945*l*. Total number of hands employed 133,015. Annual amount of business returns 2,300,000*l*.

These statistics are the result of extensive and careful inquiries made purposely for the occasion; and are as accurate as such documents can be, considering the difficulty, in some cases, of obtaining all the facts from manufacturers.

The "*Warp Machine.*"—In addition to the bobbin-net machine for making lace, there is also the warp machine, several productions from which are exhibited on this occasion, of a novel and beautiful description.

The invention of the warp frame (about the year 1775) has been ascribed to four persons, Vandyke, a Dutchman; Mr. Clare, of Edmonton, near London; Mr. Marsh, Moorfields, London; and Mr. Morris, of Nottingham. Blackner (who was a contemporary), in his History of Nottingham, mentions three of these, and inclines to the opinion that Mr. Crane, who was a mechanic, was the first to apply the warp to the common stocking-frame. It must here be understood that, for the common stocking-frame, but one thread is requisite; whilst to the warp, a thread for each needle was employed, and hence it derived the name of "warp machine." The first articles attempted from the new application, were silk stockings, having blue and white zig-zag, or, as they were called (from the supposed inventor), Vandyke stripes; and this new kind of hosiery continued in considerable request for upwards of twenty-years. Purses were also made in considerable quantities after the same manner.

The first machines were about 16 inches in width, and they were merely the common stocking-frame, with the warp or new principle applied.

In the years 1784-5, a person named James Tarratt, considerably improved them by applying treddles to perform the requisite movements, and built them as wide as 44 inches, by which improvements the speed was doubled, and the width tripled. About this period, a Nottingham mechanic considerably improved the warp frame, by the application of the rotary motion, and the "cam" wheels to move the guide-bars, which are still known in the trade as Dawson's wheels: he employed several of his improved machines in the production of officers' sashes, braces, purses, and other elastic textile fabrics, the manufacture of some of which continues to this day. In the year 1796, a person named Roland invented a new fabric from the warp, which was patented by Mr. Barber, of Bilborough, near Nottingham. This fabric was used very extensively for pantaloons, sailors' jackets, and other articles.

This new manufacture rose to great importance, and large contracts for the Admiralty were supplied. In the year 1812, 500 frames were said to be employed in the midland counties on this article, which is still known as "Berlin," and is extensively used for the making of gloves. It is said, that in the year 1808, 1,800 point-net frames were at work in the neighbourhood of Nottingham. About this period, two persons of the names of Brown and Pindar, made silk lace from what they termed an upright-warp frame (from the needles being placed upright, and not horizontally, as in the ordinary warp frame). In the year 1810, 120 of these upright frames were at work in Nottingham; and the wages of the workmen were very high, never less than 50s. per week.

In a very short period, lace was made from the horizontal warps; and the uprights were soon rendered useless. The first lace produced was of a very inferior description; and various attempts were made to improve it. At length, Brown and Copestake invented what was called Mechlin net, which, from its intrinsic excellence, soon entirely superseded the point net; and in a short time 430 frames were making it; the wages of the workmen averaging four guineas per week; whilst the cotton used was 15 guineas per lb. From this period the point-net manufacture declined, until it became quite extinct; and the warp machine was in the ascendant.

Soon after the introduction of Mechlin lace, an imitation of it was made by a Mr. Kirkland, which was known as "two-course" net; and another kind of silk lace known as "Blonde," invented by Daycock, appeared about the same time. These two kinds of silk lace subsequently attained to great importance, especially the latter, which still forms a considerable branch of the lace trade.

The blonde, soon after its introduction, became in great repute, and the workmen made enormous wages—it is said, as much as 10*l*. per week.

In the year 1819, the Mechlin disappeared; and soon after the two-course and blonde greatly declined until 1830, from the large importations of French silk-lace; the French method of dressing being much superior to our own.

The bobbin-net machine, which was invented and patented in 1809, had now become the great rival of the warp.

Cotton "Mechlin" lace speedily disappeared before the more approved manufacture, bobbin-net: and what from this new competitor at home, and large importations of silk lace from France, the warp trade may be considered to have fallen to its lowest state of depression. Numbers of the machines might be bought for the price of old iron; and many were broken up as no longer of use. Such was the state of this branch of industry when attention was directed to the ornamentation of lace on the machine. Hitherto, the lace or net had been made wholly plain, and was embroidered or "tamboured" afterwards by hand.

Driven from the plain by the bobbin-net, the warp was the first to attempt the ornamental; and has the credit of leading the way in what has become the most important branch of the lace trade. Boot, Roberts, Herbert, and Copestake were the earliest in the field, and laces with spots and bullet holes introduced first appeared.

A new kind of net also was produced, which was called "mock twist, in imitation of its rival the bobbin-net. From these sprang the tatting trade; and, suddenly, machinery which before was worthless, rose to a great value: many new machines began to be built; and these warp tattings gave quite a new impulse to the warp trade. Whilst the tatting trade was at its height in 1830-31, the silk blonde again revived under the patronage extended to it by the Court at this period. Machines were now constructed on improved principles; and rotatory action was successfully applied. These gradually superseded those worked by hand, and instead of old 44 inches wide, many from 100 inches to 150 inches were constructed. This state of prosperity continued for several years, until 1835-6, when the silk blonde and cotton tattings became greatly depressed.

The bobbin-net machine again outrivalled its forerunner by producing superior ornamented laces; and Heathcoat's plain silk bobbin-net had now begun to take the place of Nottingham white silk blonde. Notwithstanding these, the unemployed warps found other and new channels. Some were making gimps, and a still greater number lace mitts and gloves, which, from 1836 to 1846, were in great demand; but these, during the last few years, have nearly become obsolete.

In 1839 the Jacquard was applied to the warp by

Draper, of Nottingham. The increased capability which this application gave, inspired new hope for the warp-lace trade of Nottingham. A new class of products of elaborate design was manufactured, such as shawls, scarfs, mitts, falls, laces, &c.; but latterly the products of the Twist machine have to a great extent supplanted them.

Great improvements were made in dressing silk lace. Mr. Dunnicliff first followed the French method of working the silk in the single thread, and in the raw state, instead of the organzine thrown which had heretofore been used. The result of this change was soon felt. French-dressed silk lace, which had long been superior to ours was now equalled in whiteness and brilliancy; and at the present day, English-dressed lace is little, if at all, inferior to the best specimens from Lyons. Within the last few years, many new kinds of manufacture have been attempted from the warp, which deserve a special mention.

Elastic woollen cloth for gloves and other purposes is one of these. Henry Dunnington of Nottingham was the first who made it, and he has produced the best of this kind.

Many new kinds of elastic fabrics for gloves, both in silk and other kinds of material, have been made by Messrs. Ball and Co. A patent for velvet lace was obtained by Dunnicliff and Dexter in 1845; but the making of velvet was not brought into practical operation until 1849, when Messrs. Ball and Dunnicliff, and Messrs. Haines and Hancock, succeeded in making piece velvet suitable for gloves, the product at the present time being entirely used for this purpose.

During the past year the same parties have had granted a patent for making velvet in combination with lace; and for other novel weavings, specimens of which are shown in the Great Exhibition.

These latter may be considered as the latest improvements of the warp frame, which bring down our notice to the present period.

The number of machines now in operation, as far as can be ascertained, is about 1,400: 600 in the county of Leicester; 400 in Derbyshire, and 400 in Nottinghamshire, and are employed in the various branches as follows:—

150	blonde, and other silk laces.
150	cotton tattings.
550	Leicester hosiery, &c.
100	lace gloves and mitts.
150	woollen cloth, hosiery, purses, and various kinds of fabrics for gloves, &c.
1,100	Total.

The average widths of the machines employed in the Nottingham trade are from 90 to 100 inches (some few being as wide as 150), whilst those engaged in the Leicester hosiery trade, are generally from 44 to 72 inches.

The number of persons employed in the warp trade is estimated at 10,000, and the capital invested 360,000*l.*, making a return per annum of 700,000*l.* On a comparison with former returns, it will be observed, that the number of machines employed in the lace branches is considerably less, whilst in the hosiery and other miscellaneous articles the numbers have increased. A warp blonde-machine, 54 inches wide (which was about the average in 1830), would produce about 20 yards or 80 racks per week, which, when dressed, would be equal to about 50 square yards.

The power-machine belonging to Messrs. BALL, DUNNICLIFF, and Co. in the Great Exhibition, illustrative of the warp-lace trade, is capable of producing—working 12 hours per day—800 racks per week, which, when dressed, would be equal to about 1,200 square yards. A yard of 4-quarter white silk blonde, which in 1830 sold for 2*s.*, is now supplied for 6*d.*

LACE made by hand, as "HONITON," and "THREAD" or PILLOW LACE, also "BRITISH POINT," TAMBOUR, and LIMERICK LACES.

Honiton Lace.—The description of lace termed "Honiton" is made by placing a perforated pattern upon a pillow, and employing pins, bobbins, and spindles to twist and interweave thread in such a manner as to produce the required design. It was formerly confined to the production of simple sprigs and borders; but during the past twenty years considerable progress has been made, resulting in the manufacture of fabrics, displaying not only extreme delicacy of execution, but also beauty, and taste in design.

The Great Exhibition affords ample proof of this in the specimens of flouncings, shawls, scarfs, handkerchiefs, berthes, &c., which are there exhibited, varying in price from ten to two hundred guineas.

This striking change has not arisen from fortuitous circumstances, but has been mainly induced by eminent houses in the trade; who, to meet the taste required by their customers, have employed every means at their disposal to raise the character of this description of lace. They are fully alive to the conviction that the more the British manufacture becomes assimilated to the characteristics of the foreign (which are chiefly suitable, beautiful, and clearly-defined patterns, with refinement of execution), the more the demand for this lace will extend; and, proportionally with such increased demand, they will be induced to expend still larger sums, in order to produce a higher class of designs. They are further encouraged in their exertions by the fact that, although the British lace cannot boast of design so exquisite, and execution so delicate, as Brussels lace, it yet possesses remarkable and valuable qualities, inasmuch as it is produced perfectly white, does not change colour, and the price is very moderate.

The district in which Honiton lace is made extends about 30 miles along the coast of Devonshire, and about 12 miles inland. A very large number of persons (from 7,000 to 8,000) are now employed in producing it.

Pillow Lace.—"Pillow" or "Thread" lace, although made upon the cushion like Honiton lace, is distinguished from it by having both the pattern and the mesh made by hand, whereas, in Honiton lace, the pattern is made separately, and afterwards sewn on to *machine-made net.*

Not many years since a very considerable number of women and children were employed in its manufacture throughout the counties of Bedford, Buckingham, Northampton, and Oxford; but the demand having fallen off (being subject to fluctuation, like all articles dependent upon fashion), has caused this branch of the trade to suffer severely. Contemporary, however, with the diminution in the making of white-thread lace, an increased requirement for black lace occurred; the manufacture of which was introduced into the districts enumerated, and has been attended with marked success.

It would be difficult to supply any accurate statistics as regards the number of persons engaged in this manufacture, as the nature of the article enables the parties employed in producing it to carry on the operation apart from each other, and without interfering with a domestic or retired life.

It is deserving of consideration, that the worth of the actual material bears such a small proportion to the value of the article itself, as to make the amount paid for the labour expended in its production to be almost the sole cost. This industrial product, therefore, cannot fail to enlist sympathy on its behalf, as it furnishes, in comparison with its price, a surprising extent of employment and maintenance, and these benefits, moreover, are afforded to a class of persons who otherwise would have a difficulty in earning a livelihood. In exemplification of which it may be said, that the poor in lace-making districts are comparatively well off, and better provided for than in other localities.

British Point Lace.—British Point, tambour, and Limerick laces, possess alike considerable merit, and are very similar in the mode of their manufacture. These embrace the imitation of Honiton and Brussels lace, and are produced in shawls, scarfs, dresses, Court trains, flouncings, lappets, &c., exhibiting a beautiful display of chaste, elegant, and elaborate designs, and are well represented in the Exhibition.

"British Point" is chiefly made in the neighbourhood of London, and is very superior as an imitation lace.

"Tambour" is made principally at Islington, London, Coggleshall in Essex, and at Nottingham.

The "Limerick lace" is peculiar to Ireland, and has been produced in considerable quantity.

There is also another description of this lace, which has been brought to great perfection. It is made in various articles, and presents an excellent imitation of the old Spanish point.

The prospects of these branches of the British lace trade are at the present time highly encouraging; and there is no doubt that by careful attention in producing appropriate designs for Honiton lace, and the cultivation of a taste for refinement and elegance, the manufacturers of this lace will be most successful in their exertions to render this department of British industry eminently worthy of the increased admiration of ladies of rank and fashion, not only in this, but in other countries.

From the well-known character of the principal houses engaged in this enterprise, it may be confidently expected that Honiton lace will assume a position in the highest class of industrial art, combined with utility. Nor are the manufacturers of the other descriptions of lace mentioned in this Report at all behind in an energetic application of their resources, in order to excel in their various productions.

The decided improvement which has been made in the black laces, now so generally worn, has led to the introduction of a new and important feature in the fabrication of piece goods, such as shawls, scarfs, veils, coiffures, &c., the manufacture of which in "black point lace" has commenced within the last twelve months, and is carried on in the southern districts of Buckinghamshire. It has already been attended with marked success, and is deserving of special notice.

It is a gratifying reflection that the growing appreciaton of the wealthy and refined class of the increasing merit of these really useful and ornamental articles of British manufacture gives suitable employment to a large number of females at their own houses, thereby increasing their comforts, encouraging habits of industry, and adding to the general prosperity of the nation.

ENGLISH, IRISH, AND SCOTCH SEWED MUSLIN EMBROIDERY.

The national importance of this branch of industry, its rapidly increasing extent, and the progress made in its manufacture, as evidenced by the number of exhibitors from the United Kingdom, and the varied merit of their productions, call for particular remark.

The articles exhibited by Messrs. D. and J. MACDONALD and Co., and Messrs. S. R. and T. BROWN, both of Glasgow, and Messrs. BROWN, Sharp, and Co., of Paisley, are very gratifying proofs of the excellence attained both in design and execution.

In taking a retrospective view of the trade, it is difficult to fix the precise date of its origin; but there is no doubt that in the year 1770, in Scotland, and 1780, in Ireland, the germs of it were in existence.

Towards the commencement of the present century the manufacture had so extended as to employ profitably the attention of eight or ten houses in Glasgow, and also a few in Belfast; but the trade generally seems to have made but little progress during the next twenty years, the employment being comparatively limited in extent, and the manufacturers principally confining their attention to the tambour branch of it (with the exception of some light cotton goods for foreign markets), in the almost exclusive production of trimmings, collars, robes, and baby linen.

One of the circumstances which first gave a decided impulse to the manufacture was occasioned by the social revolution wrought among the Scotch and Irish peasantry, and particularly the latter, by the destruction of linen yarn spinning by hand, through the introduction of machinery. Previously the female population were so generally and profitably employed that it was with much difficulty their attention could be directed to "needlework," as a means of subsistence; but when the manufacture by machinery had nearly destroyed the occupation of hand-spinning, and the softened hum of the "wheel" ceased to be heard, both the women and girls of the country were left almost without any source of profitable labour, and a very serious change became apparent in the homes of the peasantry.

In these trying circumstances a new field of labour, destined to more than compensate, was opened to them in the manufacture of embroidery; and, though some prejudice existed at first against the employment, the desire soon became universal to have it established. Manufacturers found it their interest to take advantage of the consequent abundance and cheapness of labour to extend their operations; and under their guidance, but frequently aided by individual philanthropy, schools were extensively opened for instructing girls in sewing: so that in a short period in the West of Scotland, and still more extensively in the North of Ireland, the workers increased to many thousands, and the trade became firmly rooted in a vast number of localities where previously it had no existence, the girls then, as now, principally working for Scotch employers.

The cheapness of labour alluded to, and the increasing skill of the workers, enabled the manufacturers to introduce, in lieu of tambouring, the more costly, difficult, and beautiful "satin stitch," and other *sewed embroidery;* its cheapness and superior elegance not only leading to its being applied to additional articles of ornamental dress, but also to more enlarged use and demand, and to a consequent increase in the trade.

In its internal operations few circumstances were more beneficial to the manufacture, or tended so directly to the improvement of design, as the substitution, about the year 1830, of lithography, for that of the old tedious and expensive system of "block printing." The cost of each block varied from 5*s.*, for the cheapest design, to 5*l.* for the richest; and the time required for cutting frequently reached three to four weeks; thus subjecting the manufacturer to never-ceasing delay, obliging him to make an inconvenient quantity to cover the expense of each block, and totally preventing cheapness in price, or variety of design.

On the other hand, by the lithographic press, the most elaborate and difficult pattern can be printed in a few hours, at the expense of a few shillings, and with a perfection and ease unattainable by block printing. The facility thus gained of multiplying patterns at such a trifling expense has afforded ample scope to the genius of the designer, the result being eminently promotive of taste, and of the production in the trade of endless variety and novelty of style. Few manufactures in the kingdom have made such rapid progress during the past fifteen years, or have afforded the same amount of valuable employment to the female population, as that of sewed embroidery, it having in that period increased at least three-fold.

The amount of employment in Ayrshire, and other places in Scotland, has not probably increased, from the population being less dense, and their being employed in other branches of manufacture; but in Ulster and the West of Ireland the embroidery trade has become almost universal, and is the principal support of the female population.

A recent writer, an eyewitness, having valuable opportunities for obtaining correct information, thus adverts to the subject:—"The progress of the trade was very slow at first, and, for a length of time, was like a speck in the great field of industrial employment; but during the last few years it has grown up, and spread itself north, south, and west, so that it has extended itself over half the counties of Ireland, and is at present giving more or less employment *to a quarter of a million of females.*" He further adds "in the counties of Donegal and Fermanagh, where it was unknown three years ago, there are now rival agents in almost every town, and in remote parts of these two counties advertisements are frequently met with, posted on the trees by the roadside, from agents in the trade, one wanting a thousand workers, and another two thousand girls, whom he offers to teach gratis, if they do not know how to work."

The wages paid for working vary much in amount depending in some degree on the prosperity or otherwise of the trade. Young and inexperienced workers will probably not receive beyond sixpence per week, the amount gradually increasing to 4*s*., 5*s*., and 6*s*., according to the dexterity of the worker; and a few first-class hands can occasionally earn as much as 10*s*. per week.

The exact number of manufacturing houses in the trade cannot be at this moment precisely ascertained; but the amount annually turned over in the manufacture is variously estimated at from 750,000*l*. to 1,000,000*l*. sterling, the latter being the most probable sum. On this hypothesis, at least 600,000*l*. (the principal outlay consisting in labour) will be distributed in wages, the workers being invariably employed in their own houses, and in a shape the most beneficial, as they can thus, by their own industry, increase their comforts without endangering their morals.

The market for the industrial productions daily enlarges both at home and in the colonies, where there is ever a ready and secure demand. That of the United States ranks next in importance. A few years ago the Transatlantic export of embroideries was merely nominal; now the United States take at least a quarter of a million's worth annually.

It is also a gratifying fact that, notwithstanding the prevalence of hostile tariffs, the beauty and cheapness of the Scotch and Irish embroideries cause them to find an increasing sale, even in the most exclusive of the continental countries. In France, where by law they are totally inadmissible, they are nevertheless daily introduced, and one particular class finds extensive favour in the fashionable circles of Paris. Also, from various countries of southern Europe, a growing demand is springing up, which, doubtless, in a short period, will become so important as to lead to a further and valuable extension of this branch of industry.

In the Exhibition the home embroidery trade is well, but not more than adequately represented, a great number of parties not having sent any of their productions; however, among those who compete are several who rank first in the trade, and in their hands the reputation of the manufacture is fully sustained.

While the foreign productions, exclusive of curtains, are chiefly confined to cambric handkerchiefs, muslin robes, and fancy articles, such as coverlets, table-covers, armorial designs, &c., the home manufactures exhibit largely every variety of collars, sleeves, cuffs, caps, robes, baby-linen, and most extensively in flouncings, insertions, and trimmings; also some beautiful toilet-covers and coverlets, the merit of which consists in their decidedly *useful character* and cheapness.

As regards the future prospects of the trade, they are of a decidedly hopeful character: the manufacture may not in future progress in the same astonishing ratio as hitherto, but there are ample grounds for expecting a further and important extension, based principally on the improvement in design and work which is being effected, as well as on the superabundance of cheap labour. A great amount of this labour is in process of training, and will continue to be absorbed so long as the employment is remunerative, producing in its turn competition, the surest guarantee for improvement in the work and consequently extensive sale.

Much has been done already to improve design, the attention of Government and of the trade being strongly directed to its importance. The Government schools, especially, by affording manufacturers and parents generally the opportunity of educating their children in design, are tending largely to foster its growth; a circumstance which, sooner or later, will lead to the advancement of all fancy manufactures, and to none more so than that of sewed muslin embroidery.

In conclusion, with a trained and industrious population, such as largely exists in the north of Ireland and in Scotland, possessing a decided aptitude for the employment, and willing to labour for a moderate remuneration—the manufacture conducted on the largest scale, with all the advantages of capital, a home market, extended foreign relations, and all the other facilities of commerce—the embroidery trade may reasonably expect not only to maintain its position, but look forward to an increase and prosperity hitherto unknown.

France.

Lace and Embroidery.

France, proverbially a lace-making and lace-wearing country, has, on this occasion, maintained its high position by contributing some of the most exquisite work, principally hand-made, that has perhaps ever been exhibited, combining perfection of design with surpassing elegance.

In proof of this, it is only necessary to refer to the articles exhibited by Messrs. **Videcoq** and **Simon**, and **Auguste Lefebure**, both of Paris.

The amount of business done, and the number of hands employed in the manufacture of lace and embroidery, are proofs of their high estimation in all countries.

Bobbin-net and Lace by Machinery.

The principal towns noted for the production of bobbin-net and lace by machinery in France, are Cambray, Lille, St. Quentin, Lyons, and, above all, Calais and its suburbs, where there are more than 600 machines in active operation.

The manufacture of this article was introduced into France by English workmen, who, coming from Nottingham, established themselves at Calais, in 1817 and 1819, bringing with them a machine upon the "straight-bolt" principle. This branch of industry has continued to increase and prosper, having always followed the progress and inventions introduced at Nottingham.

Until the year 1845, the articles fabricated in France were only such as were known in the English market; but since that period this branch has been considerably improved by the application of the Jacquard system to the bobbin-net machine, more especially to that called "Leavers," and in consequence its production of articles of novelty has greatly increased.

The following articles are manufactured in a superior style, principally at Calais and at St. Pierre-les-Calais:—

1st. The Neuville ground, with coarse thread, on Leaver's machine.

2nd. The Malines. In order to imitate the lace of this name, made on the pillow, it is purled, and the pattern embroidered by hand.

3rd. The fine plat, made from 14 or 16 point machines, in imitation of the pillow-lace, called Valenciennes.

4th. The coarse plat made from 10 or 11 point machines.

At Lyons, a great quantity of silk net and black lace is made in imitation of pillow-lace.

At Cambray, also, is produced, with great skill, black lace in lengths, and in piece, for berthes, scarfs, &c.

These articles are made on the circular machine, and are admirable imitations of the beautiful black lace of Caen and Chantilly, the patterns of which are most correctly copied, while the difference in price is 75 per cent. This manufactory is in full work, and has been steadily improving for the last three or four years.

Embroidery.

Embroidery work of every description is of very ancient date in France: it gives employment to from 150,000 to 180,000 females, spread over more than twenty departments. 8*d*. to 1*s*. a-day is earned in the country, and double that sum in Paris.

This branch of industry is subdivided into several parts, which may be placed under two separate heads.

1. Embroidery in colours and fancy work.
2. White embroidery.

Fancy work embraces an infinite variety of forms, and is done in all colours, in all shapes, and on every kind of material.

The two chief seats of this manufacture are Lyons and Paris. It is in the latter place particularly where that great variety of tasteful articles of every description, that occupies so large a portion of its industrious population, is fabricated; for example, embroidery in cotton, wool, silk, straw, gold and silver, thread, beads, &c. &c.,

and it is from the workshops of Paris that those magnificent fabrics are sent forth, from rich robes, shawls, and scarfs, to the smallest fancy article, such as purses, bags, Greek caps, cigar-cases, &c.

If the embroidery in fancy articles is so considerable, much greater is that of white embroidery; in fact, this work is carried on in many different ways, by hand, in a frame, with needle, or crochet, with passé or plumeti, &c. &c. White embroidery is always done upon lace, muslin, or fine cambric.

Embroidery for furniture is principally done in crochet.

The chief seat of this branch of manufacture is Tarrare, where lace and muslin for curtains and window blinds are worked; as also mousseline-de-laine for ladies' dresses, mantles, and pelerines, which is likewise in crochet.

At Luneville the work is principally done on tulle with the needle, and consists generally of scarfs, dresses, collars, pelerines, and other articles of taste and novelty. But the very fine embroidery in satin-stitch, for articles of luxury, is the most important part of this branch.

The seat of this beautiful manufacture was formerly Nancy; but for some years past it has extended to the departments of La Meurthe, La Moselle, La Meuse, and des Vosges (forming the ancient province of Lorraine). In these departments they formerly worked on the hand only; but, for the last four or five years, frame embroidery has been more esteemed as giving greater neatness and perfection to the work, particularly in the extra fine. Special attention is now given to the instruction of the new hands in the use of the frame only.

It is in the department of the Vosges that this work has been attended with the most complete success. The women of this department have great aptitude for the employment, and their number is daily augmenting. The characteristic of the Frenchwoman is the remarkable taste she displays in her work. In this delicate and beautiful branch of art, chasteness and elegance of design effect much, but still the embroiderer must blend with these, taste and intelligence. The French workwomen excel in open work, which gives so light and graceful an effect to the various rich patterns so eagerly sought for, and so difficult to obtain. This excellence is attained principally through their being accustomed to the manufacture of white lace by bobbin or needle, generally known throughout France, and which offers so many beautiful patterns for imitation. Every embroiderer pursues her work at home with her family, leaving off when household affairs require her attention, and taking it up again when she pleases. This system has introduced much comfort and ease where it exists.

Hand-made Lace.

The manufacture of lace by hand in France gives employment to upwards of 200,000 females, from six to seven years to a very advanced age; each individual earning, upon an average, for a day's work of 10 hours, from 6*d.* to 1*s.*, sometimes more, according to her skill, or the demand there is for the article.

All French lace is made with bobbins, upon a small portable pillow or cushion, except at Alençon, where the needle is employed and working on parchment.

This branch of industry has latterly increased to an immense extent, and nothing can be more admirable than the beauty of the patterns, combined with the purity of the work and delicacy of the web.

Hand-spun linen thread, cotton, wool, silk, and often gold and silver thread, mixed with the silk, are employed. The great expense in this manufacture is the labour, for in the east of France, setting up work, and the purchase of material does not exceed, upon an average, 12 to 18 per cent. of the whole.

About twenty years ago all the white lace was made with linen thread, spun by hand (called Malguinerie thread); at present, however, it is rare to find any other used than cotton thread, Nos. 120 to 320.

White and black blonde and black lace are manufactured in the same manner as white lace, there being no difference in the work, the material alone being changed.

Formerly white lace only was made, at present blonde and black silk employ half the workers.

This branch is spread over a great part of France, extending from north to south-east, through fifteen departments. Each district has a peculiar style, and what is very remarkable, that, although made in the same way, with the same material, they are instantly recognised; hence the different appellations by which they are known, are derived from the seats of their manufacture. The following are the principal places where this manufacture is carried on in France:—

1. Caen and Bayeux.
2. Chantilly and neighbourhood.
3. Lille.
4. Arras.
5. Mirecourt.
6. Du Pay.
7. Boilleul.
8. Alençon.

For an explanation of the productions of the abovementioned establishments, a short notice of each is here given.

1. *Caen and Bayeux* (Calvados). The manufacture of lace in these places is much the same, and is the most extensive in silk lace, in length and pieces, employing from 35,000 to 40,000 women. The manufacture of silk lace at Caen, and particularly at Bayeux, was formerly very little known; now, however, it is different, and scarcely any other tissue is made.

The first silk blonde was made at Caen, and called blonde, being made of undyed silk of a nankin colour; now they only use silk of the finest white, or of the finest black, with the exception of a few coloured blondes.

The blonde manufacture had rapidly risen to great perfection, and Caen stood unrivalled in her prosperity; but fashion or caprice changed the face of things, the demand for the article became every day diminished, and the majority of the workers are now employed on black lace. Caen and Bayeux excel all other places in the production of what are called piece goods, such as veils, scarfs, berthes, mantles, ladies' robes, shawls, &c. &c., and are considered of these goods the most extensive manufactures in the world. The women of the department of Calvados are remarkably quick at this work, and by means of a stitch called *racroc*, which is used in joining several parts in one entire piece, so that the same is imperceptible to the eye even with a glass, they are able to perform in less than a month, with nine or ten persons, what formerly occupied a workwoman one whole year. The manufactures have attained a high reputation, on account of the skill of the workpeople in silk and thread lace.

2. *Chantilly.*—Though this is a name given to a particular lace, being the place of its birth, its fabrication has been principally removed to the neighbouring districts. This lace completely resembles that of Bayeux, except that it has been brought to much greater perfection in the production of finer and richer articles; the prices, consequently, range higher. Fewer hands are employed than at Bayeux, but the improvements of the latter have been regularly adopted. The articles manufactured are less intended for general use, than to satisfy the desires of the luxurious, being laces of the very finest textures and most beautiful patterns.

3. *Lille.*—This manufactory is the oldest in France; it is small, and has not, for a length of time, increased; on the contrary, the only article produced here is white thread-lace, very light and simple, called *clear foundation* (fond clair). Of all similar productions, these are the finest, the lightest, the most transparent, and best made, and, consequently, in higher esteem than any other. This manufacture is of little importance, being on the decline. The workwomen of Lille derive more lucrative remuneration from other industrial resources in that town.

4. *Arras, Pas-de-Calais.*—This manufactory is in the same condition as that of Lille. The lace of this place is, however, esteemed for its low price, but the designs require to be improved.

5. *Mirecourt, Vosges.*—Contrary to that of Arras, this manufacture is constantly introducing new designs. Nearly all the improvements and novelties in lace-making

proceed from Mirecourt, which is renowned for the good taste and elegance of its productions. The same kind of lace is made here as at Lille and Arras, that is to say, clear foundation, and "*fonds de champs*," in white thread-lace.

They also produce here a lace, very much resembling the Honiton, called "guipure." Within the last four or five years flowers have been made and sewn upon that extremely fine net termed "Brussels net." This fabric has, in two years, been so much improved that it now bears a close affinity to the Belgian, at Binche and at Brussels, and is greatly esteemed for its admirable whiteness, its fine quality, and moderate price.

6. *Puy, Haute-Loire.*—This town employs the greatest number of workpeople in France, from 40,000 to 50,000 being spread through the neighbouring departments. The lace made here is coarse, and not rich in texture, but of low price. At Puy all kinds of lace are also made in silk, thread, and wool, as well as point, clear point, point de Chacey, and point de Valenciennes. This town also produces black and white lace, blonde, and other articles of every colour, and especially worsted lace, in pieces, shawls, scarfs, &c. This manufacture promises much for the future, being situated in a province where there are few other industrial resources, and where labour is consequently cheap. The workwomen of Puy and its environs are very skilful, and yet, up to the present time, they have only succeeded in ordinary articles, for which there is no competition.

7. *Bailleul.*—This is the only important town in France for Valenciennes: it produces lace of the same kind as that of Bruges (Belgium), but rather coarser. The lace of Bailleul possesses two valuable qualities, being the whitest and the cheapest. This lace, though somewhat thick, is very good.

8. *Alençon, Orne.*—The lace of Alençon is the only fabric of this description not made on the pillow, being worked entirely with the needle. It was introduced into France in 1660, by Colbert, who sent to Venice and Gênes for workmen, and they introduced the *point de Venise*, which was at first named *point de France*, and afterwards *point d'Alençon*, from the name of the town where it was made. This lace, however, does not resemble in any manner the *point de Venise*, as it forms an exception to the others; for, while in the other fabrics one single worker is required to make the richest piece, the Alençon requires from fourteen to sixteen different workers, for the smallest size, even one-quarter of a yard, and the most simple pattern. It is the only lace made with pure linen thread (handspun). This thread is worth from 100*l.* to 120*l.* per pound.

All the workwomen here are extremely skilful. The open work in the lace is made in a superior style, and every day new is made of great perfection. It is the richest, the finest, and the strongest, and consequently the prices are the highest. There are in France several other manufactures of lace, but the foregoing detail will be a *resumé* of all.

This branch of industry, one of the most important, is very interesting, particularly as regards commercial relations, and in a moral point of view.

All the females employed in making lace carry on their work in their own houses, under the surveillance of their parents or friends, who act as their instructors.

SWITZERLAND.

Switzerland has largely availed herself of the benefits held out by this Exhibition, and well sustained her long-enjoyed celebrity for both lace and muslin embroidery of every description. It will be seen by the numerous articles shown (displaying at once cultivated taste and excellence of work, combined with cheapness and utility), that her motto is progression, and, as stated by one of themselves, "Under the beneficial effects of free trade the Swiss sewed-muslin trade has made enormous progress." From the variety of articles manufactured, the excellence of the work, and the beauty of the design, the manufacturers send their productions to all parts of the globe, and find ready sale, even where they are met by hostile tariffs. The hands available for needlework in Switzerland are no longer sufficient to satisfy the demand, and the Swiss manufacturers are employing large numbers in the eastern provinces of Austria, and the southern provinces of the Duchy of Baden.

It would be difficult to state the exact numbers employed in this branch of manufacture, the hands not being in factories or large rooms, as frequently the case in this country—the pattern being stamped or printed on the muslin or net, and given out to workers at their own homes, so that many do their household work, and fill up their time with this embroidery; there cannot, however, be less than 40,000 earning their living by this branch of industry.

A good steady hand can earn, in ordinary times, 1*s.* per day; second-class hands, down to children, range from 3*d.* to 8*d.* per day. The needlewomen of Appenzell (Rhodes intérieures) are noted as the most skilful workers in sewed muslin, &c.; hence the finest and most difficult work is done there, and the highest wages are received.

Those articles in which cheapness is the recommendation, are done by the needlewomen of St. Gall, Vorarlburg, and Baden. It is estimated that 100,000 pairs of curtains alone are annually imported into the United Kingdom of Great Britain, at prices varying from 3*s.* to 100*s.* per pair, paying a duty of 15 per cent.

The Swiss manufacturers do not regard England as their best customer; they export largely to America (North and South), Germany, Italy, Spain, and other southern countries. The trade is steadily progressing, and is principally conducted by the manufacturers of the canton of Appenzell, a few only residing at St. Gall, where they have a Wednesday's and Saturday's market for the transaction of business.

The continued care for new styles, novel designs, and cheaper productions, has evidently had the effect of developing the skill and artistic faculties of the Swiss manufacturers, as may be seen by the unrivalled excellence of some of the goods in the Exhibition.

The productions of Mr. J. J. SUTTER and Mr. J. U. TANNER, both of Buhler, are here more particularly referred to, as being of unrivalled excellence.

SAXONY.

Saxony has furnished a small assortment of lace and embroidery, mostly of a manufacture peculiar to the country, being heavy, firm, and well made, but of limited sale in the English market.

SPAIN.

The exhibition of lace and embroidery is limited, although there are some articles deserving of notice, from their richness and antiquity.

HAMBURGH.

There is little from this place, except some specimens of embroidery with hair, displaying much taste.

AUSTRIA.

We cannot say much of the articles exhibited in lace and embroidery, as they are very few, and of a class that would not suit the British market.

MALTA.

There is little worthy of notice from Malta.

LACES OF BELGIUM.

The description of lace peculiar to this country is admirably sustained by some of the exhibitors in this department, there being a valuable display of Valenciennes edgings and laces of Mechlin, and other goods of the most costly and superb character, representing some thousands of pounds in value, evincing at once the taste and perseverance of the Belgian manufacturers, who are finding employment for at least a hundred thousand hands annually, by the production of this description of lace, used principally by the middle and upper classes of society.

Belgium still retains the pre-eminence it has long enjoyed, for the perfection displayed in the manufacture of the most beautiful laces; in proof of which the articles exhibited by Messrs. **DUHAYON-BRUNFAUT** and Co., of Brussels and Ypres, may be more particularly referred to, as also those of other exhibitors. The laces chiefly manufactured are termed Brussels, Mechlin, Valenciennes, and Grammont laces.

I. "Brussels" produces two different descriptions of lace, known as "Point à l'aiguille," and "Brussels plait."

The former is made entirely with the needle, the latter is made on the pillow, and "Honiton lace" very much resembles it.

The finest and most expensive kind is made of very fine flax thread, and some of cotton. Formerly the laces were made only on the "real ground," which is made on the pillow in narrow widths of from 1 to 3 inches, and then joined with such admirable ingenuity as to be imperceptible.

It is of the most beautiful description, being remarkably soft and clear, but so costly as to be within the reach of comparatively few persons Hence it was only worn at Court, and by the most wealthy.

Trimming lace of 4 inches wide varied in price from four to ten guineas per yard: veils, from twenty-five to one hundred guineas each, and other articles were proportionately expensive; but recently, owing to the great improvement which has been effected by eminent houses in the town of Nottingham (England), in producing a very superior net by machinery, the lace is now manufactured at a much less cost; the flowers or designs being made by hand, and afterwards sewed on to the "machine-made" net. This description of lace is known by the term "application of Brussels," and its resemblance to the Brussels point lace is so striking as frequently to deceive those who possess a good knowledge of lace.

"Brussels plait" is in considerable use in France, Spain, Russia, and other countries, and is made of most exquisite quality.

The "Point à l'aiguille" is more worn in England; and since the great improvements which have been made in producing this beautiful lace at so considerable a reduction in price, the demand for it has become very general, and it is now worn by nearly all ladies of rank and fashion.

In the manufacture of Brussels lace several classes of workers are employed, as follows:—1. Those who make the flowers in plait. 2. In point. 3. The real ground. 4. The ground in the flowers. 5. The attacheuses (fasteners). 6. Those who apply on the net. 7. Those who work the point, and the new kind of real Brussels, &c. (the "gase point").

With the exception of the point d'Alençon (made in the north of France), Brussels produces the most valuable lace that is known.

II. Mechlin laces are made at Malines, Antwerp, and in the vicinity, and are of the lightest and most beautiful texture. They are all made in one piece on the pillow, and their peculiarity consists in a plait thread surrounding the flowers, and designing the outline, so as to give the appearance of embroidery. This manufacture has suffered very much from the caprice of fashion.

III. Valenciennes laces are made chiefly in the following towns, and the surrounding villages, viz., Ypres, Menin, Courtrai, Bruges, Ghent, and Alost.

Although all made in the same manner on the pillow, yet the productions of the various towns named are so characteristic, that a person accustomed to examine them, will readily distinguish where each piece of lace was made.

1. Ypres excels particularly in laces of the finest square grounds, of the widest and most expensive description, varying in price from 6*d*. to 50*l*. the English yard. This branch of industry was commenced at Ypres about 1656; and according to a census made by Louis XIV. in 1684, there was then one lace manufacturer, and 63 workers employed. It is only since 1835, that its trade has been so considerably developed; and now it is estimated that the lace-dealers of Ypres purchase the produce of about 20,000 workers living in the town and its environs.

The bulk of the lace manufactured here is exported, principally to England, France, and Germany, and a trade has been opened with the United States; but a great barrier to its increasing development exists in the greatly-varying duties levied upon lace by different countries.

2. Menin provides employment for about 2,000 or 3,000 workers.

3. Bruges. The manufacture in this town has immensely increased, and a considerable trade is now carried on. The laces here are of a good, useful quality, suitable for trimmings, and are much sought after by English buyers; but the number of persons engaged here in the making of lace is not so large as in Ypres.

4. Ghent. The fabric of this place is extremely good, and laces of all qualifies are produced, principally consisting of the narrow and medium widths, employing in their manufacture about 10,000 or 12,000 persons.

5. Alost possesses very excellent workers; but the designs are not equal to those of Ypres, and the colour of the laces is inferior.

IV. In the village of Grammont great improvements have been made in white-thread lace, also in black point trimming laces.

Recently, the manufacture of piece-goods, as shawls, scarfs, berthes, &c., has been commenced, and is carried on with great success. The quality and designs are not equal to those of France, but the prices are much lower, and these productions are now in considerable demand.

BRITISH LACE.

A Council Medal has been awarded to **BALL, DUNNICLIFFE**, and Co., Nottingham (19, p. 560), for velvet and Simla lace; being new patented fabrics, suitable for shawls, dresses, and for various ornamental and useful purposes, and of commercial importance. Also imitation Valenciennes, and white and black point tulle, of great merit.

The Jury award prize Medals to the following:—

AYERS, W., Newport Pagnell, Bucks (388, p. 573), for specimens of wide thread-lace of good useful quality.

CLARKE, ESTHER, London (130, p. 565), for a Honiton lace flounce, of which the design and quality are unequalled in its class.

FISHERS and **ROBINSON**, Nottingham (2, p. 559), for imitation of Valenciennes laces, black trimming laces, and patent spot-nets, all possessing merit as machine-finished goods; also two tamboured net shawls, with a variety of excellent black Jacquard laces and shawls of superior merit.

FORREST, JAMES and **SONS**, Dublin (45, p. 561), for jacket-flouncings, scarf, berthe, and handkerchief, in imitation of old Spanish point, with specimens of Limerick lace. The whole unequalled in their class.

GREASLEY and **HOPCROFT**, Nottingham (34, p. 561), for very superior Jacquard shawl; also flouncings and falls, together with some needlework-shawls well executed, and truthful imitations of real lace.

GROUCOCK, COPESTAKE, MOORE and Co., London (3, p. 559-60), for Honiton guipure half-shawl, flouncings, lappet, and trimming-lace, of excellent design and manufacture. Double-flounced dress, with court train, tamboured on fine Brussels net, elaborately worked and well designed. Very wide Buckinghamshire lace of fine quality. Embroidered muslin low and high chemisettes, collars, cuffs, trimmings, &c., of superior work.

HEALD, B., Nottingham (269, p. 570), designer, for pastern for broad lace flounce, evincing good taste and suitability of design.

HEYMANN and **ALEXANDER**, Nottingham (25, p. 560), for machine-made lace curtains in great variety; also, plain and fancy nets, remarkable for cheapness and utility.

HOWELL, JAMES, and Co., London (5, p. 560), for guipure Honiton lace shawl and mantle of very excellent manufacture.

LAMBERT and **BURY**, London (4, p. 560), for Limerick lace shawl and tunic dress.

LESTER, T., Bedford (236, p. 568), for wide white and black lace.

Mallett and Barton, Nottingham (29, p. 561), for imitation black trimming-laces, and Valenciennes edgings.

Reckless and Hickling, Nottingham (32, p. 561), for shawls, scarfs, flounces, falls, and trimming-laces, in imitation of black point lace. Also for white tamboured shawls, scarfs, flounces, and falls. The whole possessing great merit in design, as well as in execution.

Riego de la Branchardiere, E., London (17, p. 560), for basket of flowers, rock, berthe, &c., in crotchet-work; very beautiful.

Robinson, Thomas, Nottingham (25a, p. 560), for machine-made lace curtain of excellent quality and graceful design, exhibited by Heyman and Alexander.

Rolph, Jonas, Coggeshall, Essex (282, p. 570), for double flounce, scarf, and berthe; the design superior, and the work unequalled in its Class.

Steegmann, H., and Co., Nottingham (41, p. 561), for machine-made lace curtains of great beauty of design and general excellence.

Treadwin, C. E., Exeter (55, p. 561), for Honiton guipure flounce, resembling ancient lace; the pattern, from Government School of Design, is particularly commended.

Viccars, R., Padbury, Buckingham (235, p. 568), for wide thread-lace of fine quality.

Vickers, William, Nottingham (33, p. 561), for shawls, scarfs, mantles, falls, flounces, and trimming-laces, of great merit in design, and for their faithful imitation of real black point lace, and at comparatively moderate prices.

Weedon, Francis, London (6, p. 560), for British point lace shawls, lappets, and specimens of flouncings; designs very good.

Whitlock and Billiald, Nottingham (27, p. 560), for imitation laces; an admirable copy of the real Mechlin.

The Jury make Honourable Mention of the following Exhibitors in this department:—

Adams and Sons, Nottingham (21, p. 560), for thread edgings, made on the traverse warp machine, being neat and useful goods.

Cardwell, C. and T., Northampton (122, p. 560), for pillow-lace of different widths.

Clarke, Jane, Regent Street, London (18, p. 560), for specimens of lace, copies of old Spanish point; the work extremely fine and beautiful.

Gill, W. L., Colyton, Devonshire (386, p. 573), for specimens of Honiton lace, in imitation of Spanish and Venice point.

Heald, Henry (295, p. 570), student of Government School of Design, Nottingham, for pattern of half shawl in good taste.

Herbert, Thomas, and Co., Nottingham (28, p. 560), for imitation blondes, laces, crochet-edgings, &c.

Irish Work Society, London (77, p. 563), for various descriptions of lace, knitted, netted, and crochet; also, various specimens of hosiery.

Kightley, I. (123, p. 564), for pillow-lace, narrow and wide.

Ladies' Industrial Society, Dublin (213, p. 567–8), for infants' lace-robes, imitation of Spanish point; also shawl, mitts, parasols, &c., made from the fibre of sweet pea, nettles, and honeysuckles, an application of a new material to textile purposes.

Laugher and Cosens, London (10, p. 560), for Honiton half-shawl of good quality.

Sim, C. J., Bedford (301, p. 571), for two pair of lappets made on the pillow, an excellent imitation of Mechlin lace; also various trimming-laces.

Turton, Samuel (179), designer, Nottingham, for a design for lace curtain.

Scotch and Irish Embroidery.

The Jury award Prize Medals to the following subjects:—

Brie, J., and Co., 189 Regent Street, London (24, Class XX., p. 578), for embroidered shirt-fronts, tasteful in design and of fine work.

Brown, Sharps, and Co., Paisley, and 18 Watling Street, London (57, p. 562), for embroidered muslin robe, of great richness of effect and splendour of design.

Brown, S. R. and T., Glasgow (58, p. 562), for rich book-robe, short cambric frock, cambric handkerchiefs, stomachers, and collars, with other articles of great beauty, utility, and excellence; also, a number of book-muslin collars exhibited for lowness of price.

Holden, J., and Co., Belfast, Ireland (1, Class XIV., p. 510), for muslin insertions and trimmings, embroidered robes, and frock bodies; also, some fine embroidery in robes and jaconot, remarkable for cheapness and effect.

Mair, J., Son, and Co., 60 Friday Street, London (59, Class XI., p. 482), for three muslin robes (sewed and tamboured), very chaste in design and of excellent work.

Macdonald, D. and J., and Co., Glasgow (66, p. 562), for embroidered muslin robe, cap, and bassinet; designs very graceful, and work exquisite, being the finest sample of sewed-work in English, Scotch, or Irish embroidery. This firm also exhibit medium and wide open-work flouncings, fine broad trimmings, embroidered muslin robe, high chemisettes, and many other articles of merit in design, execution, and utility.

Salomons and Sons, 42 Old Change, London (305, Classes XII. and XV., p. 501), for embroidered guipure cambric cape and handkerchief, high chemisette, and collar, work of much excellence, and great novelty in the introduction of a new guipure stitch.

The Jury make Honourable Mention of the following Exhibitors in this department:—

Brown, Hugh, Glasgow (64, p. 562), for muslin flounce and trimmings, embroidered robes, and cambric handkerchiefs.

Brown, J. R. and W., Bangor (2, Class XIV., p. 510), for embroidered muslin robe, of good work.

Capper and Waters, London (21, Class XX., p. 578), for court suit in work, lace frill and cuffs in imitation of point lace.

Robertson and Sons, Glasgow (62, p. 562), for cambric table-cover, collars, and other useful embroidery.

British Trimmings and Fringes.

The Jury award Prize Medals to the following subjects:—

Bennoch, Twentymann, and Rigg, 77 Wood Street, Cheapside, London (394, p. 574), for a variety of gimps, fringes, and cameo braids, showing general excellence.

Danby, C. and T., 14 Coventry Street, London (71, p. 562), for a variety of silk fringes, garniture for dresses, cord and tassels, and other trimmings of taste and novelty.

Evans, R. and Co., 24 Watling Street, London, (74, p. 563), for silk fringes, braids, and fancy buttons.

Hamburger, Rogers, and Co., 30 King Street, Covent Garden, London (186, p. 566), for epaulettes, military hats, and embroidery suitable for regimentals, of good design and execution.

Lambert, Brown, and Patrick, 236 Regent Street, London (83, p. 563), for epaulettes and laces, embroidered waistcoats, masonic emblems, church decorations, facsimile of Bible used by King Charles I. embroidered in gold, and coloured silks; all of great merit.

Upholstery Fringes, Trimmings, and Coach Laces.

The Jury award Prize Medals to—

Burch, Robert, 42 Bartholomew Close, London (75, p. 563), for specimens of gimps, tassels, and ornaments, in fine taste, and well executed.

Jullien, sen., Tours (Indre and Loire), (1280, France, p. 1238), for specimens of gimps, fringes, tassels, ornaments and glass frames, formed of silk rope, very tastefully and well executed.

Lees, R. and Co., 36 King Street, Cheapside, London (79, p. 563), for printed mohair velvet, of very handsome design and well executed.

Schaerff, R., Brieg (118, Prussia, p. 1055), for a large assortment of coach laces and trimmings, possessing a high degree of excellence in design and execution.

The Jury make Honourable Mention of the following Exhibitors:—

Ellis, Sophia A., Ireland (159, p. 566), for specimens of tatting in collars, berthes, chemisettes, &c., of very fine quality.

Guillemot Brothers (251, France, p. 1188), for coach and livery laces.

Harrison, T., London (85, p. 563), for altar-cloth and cushions of crimson Genoa velvet, embroidered in gold.

Kingsbury, Louisa, Taunton (225, p. 568), for a basket of flowers, &c.

Onion, E., Birmingham (56, p. 562), for an assortment of good fringe, tassels and ornaments.

Puzin, Beaumont Depôt (1414, France, 1244), for lace and trimmings for carriages, and livery laces, extremely good.

Standring and **Brother**, Manchester (239, Class XXIX., p. 802), for a good assortment of braids, laces, plaited lines, binding plain and figured, and fringes for dresses.

Westhead and Co., Manchester (275, Class XXIX., p. 816), for a good assortment of tapes, and binding of various kinds, lines, &c.

Zeisig, H., Breslau (225, Prussia, 1060), for specimens of upholstery and coach trimmings of good workmanship.

France.—Lace and Embroidery.

The Jury award Prize Medals to the following:—

Aubry Brothers, 33 Rue des Jeuneurs, Paris (1544, France, p. 1250), for laces from Mirecourt, made in the same manner as Brussels plait; double skirt-dress, half shawl, coiffure, lappets, also trimming lace, &c. Designs and work meritorious.

Berr and Co., 17 Rue de Clery, Paris (54, France, 1174), for robe, shawl, scarf, veil, berthe, cape, &c., in imitation of Brussels lace, being superior to any others exhibited of their class.

Darnet, Rue Richelieu, Paris (1578, France, p. 1252), for a great variety of shirt fronts, beautiful in designs, and of good embroidery.

Debbeld-Pellerin, and Co., 73 Rue Richelieu, Paris (1173, France, p. 1234), for a magnificent counterpane (worked at Nancy). Beauty of design, excellence of work, and general effect.

Delaroche-Daigremont, 17 Rue de la Paix, Paris (267, France, p. 1189), for muslin robe, jacket, and a variety of cambric handkerchiefs and collars, all of much merit.

Fouiquié, Mlle., and Co., 20 Rue Hanteville, Paris (1603, France, p. 1253), for collars, half shawls, neckerchiefs, and other articles of knitting work, possessing merit as regards novelty and cheapness.

Heyler, Mlle. **Marie**, 36 Rue de l'Echiquier, Paris (539, France, p. 1204), for silk-net mittens and gloves of very superior quality.

Hubert, Madame **Josephine**, Mondeville, and 2 Rue du Grand Chantier, Paris (268, France, p. 1189), for head-dresses, and garnitures for robes, in needle-point relievo. Designs of high artistic excellence, and much novelty and ingenuity exhibited in their application for the purposes named.

Lefebure, Auguste, Bayeux, and 42 Rue de Cléry, Paris (1646, France, p. 1256), for white thread-lace counterpane, black lace half-shawl and scarf; Alençon point lappets and scarf, and white blonde mantilla. The white lace counterpane is a very beautiful production, and deserving the highest encomiums for fineness of quality, beauty, and elaboration of design.

Lemire and Son, 1 Rue des Feuillantes, Lyons (1649, France, p. 1256), for embroidery in gold, and the application of gold and silver to this purpose, evincing superior skill. (Prize Medal awarded by Jury of Class XIII.)

Mallet Brothers, Calais (599, France, p. 1256), for specimens of machine-made imitation Valenciennes lace and lappet. Fine ground and good patterns.

Michelin, T., 139 Rue Montmartre, Paris (641, France, p. 1208), for fancy ribbon trimmings for dresses and cloaks. Designs very tasteful.

Méraux, J. H., 7 Rue de la Jussienne, Paris (631, France, p. 1208), for patterns for rich flounce, handkerchief, lappets, &c., in excellent and appropriate taste.

Moreau and Co., 22 Rue d'Enghien, Paris (652, France, p. 1209), for embroidered shirt-fronts, of much merit, both in design and execution.

Moulard, Mlle., 39 Rue Montmartre), Paris (655, France, p. 1209, for lace head-dress, caps, tobacco-bags, net-purses, with various fancy articles in chain-stitch work.

Mornieux, F., 31 Rue Mendètour, Paris (1362, France, p. 1241), for galloons, and buttons of superior quality, and excellent taste.

Pagny, Paris (675, France, p. 1211), for black point-lace shawl and scarf. Design and quality deserving high praise.

Repiquet and **Silvent**, Place de la Croix-Paquet, Lyons (1432, France, p. 1244), for a large variety of velvet and silk trimmings in very good taste. (Prize Medal awarded in Class XIII.)

Randon, L., Caën, and 9 Passage des Petits Pères, Paris (1684, France, p. 1257), for white blonde flounce, scarf, berthe, lappet, and coiffure; also lappet in gold and silver. Decided merit in an effective and beautiful style of design, with great richness of effect.

Vaugeois and **Truchy**, Rue Mauconseil, Paris (718, France, p. 1213), for gold and silver embroidery. The arms of Paris, chasuble, epaulettes, and fringes.

Videcoq and **Simon**, 35 Rue de Jeuneurs, Paris (1706, France, p. 1258), for Chantilly shawl, scarf, dress, flounce, and suite of Alençon point-lace. The magnificence of design, extraordinary beauty, and surpassing quality of the articles exhibited, merit the highest praise.

French Lace, &c.

The Jury make Honourable Mention of the following Exhibitors in this department:—

Audiat, F., Paris (1545, France, p. 1250), for embroidered imitation trimming laces, on Mechlin grounds, of good design and workmanship.

Dabaret-Tampé, Oise (152, France, p. 1178), for a great variety of silk buttons.

Delcambre, A., Paris (1584, France, p. 1252), for gold and natural colour silk lace, and black point-lace and scarf.

Hooper, Carroz, and **Tabourier**, Paris (1625, France, p. 1255), for lace scarf, lappets, and berthe, in imitation lace.

Laroche, E., Designer, Paris (291, France, p. 1190), for pattern suitable for guipure lace. (Prize Medal awarded by Jury of Class XXX.)

Laurent, J. B., Paris (902, France, p. 1223), for silk buttons and other articles of trimming.

Martin, C. A., Paris (613, France, p. 1207), for silk buttons, fringes, &c.

Mercier, Paris (1354, France, p. 1241), for purses, Greek caps, reticules, and various other fancy articles, evincing much taste and novelty.

Seguin, Joseph, Puy, Haute-Loire, and Paris (1008, France, p. 1227), for new description of black diamond open ground lace in half-shawl, mantle, and laces.

Tuissant Designer (France, p. 1200), for rich scarf with guipure border, showing novelty in design.

Switzerland.—Lace and Embroidery.

The Jury award Prize Medals to the following:—

Alther, J. C., Speicher, near St. Gall (110, Switzerland, p. 1273), for muslin curtains, embroidered in colours, in good taste.

Bunziger, J., Thal, near St. Gall (188, Switzerland, p. 1278), for embroidered double-flounced dress, of great novelty in design; arms of England embroidered on cambric, with several other articles of merit.

Ehrenzeller, F., St. Gall (191, Switzerland, p. 1278), for net and muslin curtains, very chaste in design, and of superior work.

Fisch Brothers, Buehler, Canton of Appenzell (192, Switzerland, p. 1279), for net curtain, decided novelty in design.

Schlaepfer, Schlatter, and Kürsteiner, St. Gall (201, Switzerland, p. 1279), for two pairs of net curtains, of excellent design; with a variety of other useful articles.

Schoch, Schiess, and Son, Herisau, Canton of Appenzell (202, Switzerland, p. 1279), for embroidered handkerchiefs, of good work and rich design.

Staeheli-Wild, C., St. Gall (208, Switzerland, p. 1279), for two embroidered table-covers, window curtains, waistcoat piece, several handkerchiefs and collars: the whole of beautiful design and superior work.

Sutter, J. J., Bühler, Canton of Appenzell (203, Switzerland, p. 1279), for chintz book robe of great beauty; net curtain, with Swiss scenery, several cambric handkerchiefs, exquisite in design, illustrating various objects in natural history, combined with landscape views and other objects of novelty portrayed in needlework.

Tanner, J. U., Bühler, Canton of Appenzell (205, Switzerland, p. 1279), for embroidered coverlet, figure of William Tell in the storm. Framed piece of needlework, representing a girl embroidering the figure of William Tell; cambric handkerchiefs of great beauty, bouquet of flowers, in silk; with other articles of great merit.

Tanner and Koller, Herisau, Canton of Appenzell (206, Switzerland, p. 1279), two embroidered muslin dresses, rich cambric handkerchiefs, with other articles of merit.

The Jury make Honourable Mention of the following exhibitors in this department:—

Holdregger, C., St. Gall (195, p. 1279), for embroidered curtain of good design and very effective.

Tanner, B., St. Gall (204, p. 1279), for muslin in the piece, fine and well manufactured.

Vonwiller, Ulric de Gasp, St. Gall (140, p. 1275), for a variety of low-priced articles, suitable for the foreign market.

Belgium.—Lace and Embroidery.

The Jury award Prize Medals to the following:—

Beck and Sons, Courtray (324, Belgium, p. 1161), for broad and narrow Valenciennes of good fabric.

Defrenne, Sophie (316, Belgium, p. 1161), for Brussels point handkerchief, of much taste and elegance.

Delehaye, A. (305, Belgium, p. 1160), for "application of Brussels" flounce. Real Brussels fall and scarf of good execution.

Duhayon-Brunfaut, and Co., Brussels and Ypres (314, Belgium, p. 1161), for wide and narrow Valenciennes laces, in great variety. Rich real Brussels half-shawl and handkerchief. The wide Valenciennes laces are of surpassing beauty, and unequalled as to quality and design. The Brussels shawl and handkerchief are most elaborately worked, and possess much merit.

Haeck, J. T. (341, p. 1161), for a real Brussels plait veil.

Hammelrath, P. H., Ypres (337, Belgium, p. 1161), for Valenciennes laces in great variety and beauty, both in design and quality. One piece, extremely wide for this description of lace, is deserving of much praise.

Heusschen Van Eeckhoudt, and Co., Brussels (310, Belgium, p. 1160), for two bobbin Brussels lace dresses, real Brussels fall, guipure handkerchief and cape, &c., excellent designs and quality.

Melotte, E., Brussels (302, Belgium, p. 1160), for magnificent piece of gold embroidery of superior work.

Naeltjens, G., Brussels (308, Belgium, p. 1160), for bobbin Brussels berthe, coiffure lappet, jacket, falls, and flounces: the whole a good medium class, and as such possessing merit.

Polak, F., Brussels (298, Belgium, p. 1160), for designs for black lace flouncings, scarfs, trimming laces, &c., in good and appropriate taste.

Reallier, Mlle., Brussels (309, Belgium, p. 1160), for Brussels point lace handkerchief, made of flax thread, needle-wrought ground; for beauty, harmony of design, perfect execution, and fineness, this article belongs more to the fine arts than to ordinary manufactures.

Soenen, F., Ypres (338, Brussels, p. 1161), for Valenciennes lace handkerchief and lappets—excellent goods.

Stocquart Brothers, Grammont (307, Belgium, p. 1160), for black point lace shawl, scarf, lappets, flouncings, &c.—much merit, taking prices into consideration.

Vander-Kelen-Bresson, Brussels (313, Belgium, p. 1160), for Brussels lace handkerchiefs, artistic design: subject, the Royal Arms of England, Glory, Industry, and Justice. Guipure flouncings and berthe of superior quality; with various other articles of much merit.

Van Halle, J., Brussels (303, Belgium, p. 1160), for complete set of rich vestments, consisting of chasuble, cope, and dalmatics. Three figures, representing Bossuet, Bishop of Meaux; Fénélon, Bishop of Cambray; and St. Thomas à Becket, clothed in episcopal robes of exquisite embroidery, studded with brilliants. The mitre is adorned with diamonds, rubies, and pearls. The albe is of real Brussels lace.

Van Kiel Sisters, Mechlin (333, Belgium, p. 1161), for real Mechlin lace lappets, trimming lace, lace fall, and collar—much merit.

The Jury make Honourable Mention of the following Exhibitors:—

Bousson de Vlieghere, Bruges (328, Belgium, p. 1161), for two flouncings, imitation of Spanish point lace, of bold and effective style.

Dartevelle and Mounoury (329, Belgium, p. 1161), for imitation Brussels scarf; Mechlin half shawl, &c.

Everaert Sisters, Brussels (321, Belgium, p. 1161), for black lace shawl, dress jacket, and veils, good in quality and design.

Roy, C. F. (301, Belgium, p. 1160), for "application of Brussels" flounce; very bold and effective.

St. Joseph, Establishment of, Verviers (322, Belgium, p. 1161), for Flanders guipure lace flounce, sleeves, and trimming-lace, of excellent quality and good style.

Saxony.—Embroidery.

The Jury award Prize Medals to the following:—

Bach, G. F. and Son, Buchholz (158, Saxony, p. 1111), for fancy gimps and silk fringes; much merit in taste, excellence of execution, and cheapness.

Hietel, J. A., Dresden (168b Saxony, p. 1112), for seven tableaux embroidered in hair and silk, in imitation of engraving. The whole beautifully executed, particularly the portraits of the King of Saxony and Her Majesty Queen Victoria.

Schmidt, G. F., Plauen (60, Saxony, p. 1107), for set of furniture; easy chair, pillow, and cushions, window-cushion, wall-basket, table-cover, shades, letter-case, and pincushion, embroidered on muslin; possessing merit, as showing a new use for embroidery. Designs and work well adapted for the purpose.

Shcreiber, F. A., Dresden (71, Saxony, p. 1108), for pillow-lace guipure, berthe, barbe, in imitation of ancient lace, both possessing merit.

The Jury make Honourable Mention of the following Exhibitors:—

Boehler, F. L. and Son, Plauen (56, Saxony, p. 1107), for embroidered cambric handkerchiefs.

Schnorr and Steinhaeuser (62, Saxony, p. 1107), for table-cover of good design and work.

Schubert, Mrs., Annaberg (156, Saxony, p. 1111), for a worked table-cover on net-lace, of rich appearance, and ingenious design.

Denmark.

The Jury award a Prize Medal to—

Wulff, Jens, and Sons, Brede, Schleswig (5, Denmark, p. 1356), for lace collars, cuffs, thread-edgings, and laces; a good useful class of goods.

Tuscany.

The Jury award a Prize Medal to—

Parlanti, E., Borgo a Buggiano (102, Tuscany, p. 1298), for a piece of embroidery in imitation of engraving. Subjects embracing the map of Europe, Napoleon at St. Helena, portrait of Rubens, &c.

Sweden and Norway.

The Jury award a Prize Medal to—

Hamrén, Sophie, Halmstad (28, Sweden and Norway, p. 1351), needlework embroidery, representing the Royal Palace of Ulriksdal, near Stockholm; extremely well executed.

Sardinia.

The Jury award a Prize Medal to—

Stefani, W., Turin (86, Sardinia, p. 1305), for two large silk embroidered tableaux of great merit.

Spain.

The Jury award Prize Medals to the following Exhibitors:—

Fiter, J., Barcelona (221, Spain, p. 1343), for rich black blonde dress and mantilla, of superb appearance, remarkable for the introduction of coloured flowers, evincing much taste and elegance.

Gilart, R., Madrid (237, Spain, p. 1344), for the royal arms of Spain, elaborately worked with coloured silks, having a rich and costly appearance, with the gold and silver on crimson Genoa velvet. The work is beautifully executed, and produces a very brilliant effect. Also some exquisite embroidery on grass-cloth, being the baby-linen made for the late Prince of Asturias.

Marguerita, Señora (236, Spain, p. 1344), for rich dress from the fibre of pine-apples, embroidered by hand; very beautiful of its class. Exhibited by W. P. **Hammond**, and Co., London.

The Jury desire to make Honourable Mention of—

G. M. Senora, Madrid (238, p. 1344), for a fine curiously-embroidered shirt.

Hamburgh.

The Jury award a Prize Medal to—

Gompertz, B. (33, Hamburg, p. 1137), for hair-embroidered pictures of the Queen and the Prince of Wales, and of the Hamburgh Exchange.

Austria.

The Jury award a Prize Medal to—

Benkowits, Marie, Vienna (389, Austria, p. 1029), for embroidery of crape thread on white silk, representing Beneficence. An embroidery of wool and silk, representing the Grave of the Fallen Soldier.

The Jury make Honourable Mention of—

Bauhofer, F., Vienna (388, Austria, p. 1029), for the arms of England embroidered with gold and silver, well executed.

Knickl, E., Vienna (263, Austria, p. 1019), for a piece of embroidery, the arms of England in gold, silver, and silk, well executed.

Russia.

The Jury make Honourable Mention of the following Exhibitors:—

Shekhonin, Alexis, of Novgorod (275, Russia); Prize Medal, Class XX., p. 1375).

Popinoff, Sophia, of Tiflis (310, Russia; Prize Medal, Class XX., p. 1376).

Nakhitchevan, Town of (274, Russia, p. 1375).

All for a number of articles in leather embroidered with gold, adapted for caps, slippers, boots, &c., with many other articles possessing both novelty and excellence.

Sardinia.

The Jury make Honourable Mention of—

Tessada, F., Genoa (49, p. 1304), for several embroidered cambric handkerchiefs.

Greece.

The Jury make Honourable Mention of **Saris** and **Rengos**, Athens (56, p. 1406), for embroidery in gold.

Needlework and Embroidery.

The Jury award the Prize Medal to the following Exhibitors:—

Faudell and **Phillips**, London (165, p. 566), for embroidered hangings for a state bed, showing various kinds of embroidery in the curtain drapery, tester, and coverlet. The panel in the foot-board is a copy of the "Aurora" by Guido, very finely executed, from a drawing: for the centre of the head-cloth, a medallion finely worked from a cast, being a successful copy of Thorwaldsen's "Night."

Houldsworth, James, and Co., Manchester (64, Class XIII., p. 506), for embroidery by machinery on cloth and silk.

Seel, G. (Prussia, 657, p. 1086), for ornamental articles, and pictures in hair, most artistically executed.

The Jury make Honourable Mention of the following:—

Grünthal, Berlin (166, Prussia, p. 1057), for Berlin patterns for needlework.

Hartree, E. and **G.**, London (195, p. 567), for a table-cover embroidered on new silk canvas, the invention of the Exhibitor; also three small pictures in tent-stitch, finely executed.

Helbronner, R., London (199, p. 567), for specimens of a new style of needlework, of good design, and well executed.

Jackson, C., London (84, p. 563), for *appliqué* embroidery, forming the top of a table; well worked, and in good taste.

Jancowski, W., York (48, p. 561), for a small picture embroidered in tent-stitch, extremely well done.

Mee, Cornelia, Bath (51, p. 561), for banner screen, flags of all nations, well arranged and executed; embroidery suitable for borders to curtains or portières, the flowers well arranged and well coloured.

Neie, F. W., Berlin (Prussia, 168, p. 1057), for Berlin pattern for needlework.

Parey, C. F. W., Berlin (169, Prussia, p. 1057), for a needlework carpet, of good design, and well executed.

Purcell, Frances, London (88, p. 563), for an embroidered table-cover, tastefully designed and coloured, and exhibiting different kinds of needlework.

Schleuss, H., Berlin (160, Prussia, p. 1057), for specimens of embroidery.

Sommerfeld, B., Berlin (173, Prussia, p. 1057), for an assortment of needlework and embroidered articles.

Todt, A., Berlin (171, Prussia, p. 1057), for Berlin patterns for needlework.

Carpets.

In reviewing the existing state of the manufacture of carpets, the first specimens that claim our attention are those from India, Persia, Turkey, and Tunis.

However great may be the differences in quality amongst the carpets from the countries mentioned, they are all made upon the same principle, and that one of great simplicity; but which yet affords the means of producing a more perfect, beautiful, and durable description of carpeting than any other mode of manufacture more recently discovered or introduced.

The manufacture is not carried on in any large establishments; but in pastoral districts, where it is combined with occupations of that nature, and engages a portion of the time of the families employed in that pursuit.

The loom consists of two perpendicular pieces of wood, fixed at some distance apart, which support a beam or roller; at the top, upon which the warp or chain is wound, and about 2 feet from the floor, is another similar beam, upon which the carpet is rolled as it is made.

The work is done entirely by hand, and each tie passes across the face of two warp threads round the back, and has the ends drawn up between them.

When a row of ties has been completed, a shed is formed in the warp, and the shoot is then passed across from right to left, and returned, binding the whole together, and is beat down to a horizontal level by the hand-beaters. Upon this plan carpets of the largest dimensions are made in one piece. The number of shades or colours that can be used is unlimited, and any design can be copied with great accuracy.

The design and colours of several of the carpets from India, Turkey, and Persia, are especially worthy of notice, and should be studied with a view to imitate their beauties by the manufacturers of other countries. There is one carpet from Cashmere, sent by **GHOLAB-SINGH** to the Exhibition, made entirely of silk, that cannot be too highly praised for the beauty of its texture, and the softness and harmony of its colouring. In this carpet there are at least 10,000 ties in every square foot. There are other specimens of carpets of small dimensions, but very beautiful, and remarkable for richness and harmony of colours. The exceptions are where an attempt has been made to copy European designs; and there the failure is as great as is the success in those of the native eastern style.

The carpets from Turkey deserve especial notice, as there are, in addition to those made all in one piece, some in breadths, extremely well coloured and closely woven; and an attempt has been made at new designs with considerable success. The carpets from Tunis and Algiers are made upon precisely the same principle, and have the same peculiar character in colouring and design.

The most costly and magnificent carpets of Europe are made upon the same principle as those above described; and that large and beautiful carpet, sent from the manufactory of the Gobelins to the Exhibition, is made by the same process of weaving as the ordinary Turkey carpets; as also are those from Tournay, in Belgium; Deventer, in the Netherlands; Aubusson, in France; London, Wilton, and Millbridge, in Great Britain. The manufacture at Axminster in Devonshire, and Mirfield in Yorkshire, of this description of carpet, generally called "Axminster," ceased to exist about twenty years ago.

The chief seat of the carpet manufacture in France is the department of Creuze, at Aubusson, Felletin, and Maurissard, where there are probably not less than 5,000 persons engaged in the manufacture of carpets and tapestry.

With the exception of the kind referred to, when describing the carpets from the east, the Aubusson carpets are all made upon the same principle as tapestry, and are consequently too expensive to be purchased by any but the rich. The specimens of Aubusson tapestry and carpets exhibited by MONS. **SALLANDROUZE DE LAMORNAIX** (1469, France, p. 1246) are especially worthy of notice, being second only to those of the Gobelins and Beauvais. Their merits are not recompensed by a Medal, in consequence of M. Sallandrouze de Lamornaix, as Commissioner for France, having withdrawn from competition.

The manufacture is well represented in the Exhibition, and deserves, for its beauty of design and colours, the highest praise. There is a considerable demand for this manufacture by the noble and wealthy of European nations, and occasionally by the United States. At Turcoing, Nismes, and Amiens, the carpet manufacture is also carried on; there being at these three towns nearly 600 looms; and the production is increasing. One of the features of the Exhibition is the progress made by France in the manufacture of moquette or velvet-pile carpets. This branch is of recent introduction in that country, dating within the last twenty-five years; and the specimens exhibited by Messrs. **REQUILLART, ROUSSEL**, and **CHOCQUEEL**, (1433, p. 1244) of Paris and Turcoing-Nord, are pre-eminent for their artistic designs and beauty of colouring. Some of the specimens of the 5-frame moquette, exhibited by **FLAISSIER BROTHERS**, of Nismes, are very good. The same manufacture is adapted for floors or for covering furniture; but for the latter purpose, it is made very fine to imitate tapestry, with a velvet surface.

Moquette, Wilton, or velvet-pile, and Brussels carpets, are all woven upon the same principle; the only difference being that in Brussels the wire, by which the pile is raised, is drawn out, and in velvet cut out by a knife. The pattern is formed by having frames placed over each other, and filled with bobbins of worsted, each frame having for the ordinary width 260 bobbins.

The manufacture of Brussels carpets was first introduced at Kidderminster, about 90 years ago, by workmen brought from Tournay, and has been steadily increasing up to a recent period, when the introduction of Whytock's patent tapestry carpets, together with two other descriptions of carpet, put a stop to its further extension. It cannot be said, however, that the manufacture has been superseded to any extent, as nearly the same number of looms continue to be employed.

The colours in each frame are different, and some of the frames are striped, or planted, as it is technically called, with various colours, when the design to be executed requires it, as in flower patterns, and drawn up by the Jacquard machine now generally used, instead of the old mode of drawing up by hand.

The number of colours, or shades of colour, that can be used in a line is limited to the number of frames of worsted, which rarely exceed five in England, but more frequently extend to six or seven in France. Within the last 20 years, three new kinds of carpet have been invented, and brought into extensive use in Great Britain, all of which are well represented in the Exhibition.

The first in order is Whytock's Patent Tapestry, which has been brought to great perfection within the last five or six years, and now employs about 800 looms, which are not adequate to supply the existing demand. The peculiarity of this manufacture is the unlimited number of shades or colours that can be introduced, so that the most elaborately-coloured designs, with flowers and scrolls, can be executed. The saving of worsted is also very important in an economical point of view. The appearance is the same or similar to Brussels carpet, but the manufacture is more simple, each thread being coloured separately, at spaces, with the various shades as they follow each other in the design. The process by which this is accomplished is beautifully simple and ingenious, but requires much care in placing and arranging the threads, and putting them on the beam. It is also necessary to the economy of this manufacture, that a large quantity of each design should be made.

This invention was patented about 18 years since, and a renewal of the patent granted for a further term of five years, which expired on the 8th September, 1851.

The specimens exhibited by Messrs. **HENDERSON** and **WIDNELL** (p. 567), and Messrs. **CROSSLEY** and **SONS** (p. 565), show in an eminent degree the capabilities of the manufacture as regards design and colouring.

The next is the "Patent Axminster" of **TEMPLETON** & Co., of Glasgow, (p. 565) of which there are some excellent specimens exhibited in carpets, rugs, and table-covers.

The object of this invention was to give the beautiful appearance of Axminster, or Tournay, at less cost; and it has been very successfully and extensively applied to the manufacture of rugs, as well as carpets.

The last is a description of carpet, having the same appearance as Brussels, or tapestry, which is woven plain by steam power, and afterwards printed by the same agency.

It is woven at Rochdale by Bright and Co., under Sievier's patent, and printed near Macclesfield, by Burch and Co., by a machine invented and patented by Mr. Burch. This manufacture has already found large sale, more especially for exportation.

Another novelty in the Exhibition is a carpet, rugs, and hangings for walls, of patent wool mosaic, the carpet and rugs being well executed, and the surface or pile peculiarly close. As yet, there has not been sufficient time to see what position this manufacture is likely to take in the carpet trade.

The rapid extension of the carpet manufacture in Great Britain is proved by the fact, that within the last seven years, not less than 700 additional hand-looms have been put in operation, for one of the new fabrics referred to; and looms worked by steam-power, equal to the production of 300 hand-looms for another, without lessening the demand for former fabrics, being an increase of full 30 per cent. in seven years.

Not only has the home consumption greatly increased, but new foreign markets have been opened, and old ones extended.

Several patents have recently been taken for the application of steam-power to carpet weaving, in addition to that referred to of Sieviers, and no doubt now exists of this having been successfully accomplished; at all events, for weaving patent tapestry carpets, if not for Brussels of the usual manufacture. This will tend to reduce the price, and, consequently still further stimulate consumption. In fact, there is scarcely any branch of our manufactures that wears a more promising aspect for the future.

The principal seat of the carpet manufacture is Kidderminster, in which there are about 2000 looms, chiefly occupied in weaving Brussels carpets; while the carpets called "Kidderminster" are made extensively in the neighbourhood of Glasgow, Kilmarnock, Bannockburn, and Aberdeen.

They are also made in Yorkshire, Durham, Lincolnshire, and Westmoreland; the largest carpet manufactory in Great Britain being at Halifax.

The number of looms of all kinds may be estimated at 4000, and the value produced at upwards of 1,000,000*l.* sterling.

The average earnings of the operatives will vary from 16*s.* to 28*s.* per week.

The specimens of carpeting from Austria, Portugal, Sardinia, and Prussia, show that the manufacture is making progress in those countries, and is evidence of a growing taste that must ultimately lead to a large increase of consumption on the Continent of Europe.

The numerous exhibitors of Berlin work and their contributions, show that this is still a fashionable occupation among our fair countrywomen, and in addition to those who follow it for amusement, affords employment to a large number of females.

Some of the specimens exhibited are very beautiful; in fact, every description of needlework may be said to be well represented in the Exhibition, and one specimen worked from a cast, and another from a drawing, without the aid of ruled paper, exhibited by FAUDEL and PHILLIPS, are especially worthy of notice.

A specimen of tapestry by a lady (Mrs. ALDERSON) is also highly creditable to the taste and ingenuity of the exhibitor.

The contributions in embroidery of various kinds from India, Turkey, Tunis, and Persia, are extremely interesting, beautiful in taste, and displaying the highest degree of excellence in execution.

SUPPLEMENT.

SINCE the Jury closed their labours and separated, some specimens of Brussels and cut-pile carpeting, that merit particular attention, have been placed in the Exhibition by Mr. BIGELOW of the United States, and by Mr. FAWCETT of Kidderminster, as well as by Messrs. JAMES HUMPHRIES and SONS of Kidderminster.

The specimens of Brussels carpeting exhibited by Mr. Bigelow, are woven by a power-loom invented and patented by him, and are better and more perfectly woven than any hand-loom goods that have come under the notice of the Jury. This, however, is a very small part of their merit, or rather of that of Mr. Bigelow, who has completely triumphed over the numerous obstacles that presented themselves, and succeeded in substituting steam-power for manual labour in the manufacture of five-frame Brussels carpets. Several patents have been taken out by different inventors in this country for effecting the same object; but as yet none of them have been brought into successful or extensive operation, and the honour of this achievement, one of great practical difficulty, as well as of great commercial value, must be awarded to a native of the United States.

A similar result is on the eve of being accomplished in this country; and two manufacturers are preparing under different patents to weave Whytock's patent tapestry carpeting by steam-power. This, however, is much more easily accomplished than to weave five-frame Brussels carpets by the same means. The first loom for weaving Brussels carpets by steam-power was the invention of Mr. W. Wood, and patented in 1842; but the feeling of those engaged in the manufacture at that time, being hostile to any change in the then existing state of the manufacture, no attempt was made to introduce it, and many asserted that it was impossible, or if possible that no advantage would result from it.

The error of this opinion is demonstrated by Mr. Bigelow, whose loom will weave 20 yards per day on the average, including stoppages, and requires only the attention of a boy or girl; while the hand-loom will produce on the average only five yards per day, and requires in addition to the weaver, the assistance of a boy or girl to draw out and put in the wires by which the pile is raised.*

Besides the great economy in labour, there are other advantages. The goods are woven with more perfect regularity, and by means of an invention for weighting the bobbins equally, and at the same time more heavily, the tension of the worsted being thereby increased, a smoother and more even surface is produced, and by the same means a saving in the material effected.

There are in the United States, 28 of Mr. Bigelow's looms at work upon five-frame Brussels carpeting, 50 upon tapestry carpeting, and 450 upon ingrain carpeting (as it is called in the United States), the same description being called Scotch, Kidderminster, or super carpet, in this country.

The invention of Mr. Fawcett is of a different nature, but also important in its results. In Bigelow's, the main feature is a saving in the cost of labour, in Fawcett's a saving of material. The specimen exhibited is cut-pile, but there is little doubt of the principle being applicable to Brussels carpeting also.

As Mr. Fawcett has a patent in progress, the results only and not the mode by which they are obtained are here noticed.

In Brussels carpet made with five frames of worsted, the proportion on the surface is as 5 to 8, and in cut-pile of average quality as 6 to 8 of the whole quantity used. By Mr. Fawcett's mode of weaving, the very important saving of one half of the worsted that is at the back of the carpet is effected, without diminishing the quantity on the surface. The weaving is also more easy and somewhat cheaper; and another advantage is, that ten-frame will be woven as easily as five upon the method hitherto in use; thus affording an immensely increased facility for the improvement of design, and the introduction of additional colours to give proper effect to them.

There is little doubt that Mr. Bigelow's loom can be applied to Mr. Fawcett's invention as well as that of Messrs. Humphries and Sons' improvement, and these two plans combined will produce a much more beautiful fabric than has hitherto been made, at a greatly diminished cost.

The Jury of Class XIX., conjointly with that of Class XXX., have awarded the GOVERNMENT MANUFACTORY OF GOBELIN AND BEAUVAIS TAPESTRY (1368, p. 1241) the Council Medal for the originality and beauty of design of the different specimens exhibited for furniture, and the extraordinary excellence of execution of most of the productions exhibited.

The Jury award Prize Medals to the following subjects:—

BRAQUENIÉ and Co., Paris (435, France, p. 1199), for

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* To prevent misapprehension, it is perhaps necessary to state, that the ingenious invention of M. Sievier, for weaving carpets and other terry fabrics *without* a wire, is in extensive operation for the manufacture of the *plain fabric* to be printed in the piece.

Aubusson carpet, tapestry, portières, and table-covers; good designs, colouring, and execution.

Brinton and Sons, Kidderminster (110, p. 564), for specimens of patent tapestry carpet, velvet pile, and Axminster rugs.

Burch, J. and Co., Crag, near Macclesfield (115, p. 564), for specimens of velvet-pile and Brussels carpets, woven by steam-power, and printed; also a fine quality of the same material for hangings.

Castel, E., Aubusson (Creuse), (83, France, p. 1175), for Aubusson carpet of fine quality, tapestry-panels, or portières, extremely beautiful, and very finely executed.

Crace, J. G., Wigmore Street (530, Class XXVI., p. 561), for specimens of Brussels and velvet-pile carpets. The design is unique and well coloured, the style mediæval.

Crossley and Sons, Halifax (142, p. 565), for the great beauty of their patent wool mosaic rugs and table-covers, in design and colours, and also their perfect execution. For the design, colours, and execution of the carpet of the same manufacture, and also for its being the first large carpet ever made upon this principle, and for the designs and colours of the specimens of Whytock's patent tapestry carpets.

Dinglinger, A. F., Berlin (175, Prussia, p. 1057), for sofa carpets well designed and executed, and for cloths.

Dove, C. W., and Co., Leeds (155, p. 565), for specimens of five-frame Brussels carpet, of good bold design, and well coloured; also a specimen of five-frame velvet-pile, of good design and colours.

Flaissier Brothers, Nimes (Gard), (204, France, p. 1183), for moquette or velvet-pile carpets, and fine moquette for chairs, &c.

Harris, G. and Co., Stourport (192, p. 567), for three specimens of velvet-pile carpet, ten frames; excellent in quality.

Henderson and Widnell, Lasswade (201, p. 567). Specimens of fine tapestry, velvet for table-covers and portières, patent rugs, and Whytock's patent tapestry carpets. The patent rugs are almost a new article, and as beautiful as any hitherto produced at double their price. The first large carpet of centre design ever made upon the principle of Whytock's patent, showing a very ingenious application of it at a small increase of cost. For the merit of the designs and colours of the patent tapestry carpets, especially the dark grounds, which are well executed.

Kroonenburg, W. F., Royal Carpet Manufactory, Deventer (43, Netherlands, p. 1144), for a large carpet of Persian style, of good quality, and well coloured.

Lapworth, A. (232, p. 568), for specimens of velvet-pile carpet, one of which is a very good design, and well coloured. Axminster carpets, very fine in quality, also patent Axminster carpet of Persian design.

Newcomb and Jones, Kidderminster (257, p. 569), for a velvet-pile carpet; an excellent specimen of colouring and shading, with the use of only five frames.

Overman and Delevigne, Tournai-Savonnerie (297, Belgium, p. 1160), for Tournai-Savonnerie carpet, of very fine quality; carpets of the same manufacture, in imitation of Smyrna carpets; velvet-pile carpets, centre design and bordered.

Pardoe, Hoomans and Pardoe, Kidderminster (263, p. 569), for several specimens of velvet-pile carpets, on Whytock's patent principle. Patent Berlin rugs.

Requillart, Roussel, and Chocqueel, Turcoing (Nord), and 20 Rue Vivienne, Paris (1433, France, p. 1244), for moquette, or velvet carpet, excellent in design and colours; also fine moquette for furniture, and Aubusson tapestry.

Smith (Turberville), Boyle, and Co., 9 Great Marlborough Street, London (318, p. 571), for patent tapestry carpets, excellent in design and execution.

Templeton, James, and Co., Glasgow (315, p. 571), for several patent Axminster carpets of good designs, and well coloured. Also rugs and table-covers of the same manufacture.

Victoria Felt Carpet Company, Love Lane, Wood Street, London (327, p. 572), for a specimen of printed felt carpet, combining utility and cheapness.

Watson, Bell, and Co., 35 and 36, Old Bond Street, London (337, p. 572), for Axminster carpet of first-rate quality, good design, and well executed. Bordered Brussels carpet, of Persian design, with centre, extremely good and well coloured.

Whitwell, J., and Co., Kendal (345, p. 572), for specimens of Kidderminster carpet, and twilled Venetian carpet of great utility and cheapness, well designed and coloured.

Wright, Crump, and Crane, Kidderminster (358, p. 573), for a velvet-pile bordered carpet, five-frame; a Brussels carpet, Persian design; a Brussels carpet, shades of crimson and oaks, &c.

Zuppinger, T., Waeundorf, Canton of Zurich (Switzerland, 209, p. 1280), for his invention in weaving chenille into carpeting, by which the outline of the design is more correctly given.

The Jury make Honourable Mention of the following:—

Brown, M'Laren, and Co., Scotland (114, p. 564), for specimens of velvet carpet, and three-fly Scotch carpet.

Daufrias, B. and Co., Portugal and Madeira (853 and 881, p. 1315–16), for two very good specimens of Kidderminster carpets.

Duchel and Son, Amiens (France), for a moquette carpet, centre design and bordered.

Haas and Son, Vienna (Austria, 619, p. 1038), for a considerable assortment of moquette carpets; good both in colours and design.

Henderson and Co., Durham (200, p. 567), for very good specimens of damask Venetian carpet, and velvet-pile stair-carpet.

Humphries, Thomas, Kidderminster (210, p. 567), for a seven-frame velvet-pile carpet, of good quality and design, and well coloured.

Ladies' Carpet Needlework (379, p. 573), for the design by Mr. Papworth.

Laroque, Sons, Brothers, and Jaquemet (901, France, p. 1223), for Aubusson carpets of good design and colouring.

Lawrance, A. and A., and Co., United States (453, p. 1464), for a specimen of Kidderminster carpet of excellent quality.

Lecun and Co. (1306, France, p. 1239), for Tapis Écossais, good in quality and design.

Morton and Sons (252, p. 569), for several specimens of velvet-pile carpets.

Newton, Jones, and Willis, Birmingham (258, p. 569), for specimens of church carpets and hangings, and episcopal robes.

Rey Brothers (35, Sardinia, p. 1303), for specimens of thick coarse carpeting, of good designs.

Simcox, G. P. (London and Kidderminster) (302, p. 571), for specimen of three-thread Brussels carpet, exhibited for cheapness.

Wilson, J. and W., Scotland (351, p. 572), for specimens of Kidderminster (or Scotch) carpets.

Woodward, B. Higgins, Kidderminster (354, p. 572), for five-frame Brussels carpet, centre design, and bordered, with other specimens.

Floor-cloths.

The Jury award Prize Medals to the following Exhibitors:—

Albro and Hoyt, Elizabeth Town, New Jersey (United States, 183, p. 1449), for specimens of floor-cloths, excellent both in quality and colours.

Burchardt and Sons, Berlin (164, Prussia, p. 1057), for printed moleskin table-covers, floor-cloths, and painted window-blinds; a very large and good assortment.

Hare, John and Co., Bristol (190, p. 566), for four large specimens of oil-cloth, the designs, colours, and qualities of which are first rate.

Jorez, jun., Brussels (306, Belgium, p. 1160), for printed moleskin table-covers, of great variety and cheapness; floor-cloths, and waterproof fabrics of great excellence.

Le Crosnier, — (1305, France, p. 1239), for table-covers, varnished and printed, on cotton, moleskin, imitation patent leather, and imitation flock.

ROELLER and HUSTE, Leipzig (161, Saxony, p. 1111), for painted table-covers, and floor-cloths; generally good in designs and well executed.

SEIB, J. A., Strasbourg (1009, France, p. 1227), for enamelled floor-cloth, waterproof fabrics, toiles and cotton; excellent in quality.

The Jury make Honourable Mention of the following:—

BARNES, R. Y., floor-cloth manufacturer (95, p. 564), for three specimens of oil-cloth, well designed, and good in quality and colours.

BISIEUX, Paris, (767, France, p. 1217), for oil-cloth, painted imitation of marble and wood on moleskin.

IHM, FERDINAND (46, Grand Duchy of Hesse, p. 1128), for printed and painted moleskin table-covers, of good designs, and well executed.

LEHMANN, M., Berlin (Prussia, 167, p. 1057), for painted moleskin table-covers and floor-cloths, of great variety.

SMITH and BABER, London (371), for one large specimen of oil-cloth.

In concluding the Report accompanying the decisions of the Jury, I have to acknowledge the kindness of—

Robert Lindsay, Belfast, for that portion relative to the Irish and Scotch embroidery.

D. Biddle, Oxford Street, London, for English and Belgian hand-made lace.

Felix Aubry, Paris, for French lace and embroidery.

— Faessler, London, for Swiss embroidery.

P. Graham, London (Vice-Chairman), for carpets and tapestry.

JURORS.—The following Exhibitors being upon the Jury, all notice of the articles exhibited by them has been omitted:—

RICHARD BIRKIN, of Nottingham, machine-made lace.

D. BIDDLE, of London, hand-made lace.

P. GRAHAM (Jackson and Graham, London), carpets.

RICHARD BIRKIN, REPORTER.

July 1851.

CLASS XX.

REPORT ON ARTICLES OF CLOTHING FOR IMMEDIATE PERSONAL OR DOMESTIC USE.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Wm. Felkin, Mayor of Nottingham, *Chairman*, The Park, Nottingham; Lace Manufacturer.
Philippe Walther, *Deputy Chairman*, Switzerland.
T. Christy, *Reporter*, 35 Gracechurch Street; Beaver and Silk Hat Manufacturer.
F. Bernoville, France.
T. Brown, 40 Wood Street; Straw Hat Manufacturer.
Elliott Cresson, United States.
— **Hülse**,* Zollverein.
E. Smith, 60 Old Broad Street, City; Clothier.

Associates.

Robert Dixon Box, 187 Regent Street; Boot and Shoe Maker.
E. Blank, 10 Trump Street, Cheapside; Merchant.
William Burchett, 29 Cheapside; Merchant.
Alexander Cumming, 104 Fore Street, City; Warehouseman.
Seymour Haden, 62 Sloane Street, Chelsea; Surgeon.
Samuel Hodgkinson, 43 Threadneedle Street, City; Hosier and Glover.
William Maclaren, 55 Cornhill; Boot and Shoe Maker.
John Baptiste Soldi, Southwark.

* **E. Blank**, Merchant, 10 Trump Street, Cheapside, Proxy for M. Hülse.

The extreme variety of the articles submitted to the inspection of this Jury rendered it a task of no small difficulty accurately to appreciate them; and when it is remembered that textile fabrics, or other substances suited for such purposes, have been exhibited from every part of the world, wrought up into "*articles of domestic or personal use*," suited to the habits of the various nations by whom they may have been contributed, too much praise cannot be bestowed upon the industry and perseverance of the numerous exhibitors, who at vast cost have responded to the invitation, and have sent very valuable, and in many instances highly suggestive, contributions to "The Exhibition of the Industry of all Nations."

Hosiery.

In 1589 the hosiery knitting trade originated, through the invention of the stocking-frame by the Rev. W. Lee, at Nottingham. It is carried on in Nottinghamshire, Derbyshire, and Leicestershire, at Godalming, and at Tewkesbury, in England; at Balbriggan in Ireland, and at Hawick in Scotland; at Chemnitz and its neighbourhood, in Saxony; at Paris, Gauges, Avignon, Orange, &c., in France. Stocking frames are spread over almost every district of France, Spain, Netherlands, Germany, and Italy: these serve for the production of hosiery, chiefly used in the neighbourhood of the machines. Goods for sale, knitted by hand, are made in Kendal, Aberdeen, and the Shetland Isles, &c. England exports all kinds of hosiery; France chiefly silk hosiery; Saxony exports are for the most part low-priced cotton and woollen hosiery. According to an exact census taken by Mr. W. Felkin, of Nottingham, in 1844, there were at that time 48,482 stocking-frames in the United Kingdom. The annual return from them was 2,565,000*l.*, or thereabouts. This consisted of 305,000*l.* imported raw materials, and 400,000*l.* of home growth: 1,350,000*l.* paid for wages; and 510,000*l.* for finishing and profits. Wages were then at a deplorably low rate, and had been so for the previous 35 years. Since 1844 the number of machines has been increased to at least 50,000; raw materials have advanced 30 to 60 per cent.; wages have risen about 40 per cent.; and profits have accumulated in proportion. The returns of the hosiery trade of the United Kingdom in the last year were probably about 3,600,000*l.*; and it is satisfactory to have to state that the export trade is extending to all parts of the world; but the chief increase in demand has been for home consumption, amongst the most numerous classes of the community. The number of English hands employed in this manufacture, either constantly or as an addition to domestic duties, is, when trade is good, about 100,000, consisting of a nearly equal number of each sex. Until a few years since, frames were entirely worked by hand in the dwellings of the artisans. They are now slowly collecting into factories, in a few of which steam-power is applied to rotary machinery. A rotary frame stands in the English compartment of Machinery in Motion in the Exhibition; and two others in the French collection of machinery. These may well be compared with the stocking-frame upon Lee's, *i.e.*, upon the usual construction, one of which is at work amongst the English machinery. There are, however (not exhibited), three other very important patented frames, each securing different degrees of speed or facility of production. The most rapid of these is capable of being worked by a youth, and of producing in a week as many frame-work knitted *sacks* as can be cut and sewn up into 75 to 100 dozens of small women's hose. A specimen of these bleached cotton stockings is in the Exhibition, weighing 14 ozs. per dozen, and offered at 2*s.* 2*d.* *per dozen* ready for the market. This is certainly one of the most remarkable instances of the power of improved machinery to cheapen production ever seen. The lowest price of English cut-up cotton hose made from the old wide frame, which is shown in the Exhibition, is 3*s.* 7*d.* per dozen, weighing 17½ ozs.

The colours dyed in Nottingham do not generally equal those of the coloured cotton and silk goods dyed for the London, Manchester, and Coventry trades. This deserves the serious attention of the dyers and manufacturers in that locality. Improvement is certainly practicable, as there is water in the district well adapted for securing brilliancy of colour. The bleach and finish of *Nottingham cotton hosiery* is unequalled. Leicester hosiery is surprisingly diversified in colour, shape, and adaptation of the articles to every market. One house sends to the Exhibition specimens sufficient to represent fairly their own production, comprising 12,500 articles with prices, employing about 4000 hands, and distributing about 1400*l.* weekly in wages. This spirit of adaptation and improvement in machinery, and diversifying its products to suit the wants of the world, pervades the Leicester trade, and has resulted in the population of that borough being quadrupled in 40 years, having risen from 16,000 to 64,000. No means are available for ascertaining the extent of hosiery production in France. French cotton hosiery is generally of uneven materials; but their silk hosiery is of superior materials. The machinery is in less perfect order than that of the English. The chevening of their embroidered hose is very beautifully designed and executed. In the Saxony Catalogue of goods in the Exhibition, their machines are stated to be about 30,000, employing 45,000 hands. Their lowest specimen of cut-up small women's hose is at 3*s.* 6*d.* per dozen, weighing 18½ ozs., half hose 1*s.* 10*d.*, and cotton gloves 1*s.* 6*d.* per dozen, all made no doubt with a view to exportation. This trade has been remarkably rapid in its progress, having risen from a trifling amount to its present extent within the present century. Saxony hosiery, as compared with English, is, from the machinery being too often in an imperfect state, liney, short-looped, and therefore finer for gauge; but less elastic and less durable, from the same cause. There is less substance in hand than, from the actual weight of materials used, there ought to be. The materials are less even in quality than those employed in the English trade. Honourable Mention has been occasionally spoken of in the following recommendations, as suitable for the meritorious workpeople referred to, and in a few instances for exhibitors who have aided the completeness of this Class. It will be observed, that no recommendation is offered for the Council Medal. The Jury do not think any of the productions exhibited present originality or inventive power justifying the award of that medal. But the merit of promoting excellence of quality, diversity of useful products, low prices of goods suitable for the mass of consumers at home and for exportation, and consequent increase of employment, has been eminently exhibited in this Class.

The Jury award Prize Medals to the following Exhibitors, and for the subjects indicated:—

Allen and Solly, Nottingham (100, p. 583), for sound and well-made articles, and a selection showing the improvement in the hosiery trade, especially in the materials used at the dates 1700, 1790, 1804, 1810, 1812, 1815, 1826, and 1848.

Angrave Brothers, Leicester, Manufacturers (202, p. 588), for drawers and shirts of excellent quality.

Biggs, H. W., and Sons, Leicester, Manufacturers (205, p. 588-9), for the general excellence of the specimens of hosiery, adapted to every market where worsted and low-priced cotton stockings, gloves, and woollen shirts are in demand.

Billson and Hames, Leicester, Manufacturers (201, p. 588), for the excellence in quality of Thibet wool, and a great variety of socks.

Cartwright and Warners, Manufacturers, Leicester (196, p. 588), for worsted yarns prepared by them from Merino and Vigonia wools, and for general excellence of the articles manufactured therefrom.

Cochois and Colin, 7 Rue des Déchargeurs, Paris, France (124, France, p. 1177), for good quality and embroidery.

Fry, J., Godalming (193, p. 588), for Lisle thread hose of excellent make, and very regular materials, and for well-finished Segovia goods.

Glaeser, J. S., jun., N. Chemnitz, Saxony (72, 83, p. 1108), for women's coloured cotton gloves.

Harris, R., and Sons, Leicester, Manufacturers (198, p. 588), for an extensive collection of examples of hosiery of every kind, adapted to the most varied markets, for superior excellence in production, alike as to pattern, colour, and finish, and as a recognition of the encouragement of inventions and adaptations of machinery in the manufacture of hosiery.

Holland, T., and Co., Godalming (194, p. 588), for fleecy hosiery, having special reference to medical uses, and the comfort of invalids, and for Merino and Segovia goods of the most superior quality.

Hurst and Sons, Nottingham (99, p. 583), for the excellence of a general assortment of articles suitable for the home and export trade.

Landgraff, Gottfried, Hohenstein (Saxony, 72, 83, p. 1108), for women's single-thread cotton-hose.

Lauret Brothers, 19 Rue des Mauvaises, Paris, and Gauges (903, p. 1223), for embroidered silk-hose of very high quality; also for embroidery in colours and general excellence of production.

McDougall, D., Inverness, Scotland (83, p. 582), for knitted hosiery, &c., and as a recognition of his efforts to create habits of self-dependence and a love of labour amongst the peasantry of the Highlands of Scotland.

The Jury consider that this exhibitor is entitled to this distinction as much for the superiority of the articles he exhibits, as in consideration of the circumstances under which they are produced. The peasants of Argyllshire, Ross-shire, &c., are afforded employment in knitting while attending flocks, and during other desultory employments. Cotters, once half starved, he states, now possess money, thus earned, placed in the savings-banks. The wool is cleaned, combed, and prepared by the peasants; dyed by themselves, where colours are desired; brown, from a lichen called *crothal;* yellow, from the tops of young heather; black, from alder bark; lemon, from furze flowers; and olive, from the roots of the water-lily. All these substances are at hand and well known to them. Stockings and socks of various patterns and qualities, thus knitted from home-dyed or self-coloured wools, are exhibited, as well as pieces of Tweed woven from the same materials. This exhibitor pays 300*l.* to 500*l.* per annum for socks alone; and all this class of products are exported to Hong Kong, Shanghai, and other distant parts, at from 12*s.* to 24*s.* per dozen pairs, besides being used in Scotland itself somewhat extensively. The Jury desired to have recognised the first preparer and dyer of wool, together with the best and most thrifty knitter, had it been possible to have ascertained this with accuracy.

McKenzie, W. B., 126 Prince's Street, Edinburgh (142, p. 585), for Shetland knitted shawls and hose. The former are of very fine materials.

Meinert Brothers, Oelsnitz, Saxony (72, 83, p. 1108), for woollen shirts of excellent make and good colour, for exportation.

Meyrueis and Sons (639, France, p. 1208), for extra fine white embroidered silk-hose, and excellence of ankle embroidery in colours.

Miles, S., Bunhill Row, London (89, p. 582), for an extensive collection of articles of dress.

Milon, P. D., sen., 98 Rue St. Honoré, Paris, France (930, France, p. 1224), for superior workmanship of hose, and for excellence of embroidery.

Morley, J. and R., Nottingham and London (101, p. 583), for great excellence in the manufacture and finish of silk and cotton hose, suited to the best demand of the London and other markets, and for silk gloves of superior make, colour and finish. The exhibitors send from the coarsest to the finest gauges in silk and cotton hose, the latter requiring a considerable magnifying power to discern the loops, and though a dozen of the silk hose weigh only 3½ oz., they are perfectly made in quality, and of the most regular materials. The silk in each pair cost 1*s.* 3*d.*, the workmanship 15*s.*

Nacke and Gehrenbeck, Chemnitz (72, 83, Saxony, p. 1108), for women's cut-up white cotton hose of fine quality.

Neuber, F., Chemnitz (72, 83, Saxony, p. 1108), for white and brown cotton hose, adapted to exportation from their low prices.

Nevill, A., and Co., 121 Wood Street, London (20, p. 578), for excellence of production in ladies' under-clothing, to fit the shape, and gentlemen's pantaloons and drawers of similar character; also for excellence of quality and make of Saxony wool shirts, and hose manufactured for the Spanish and other markets.

Solbrig, F., Chemnitz (72, 83, Saxony, p. 1108), for adaptation in price to export demand in certain qualities of hosiery.

Taylor and Co., Rochdale (127, p. 587), for plushes manufactured from waste silk, and the use of that material, which is of comparatively small value for the manufacture of articles of general utility.

Thresher and Glenny (79, p. 581), for a fabric for under-clothing in warm climates.

Thurmann, Picott, and Co., Nottingham (92, p. 583), for a good collection of self and parti-coloured patent floss and floss-velvet gloves, of very superior dyes. The former are flossy within, and run in with the needle after the fabric is made; the latter have the velvet-pile outside the glove.

Ward, Sturt, Sharp, and Ward, Belper, Derbyshire (195, p. 588), for examples of nearly every class of stockings and gloves, made from silk or cotton yarn, of great excellence, whether as to make, colour, or finish, or adaptation to various markets; and also for the lowest sample of cut-up hose in the Exhibition.

Wex and Lindner, Chemnitz (72 and 83, Saxony, p. 1108), for hosiery of great excellence, suitable for general use.

Wilson and Son, Balbriggan, Ireland (183, p 587), for excellent thread hosiery, with lace fronts.

The Jury make Honourable Mention of the following Exhibitors:—

Biddle, John, Leicester, Manufacturer (207, p. 589), for warp in hares'-fur, and Saxony wool goods, spun silk, cloth, hares'-fur gloves, and Vicuña wool articles.

Corah, H., and Sons, Leicester (208, p. 589), for the very creditable character of their contributions.

Hadden, A., and Sons, Aberdeen, Manufacturers (134, p. 585), for specimens of dyed wools in every shade of colour.

Hudson, James, Leicester, Manufacturer (199, p. 588), for good Vigonia hosiery, black worsted hosiery, and an imitation of Shetland half-hose.

Lart, John, and Son, Nottingham, Inventor and Manufacturer (81, p. 582), for articles of clothing fashioned to fit the bust and waist of the wearer, and registered gusset to band, 70G lace insteps of No. 200 yarn. The workman who made the latter article also deserves commendation.

Musson, R. and J., Nottingham, Manufacturers (97, p. 583), for superior plaited gloves, and good plain silk gloves.

Pope and Plante, 4, Waterloo Place, Pall Mall, London, Manufacturers (6, p. 576), for surgical elastic belt, sock, &c.

Shaw, John, Radford, near Nottingham (91, p. 582), for his application of the principle of the Jacquard to the stocking frame.

Wheeler, T., and Co., Leicester (206, p. 589), for the application of the stocking frame to weaving shawls.

The Jury also make Honourable Mention of John Richards, jun., Riste Place, Nottingham, the maker of the silk hose, No. 1000, exhibited by Messrs. J. and R. Morley (105, p. 582), for the great skill displayed therein.

Boots and Shoes.

Boots and shoes have been exhibited manufactured from almost every description of material, and from most parts of Europe and the United States; in some instances great novelty of construction and adaptation have been manifested, but we have chiefly to remark upon the greater or less amount of skill attained, in producing an article of fashionable use.

On a review of the whole of the boots and shoes of every class and description exhibited to the Jurors, the conclusion arrived at is, that the improvements which have been made during the last five or six years by the English manufacturers have enabled them to compete with the foreign; the introduction of foreign leather since the alteration of the tariff a few years back, as well as foreign boots and shoes at a lower rate of duty, has had the effect of rousing the energies of the English manufacturers, and of calling forth the requisite talent to bring about the results before alluded to; and not the least remarkable part of the question is the fact, that the increase in the consumption of English boots and shoes has not been less (in the period before named) than 20 per cent.

From France, it must be observed, that in many cases, exhibitors have shown goods remarkable for qualities more esteemed in the country for which they are required than in our own; and such goods must not be regarded entirely with an English eye.

The Jury award Prize Medals to the following Exhibitors:—

Addington, W. H., Norfolk, Virginia, United States (471, p. 1465), for very strong shoes for mining purposes.

Atloff, J. G., 69, New Bond Street, London, Inventor (32, p. 578), for a novel and economic plan of cutting, by which a short boot can be made at nearly the same cost in material as a shoe.

Bathier, V. (Creuse), France (22, France, p. 1172), for novelty and cheapness in the production of wooden shoes, with leather applied to the top of the soles; and for the taste displayed in the manufacture.

Christl, J., Vienna (327, Austria, p. 1023), for strong and excellent workmanship.

Clarke, Cyrus and James, Street, near Glastonbury, Inventors and Manufacturers (48, Class XVI., p. 520), for elongating goloshes, elastic insertions on the instep, both useful and novel, and an excellent assortment of ladies' shoes in various styles.

Deschamps, N., 14, Galérie d'Orleans, Palais National, Paris (1185, France, p. 1234), for his plan of cutting without block a front in one piece of leather.

Dufossée, sen., 13 Rue St. Dominique, Paris (1200, France, p. 1235), for solid and excellent work. The Jury consider that Honourable Mention ought to be made of the workmen who produced the best.

Dufossée and Melnotte, 20 Rue de la Paix, Paris (1201, France, p. 1235), for excellence of workmanship in boots and shoes. Honourable Mention is also due to the workmen who produced the best articles.

Gilbert and Co., 13 Old Bond Street, London (179, Class XVI., p. 525), for riding-boots, of excellent manufacture, produced with great care and attention.

Groskopf, George, Vienna (343, Austria, p. 1024), for strong and good boots and shoes, of excellent workmanship.

Hefford and Eaker, Derby (150, Class XVI., p. 525), for glazed Wellington boots, of excellent workmanship, elaborately and beautifully "stabbed." Honourable Mention is also due to the workmen who produced them.

Hickson and Sons, 20 West Smithfield, London, Manufacturer (192, Class XVI., p. 526), for general excellence of the lighter kind of export and other goods.

Hook, John, 66 Bond Street, London, Manufacturer (114, Class XVI., p. 523), for the superior workmanship, great excellence, and beauty of ladies' shoes.

Jeffers, W. H., 467 Broadway, New York (116, United States, p. 1441), for a case of ladies' boots and shoes, of exquisite workmanship; the Prize Medal to be awarded to the workman, and Honourable Mention to the manufacturer.

Kunurth, Anton, Vienna (333, Austria, p. 1023), for magnificent slippers in the Turkish style, of excellent work and elegant appearance.

Lefébure, J. P., 14 Rue du Paradis Poissonnière, Paris (578, France, p. 1205), for a remarkable invention for making boots and shoes by means of brass screws, the work being pressed together by an extraordinary pressure, thereby preventing damp from entering. There are, also (by the same exhibitor), other mechanical contrivances for cutting out the various parts of boots and shoes, combining great novelty and utility.

Massez, —, 24 Rue Aubyle Boucher, Paris (1347, France, p. 1240), for excellence of production relative to price, the articles being at once cheap and well made.

Meier, F., 17 Rue Froncliet, Paris (1352, France, p. 1240), for the great excellence of the workmanship of ladies' shoes, and beauty of finish. The Jury also desire to make Honourable Mention of the workman or workmen who executed them.

Mohr, W., Berlin (186a, Prussia (I. Zollv.), p. 1058), for clogs of light and elegant quality, and for kid boots.

Parker and Sons, Northampton, Manufacturers (116, Class XVI., p. 524), for general excellence.

Parker, J., 35 Dame Street, Dublin, Manufacturer (242, Class XVI., p. 527), for excellence of work in strong boots, and the great care evinced in the light boots. It is desired to make Honourable Mention of the workmen who produced the stout work.

Peplow, W., Browning Street, Stafford (157, Class XVI., p. 525), for workmanship of a high character, and the application of an elastic spring.

Poirier, P., Châteaubriand (Loire Inférieure), France (1398, France, p. 1243), for the excellent quality and make of self-coloured leather boots, for very hard wear. These articles are highly esteemed in France, and fulfil the peculiar requirements of the market for which they are made.

Popinoff, Sophia, of Tiflis (310, Russia, p. 1376), for shoes, slippers, and other articles of usual and useful wear. The Jury also desire to make Honourable Mention of three workmen.

Shekonin, Alexis, Government of Novgorod, town of Novotorjok (275, Russia, p. 1375), for embroidered boots and shoes, and other goods, of the highest class of workmanship in boots.

Thierry, C. A., 301, Rue Gré, Paris (391, France, pp. 1196–97), for gentlemen's boots of great excellence. The Jury desire to make Honourable Mention of the best workmen by whose skill these were produced.

Thomas and Son, 36, St. James's Street, London, Manufacturers (211, Class XVI., p. 527), for high-class workmanship in boots.

Walsh, William, 7 Buckingham Place, Fitzroy Square, London, Manufacturer (207, Class XV., p. 526), for welted cork soles of high merit as to workmanship.

Wemmer, J. (3, Luxemburg, p. 1130), for the excellent quality of shoes for labouring men, and for cheapness, and a novel principle in the nailing.

The Jury make Honourable Mention of the following Exhibitors:—

Adolphi, C. F. W., Berlin (172, Prussia (I. Zollv.), p. 1057), for a case of well-made ladies' boots and shoes.

Allen and Son, Pembroke, Wales, Manufacturer (149, Class XVI., p. 524), for a stout-made boot.

Bearn and Jeffs, Parade, Northampton, Manufacturer (118, Class XVI., p. 524), for "stabbery" of the very highest class. The workman who executed it is deserving of Honourable Mention.

Beckett, George, 41 Fenchurch Street, Manufacturer (220, Class XVI., p. 527), for well-made boots and shoes.

Bridard, J., 53 Rue Vivienne, Paris (1115, France, p. 1232), for strong boots and shoes.

Brediff Brothers, 5 Rue Colbert, Tours, Manufacturer (73, France, p. 1175), for strong and very good shoes.

Breed, N. A., and Co., Lynn, Massachusetts (411, United States, p. 1462), for very good shoes for children.

Cabu-Février, Manufacturer (263, Belgium, p. 1159), for boots for exportation, and their excellence relative to price.

Clark, B., Whitehaven, Cumberland, Manufacturer (154, Class XVI., p. 525), for a lady's boot "clumped" with wood.

Cowling, J., Richmond, Yorkshire, Manufacturer (142, Class XVI., p. 524), for easy shooting boots of excellent workmanship.

Creak, James, Wisbeach, Manufacturer (141, Class XVI., p. 524), for stout boots.

Coulbois, (1569, France, p. 1252), for varnished skins and boots made therefrom.

Doe, W., Colchester, Manufacturer (145, Class XVI., p. 524), for very strong and well-made navigator's boots.

Dörr and Reinhardt, St. Worms (33 Grand Duchy of Hesse, p. 1128), for two pair of excellent boots.

Friedl, Leopold, Vienna (332, Austria, p. 1023), for ladies' boots and shoes.

Fromont-Clolus, 15 Rue Neuve St. Meric, Paris (208, France, p. 1183), for boots and shoes, and well-made wooden shoes, adapted to persons obliged to work in the wet.

Garner, D., 41, Finsbury Market (230, Class XVI., p. 521), for "lasts."

Gordon, E., 6a Prince's Street, Leicester Square, London, Manufacturer (212, Class XVI., p. 527), for well-made screwed clamps solid boots, "pegged waist."

Helia, John, Vienna (331, Austria, p. 1023), for an assortment of ladies' boots and shoes, suitable for the class of wearers for whom they are intended.

Hubert, C., 292, Regent Street, Manufacturer (194, Class XVI., p. 526), for ladies' and gentlemen's boots, and a lady's boot made from a single piece of leather.

Jacobs and Dupuis, 32 Rue de la Paix, Paris (886, France, p. 1222), for ladies' boots and shoes suited to the higher classes of society, very well made.

Langder, J., Vienna (329, Austria, p. 1023), for good examples of boots and shoes.

Lerkhe, Petersburg (311, Russia, p. 1376), for clogs and goloshes.

Longdon, R., and Sons, Derby, and Thomas Smith, Bedford (119, Class XX., p. 584), conjointly, for the introduction of the elastic welt into boots and shoes.

Miller, jun., Warsaw (234, Russia, p. 1374), for exceedingly light well-made boots, weighing only three ounces.

Norman, Samuel Willis, 4 Oakley Street, Lambeth (167, p. 586), for excellence of work in lady's cork-soled boots.

Peal, Nathaniel, 11 Duke Street, Grosvenor Square (197, Class XVI., p. 526), for two pairs of very good fishing or hunting boots of excellent workmanship.

Rapp, C. F., and Son, 22 Rue Feydeau (974, France, p. 1226), for tasteful-looking goods.

Robert, A., 123 Regent Street, London (224, Class XVI., p. 527), for excellence of workmanship.

Schumacher, jun., Mayence (47, Grand Duchy of Hesse, p. 1128), for well-made gentlemen's boots and shoes, "spring-fastened."

Scott, S. T., Union Street, Southwark (228, Class XVI., p. 527), for a "last" with an adjustment to elongate the model of the foot; a very useful and ingenious improvement.

Suser, H., Nantes, and La Morinière (Loire-Inférieure) (1022, France, p. 1227), for boots and shoes made for exportation. (Prize Medal awarded in Class XVI.)

Toltshkoff, V., Government of Nijni Novogorod (314, Russia, p. 1376), for curiously made felt shoes, produced by the peasants of the country.

Vanderoost, M., Brussels, Belgium (427, p. 1164), for boots of excellent quality.

Viault-Esté, J. J. J. B., 17 Rue de la Paix, Paris (725, France, p. 1214), for a very handsome case of ladies' shoes.

Wilshin, S. B., 86 Albany Road, Camberwell (205, Class XVI., p. 526), for a method of fastening skates to boots.

Gloves.

The article of gloves, on the manufacture of which so much skill and talent have been of late years brought to bear, employs a large amount of the population of the United Kingdom. We have to report many very valuable and highly important contributions, prepared with great skill, and exhibiting this branch of industry in every form in which it can be presented. France, particularly Paris, many cities included in the Zollverein, and some in Denmark and Switzerland, have also contributed specimens of gloves. It will be needful to remark, in the first instance, upon the great talent of the French dyers of kid skins: in one case as many as 94 different colours are exhibited in the article of ladies' kid gloves; and various other descriptions are shown, particularly in lamb and sheepskin gloves, wherein great skill is exhibited; but it appeared to the Jury, that French gloves being so very largely imported into this country, some of the more important foreign manufacturers possibly considered that their articles were sufficiently well known, and did not think it worth while to send any contributions to the Exhibition. The **Associated Glovers** at Prague have forwarded a highly-interesting contribution, which illustrates the state of this branch of industry in their city, in a manner highly creditable to their skill. In conclusion, we may observe, that since the alteration of the tariff, and the importation of French kid skins, a rapid advance has been made by the English manufacturers, their skill and energies having been greatly called forth thereby.

The places at which gloves are chiefly made, are, London, Yeovil, Worcester, Woodstock, Torrington, Hexham, and Witney; and the value of the yearly produce is estimated at about a million sterling. Total of hands employed in England is about 46,000.

The Jury award Prize Medals to the following Exhibitors:—

Ball, W. Y. and Co., 32 Wood Street, Cheapside (80, p. 581), for a variety of kid gloves, remarkably well made.

Chosson and Co., 63 Rue Montmartre, Paris (1150, France, p. 1233), for ladies' and gentlemen's kid gloves.

Dent, Allcroft, and Co., Worcester (78, p. 581), for a very handsome and interesting collection of gloves, showing the various kinds produced in England; with very few exceptions, of the highest class of workmanship.

Ensor, T., Milborne Port (185, p. 587), for two-finger gauntlets, and various gloves, exhibiting very good taste.

Foster, Porter, and Co., 47 Wood Street, Cheapside (2, p. 575-6), for plush plumage gloves of good quality, forming a variety of novel and fashionable articles.

Fownes Brothers, 41 Cheapside, London (82, p. 582), for Irish kid, English dressed men's round seam gloves, of good quality.

Houbigant-Chardin, Rue du Faubourg St. Honoré (1627, France, p. 1256), for an assortment of gloves of excellent quality and colour, and very well sewed.

Jouvin and Doyon, 8 Boulevard Bonne-Nouvelle (1279, France, p. 1238), for a great variety of kid gloves of ninety-four different colours.

Jouvin (Widow), Xavier (893, France, p. 1222), for many specimens of gloves of very good quality.

Laydet and Co., 27 Rue de Grenelle St. Honoré (296, France, p. 1191), for a case of gloves very well sewed.

Lecoq-Preville, 50, 52, 53, Passage du Saumon, Paris (1303, France, p. 1239), for an assortment of habit kid gloves of good quality and taste.

Prague, Glovers' Association of (336, Austria, p. 1023), for a very handsome contribution of gloves of various descriptions.

Whitby, E., jun., Yeovil (186, Class XX., p. 587), for habit lamb-skin gloves, of a superior quality and very well made, the trade being prettily illustrated in the manipulation.

Hats.

In this branch of industry, examined by the Jury and Associates, important from the large number of persons employed in its various ramifications (scarcely less than 60,000), there have been numerous contributors; London, Manchester and other parts of Lancashire, Cheshire, Germany, France, particularly Paris, the Netherlands, and the Zollverein, have, at considerable cost, forwarded illustrations of their manufacture. The specimens may be divided into four different classes. 1st. The old make of beaver hats, with nap; 2nd. The silk plush hat on foundations of cotton, linen, and other fabrics; 3rd. The felt hat (some specimens were shown in pure beaver fur), chiefly of hare's fur, or rabbit's fur; 4th. Hare's fur or rabbit's fur, mixed with lamb's wool, for lower or cheaper qualities. In all these descriptions of goods, the manufacture of each country is necessarily in conformity with the taste, style, and habits of the people; whence the various productions in this Class are highly suggestive and interesting. In the British contributions there are several very novel styles introduced, wherein the manufacturers have given considerable latitude to their fancy; but in an article of fashion, and of such constant use as hats, it does not appear to be easy to change the habits and tastes of the wearers, or to induce them to adopt a new costume. The specimens, where attention has been chiefly directed to excellence in quality and very high finish, are commendable, and form an interesting feature in this section of the Exhibition.

The manufacture of hats ranks as one of the oldest of the staple manufactures for which England is celebrated, and at an early period hats were articles of considerable export. They have been the subject of many legislative enactments; and it was not until the close of the last century that they were freed from Government interference, by the abolition of the stamp duty, which up to that time was chargeable upon them.

Christy and Co. (35, p. 578-9), of 35 Gracechurch Street, London, and of Stockport, near Manchester, have contributed a most complete and interesting illustration of the manufacture of hats, both in beaver and silk, consisting of materials in the raw state, prepared for use, and in the different stages of manufacture up to the finished state, as made for the home, colonial, and foreign markets, together with the tools used in the manufacture.

Although this exposition completely fulfils the object proposed in the Exhibition, and the manufactured specimens are of the highest class, the Jury are unable to award the prize to this house, from the circumstance of its being one from which a Juror has been selected.

The Jury award Prizes to the following Exhibitors:—

Berni and Meliard, 56 and 57 Great Guildford Street, Southwark (103, p. 583), for a case of hats of various styles, well manufactured.

Chenard Brothers, Paris (87, France, p. 1175), for a beaver hat, and two hare's fur hats, made upon the old Flemish principle, and very well done.

Coupin, J., Aix, Rhone, Rue de l'Aigle d'Or (1162, France, p. 1233), for some felted hats "in the rough," very well felted, and good in quality.

Simmonds and Woodrow, Oldham (105, p. 583), for a selection of felt bonnets of good quality, and handsomely got up, in pure beaver and other furs.

The Jury have made Honourable Mention of the following Exhibitors:—

Baton, W. and Sons, Rue St. Avoie, Paris (1069, France, p. 1129), for hats made of hare's fur, on the Flemish principle, and exemplifications of the various stages of manufacture.

Braund, J., 26 Mount Street, Grosvenor Square (66, p. 581), for a cap with transparent talc peak, useful for travellers.

Lyons, J., 12 and 13 Artillery Place, Woolwich (67, p. 581), for military caps, which will resume their shape after having been folded in a knapsack.

Melton, H., 194 Regent Street, Manufacturer (54, p. 580), for a lady's elegant lavender-coloured riding hat.

Pearson, J., Stockport (126a, p. 584), for a child's bonnet and feathers.

Articles for General or Personal use.

The almost infinite variety of articles in this class, although possessing great merit and excellence, do not, except where specially noticed and recommended by the Jury, exceed what may be obtained in the ordinary way of trade, and although many of these contributions are valuable, and exhibit great skill and talent, serving to complete this department of the Exhibition, it has not been deemed necessary to do more than mention them in general terms.

Upper Clothing.

Considering the vast extent and variety of this branc of industry in every part of Europe, it is almost impossible to give a summary which will do justice to the talent and ingenuity displayed by many individual contributors. In the fashionable articles of dress presented, not only from the metropolis, but from many of the largest towns of the United Kingdom, great skill is exhibited; and when to these are added the leather coats richly embroidered and lined with skins and furs from the northern parts of Europe, the richly embroidered dresses of Hungary, Russia, Tartary, Turkey, Egypt, China, and India, of exquisite workmanship, and in many cases made up with the greatest ingenuity to repel the cold, it is imperative on the Jury to call attention to the high merit due to the contributors of this vast assemblage of merchandize, and to bear testimony to their great and persevering industry. The cursory observer passing from section to section, may indeed admire the various productions of art; but those alone whose duty it has been to visit every individual contribution, and examine it in detail, can justly appreciate the vastness of the effort by which it has been made.

The importations of wool for home consumption in the manufacture of cloth, exclusive of that of our home growth, was, in the year 1849, 279,472 bales, or about 56 millions of pounds. It is not possible to estimate the number of yards of cloth into which the said wool is wrought, or the various articles made therefrom; but it is evident that the working up of cloth into clothing "*for immediate personal or domestic use*," must necessarily employ a large mass of the population. In London alone, it is estimated that there are 30,000 persons employed in making up clothes for men. It must be remarked and regretted, that the Exhibition has received no contributions adequately representing either the British or foreign superior "tailoring department," or the article produced by the ready-made and slop-selling departments, employing so many thousands of hands, in which also a large capital is embarked, and from which sources, whether it regards Great Britain or foreign countries, the army, navy, and other Government institutions, public bodies, the commercial marine, and, to a great extent, the colonies, derive their supply of clothing.

The Jury award the Prize Medal to the following Exhibitors:—

Buckmaster, W., and Co., 3 New Burlington Street (1a, p. 575), for a very handsome blue frock coat, and various articles of Court costume; exhibiting great taste and improvement in this kind of dress.

Krach, Brothers, Prague (391, Austria, p. 1029), for double pilot-cloth, to form a coat either side outwards of a different colour, and coats of excellent workmanship.

Malatinzky, E., Hungary (394, Austria, p. 1029), for richly-embroidered over-coats.

McGee, Jno. G., and Co., Belfast, Manufacturers (118, p. 584), for several extremely elegant waistcoast pieces, the patterns for which were produced in the School of Design, Belfast.

Opigez and **Chazelle** (336, France, p. 1193), for very excellent embroidered silk, wrought up into dresses of elegant style.

Singer, J., Pesth, Hungary (392, Austria, p. 1829), for several very good dress coats.

Welch, Margetson, and Co., 17 Cheapside (212, p. 589), for a very elegant contribution of braces, carriage rugs, ties, cravats, handkerchiefs, shirts, robes, &c.

The Jury make Honourable Mention of the following Exhibitors:—

Bally and Co., Schoenenwerd (210, Switzerland, p. 1280), for a display of braces, of merit and moderate price.

Briquet and **Perrier**, 22 Rue Jean Robert, Paris (1116, France, p. 1232), for a case of elegantly-wrought braces.

Farrange, Miss, Bray, County Wicklow (176, p. 587), for some very beautifully-knitted stockings.

Harding, T., 108 Regent Street (211, p. 589), for real agate buttons, good both in style and taste.

Harris and **Tomkins**, Abingdon, Berks (111, pp. 583-4), for two smock frocks, exceedingly well made by two cottagers.

Holmes, J., and Co., 171, Regent Street (84, p. 582), for a very elegant shawl cloak, of new design.

Huet, Widow, Rouen (270, France, p. 1189), for a great variety of elastic very well made.

Kearse, T., Limerick (175, p. 587), for a novel plan of inserting India-rubber in articles of dress.

Rabourdin, 88 Rue du Marais, St. Martin, Paris (1416, France, p. 1244), for elegantly-made braces, at very moderate prices.

Sayce, J., and Co., 57, Cornhill (307, Classes XII. and XV., p. 501), for a very light coat called "Piuma Coat."

Solomon, Mrs. S., 52 York Road, Lambeth (86, p. 582), for an embroidered ball dress.

Stewart, Jane, Templetrine Glebe, Bunder, Ireland (177a, p. 587), for some very elegant knitting.

Vincent, Richard, Glastonbury (177, p. 587), for a suit of clothes made of black dyed and prepared sheep skins; a new application of this material.

Walker and **Babb**, 306 Strand (63, p. 581), for an alpaca coat sufficiently light and portable to be carried in the pocket.

Shirts.

On carefully examining the shirts, our opinion is, that in the finer quality, into which embroidery enters largely, the French are superior; there is but a small exhibition from wholesale houses, and scarcely any of a low quality; the collection, therefore, embraces only the higher class of goods. This branch of our industry is an article of fashion, and the number of persons employed is much on the increase. In the better classes of work, the hands obtain for their labour prices which afford them a fair livelihood, their earnings amounting from 9*s.* to 12*s.* per week: the shirts for which wages of 2*s.* each shirt are paid, enable the quick workwoman to earn about 2*s.* per day; but it must be observed, that by the division of labour, an increased amount of wages is earned relatively, and the work is thereby considerably enhanced in quality and skill. These observations apply solely to the higher class of shirt-making.

The Jury award Prize Medals to the following Exhibitors:—

Doucet and **Duclerc, A.**, 21 Rue de la Paix, Paris (147, France, p. 1178), for shirts, embroidered with crests and names, of good shape and make; and for various other articles.

Haight, Mrs. W., New York (385, United States, p. 1461), for a plain shirt, of good shape, and very good work; a light material, suited to hot climates.

Moreau and Co., 22 Rue d'Enghein, Paris (652, France, p. 1209), for some exquisitely-embroidered shirts of good shape, suitable for French wear.

The Jury make Honourable Mention of the following Exhibitors in this division:

Brie and Co., 189 Regent Street, London (24, p. 578), for attached shirt collar to a waistcoat; the waistcoat of excellent shape. (Prize Medal awarded in Class XIX.).

Darnet, Rue Richelieu, Paris (1578, France, p. 1252), for very elegantly-embroidered shirts. (Prize Medal awarded in Class XIX.)

Havem, —, sen., 38 Rue du Sentier, Paris (1265, France, p. 1237), for exceedingly beautiful cravats.

Scott, P., Edinburgh (141, Class XX., p. 585), for fine-breasted shirts, and several collar-shirts.

Smith, J. E., 3 Lawrence Lane, London (29, p. 578), for a shirt without seams or gathers; and Moravian needlework.

Society of Needlewomen (147, p. 586), for a collection of shirts of good shape, and very firmly worked. Exhibited by a benevolent lady.

Valtat and **Rouillé**, 70 Rue de Ramboteau, Paris (709, France, p. 1213), for a quantity of good shirts, well made, and very cheap.

Wheeler and **Ablett**, 23a Regent Street (22, p. 578), for a shirt, elaborately embroidered, and very well made.

Corsets.

On reviewing the articles of corsets, as produced by the Exhibitors, the Jurors and Assistant Jurors conversant with the trade, after carefully examining every case, find but few specimens in which there is novelty combined with useful improvement: there are several combinations of anatomical bandages, or supports, with the corset, as an article of dress; with these exceptions, it does not appear that any very great advance has been made in the higher class of corsets beyond the attention which is unceasingly given to an article of such universal and fashionable use. In the instances before alluded to, the improvements have been pointed out. In the general trade, within the last four or five years, the make and shape of these articles have been greatly improved, so that there can now be obtained by all classes, a well-formed and good corset at a very moderate price: a large quantity are now woven by machinery.

The Jury award the Prize Medals to the following Exhibitors:

Joly, Madames, Sisters, 45 Rue Neuve St. Augustin, Paris (892, France, p. 1222), for a corset of very novel description; elegant and useful.

Josselin, J. J. (551, France, p. 1204), for corsets.

Robert Werley, and Co., Bar le Duc, Meuse (1444, France, p. 1245), for corsets of excellent manufacture and unexceptionable shape.

Van Beneden-Bruers, Brussels (345, Belgium, p. 1162), for stays of good description, without seams and of excellent workmanship.

The Jury make Honourable Mention of the following Exhibitors in this Department:—

Berger, Madame, Brussels (349, Belgium, p. 1162), for a variety of excellent stays.

Piper, T. F., 4 Bishopsgate Street Without (41, p. 579), for the hygienic child's corset; of novelty and great advantage.

Smith, Mrs. Charlotte, Bedford (119, p. 584), for a corset of construction.

Soulès, Hypolite, Madame, Paris (1492, France, p. 1248), for corsets of good make.

Straw Plait and Bonnets.

Though the manufacture of straw-plait and bonnets in England may be considered of recent date, its origin being about one hundred years ago, it has now arrived at a state of great perfection in all its varied branches: this may in a measure be accounted for by the circumstance of the whole female population wearing bonnets; which, with the exception of North America, are but partially used in other countries. At the present moment, it is calculated that from 60,000 to 70,000 persons are engaged in the production of this article; and it is considered that the yearly return cannot be less than from 800,000*l.* to 900,000*l.* With regard to straw goods of foreign manufacture, we have to mention, as most prominent, those of Tuscany and Switzerland. The Leghorn hats, formerly in so much demand, are now but very partially worn, and the same remark may also be applied to the Tuscan plait, which, at the present time, is not adopted in fashionable wear. The Swiss fancy straw-plaits and trimmings occupy a prominent place in this branch of industry, are of great importance to the localities where they are produced, and great taste is displayed in their design and execution, so as fully to meet the constant demands of fashion. Germany and Lombardy have also a limited share in the straw manufacture, of whose production a few specimens are exhibited. We regret to be unable, from want of sufficient data, to state the extent of the amount of the annual returns, or of the employment furnished by the foreign branches of this trade.

The Jury award Prize Medals to the following Exhibitors in this department:—

Art Brothers, and other exhibitors (227, Switzerland, p. 1281), for straw plait.

Allen, James, and Co., 158 Cheapside (13, p. 577), for ladies' and children's straw hats and bonnets, principally of British materials, some of which are very good.

Gregory, Cubitt, and Co., 15, Aldermanbury (8, pp. 576-7), for an assortment of hats and bonnets, with specimens of various kinds of straw and plaits, forming an interesting exhibition of this branch of industry.

Long, George, of Loudwater, Bucks (16, p. 578), for hats and bonnets made on the pillow-lace principle.

Muirs, Connell, and **Brodie**, Luton, Bedfordshire (173, p. 587, and 215, p. 589), for bonnets made from rye-straw, grown in the Orkney Islands, in imitation of the Tuscan plait.

Nannucci, Florence (81, Tuscany, p. 1297), for a case of very fine Leghorn hats and capotes of good workmanship.

Sulzberger and **Akermann**, Meisterschwanden, Switzerland (234, p. 1281), for a variety of Swiss straw plaits and trimmings of good kind, exhibited in six glass cases.

Vyse and **Sons**, 76 Wood Street (11, p. 577), for a case of bonnets of various sorts, in good taste and well manufactured.

Vyse and **Sons**, Prato, Florence (79, Tuscany, p. 1297), for a selection of very fine Leghorn hats and capotes.

Welch and **Sons**, 44 Gutter Lane, London (12, p. 577), for a case of hats and bonnets, made of foreign and English materials, of good style and manufacture.

Wohler and Co., Canton of Argovie (227, Switzerland, p. 1281), for a large assortment of Swiss straw-plait and trimmings, of all descriptions; together with articles showing great skill in this branch of industry.

The Jury make Honourable Mention of the following Exhibitors in this department:—

Claraz, A., Fribourg, Switzerland (228, p. 1281), for a variety of straw-plaits, hats, and bonnets, illustrating the peculiar description of industry of this canton. (Prize Medal awarded in Class XXVIII.)

Depierre Brothers, Heiden, Canton of Appenzell (189, Switzerland, p. 1278), for embroidered straw bonnets, got up with great taste.

Milward, James, and **Sons**, New York (93, United States, p. 1439), for bonnets made of cotton-braid; commendable for being a new application of this material.

Various articles of foreign manufacture, not easily classed with the European goods, have been considered by the Jury in reference to the producing countries.

TUNIS.

Magnificent dresses for Turkish ladies (page 1414), of rich silks finely embroidered in gold and silver; dresses for gentlemen, and also richly-embroidered woollen dresses woven in one piece. The strength of thread fabrics, and the excellence of the weaving, entitle them to notice as highly-interesting specimens of woollen manufacture.

The Jury make Honourable Mention of the following articles exhibited in this department:—

(41, Tunis, p. 1414), silk wrought as a separate article, of great substance and beauty, highly remarkable; and the woollen bernous for common wear, and that for the higher classes, are both very excellent.

(48, Tunis, p. 1414), for dresses of the country, in cotton and silk; also dresses in woollen and mixed materials, exhibiting great strength and excellency in the weaving.

(10, Tunis, p. 1413), for various articles of dress, fez caps, and many shawls made of worsted, and other materials, very strong and durable, and colours remarkably good.

(12, Tunis, p. 1413), for a variety of slippers adapted for use in that country, and some richly-embroidered boots.

TURKEY.

The admirable examples of costumes, collected by order of the Turkish Government, and exhibited by His Highness the Sultan, were found worthy of the highest commendation by the Jury; but unfortunately, from the system adopted in the collection of these examples by traders, from the dwellings of the poor in the more useful domestic articles, and the harems of the wealthy in those of fancy embroidery, such as slippers, veils, &c., it is impossible to recognise, either by Medal or Honourable Mention, many of those to whom such distinctions are justly due, as no names are given whereby the Jury can take cognizance of the articles. Those cases which the Jury have been enabled to recognise are selected as much from the facility for giving such recognition as for the high merit displayed in the production, inasmuch as there are others deserving of the same consideration, could the Jury have discriminated amid the vast collection of articles.

The embroidery and fashion of the costumes are of the highest class, and extremely costly. These dresses, although the costume of the country, are very suggestive; the style of the embroidery is of the highest order—an art which appears peculiar to the country: the slippers also are very elaborately wrought; the veils are richly ornamented with gold and pearls, several of them valued at 25*l*. each.

The various articles of ladies' attire in silk are very richly embroidered; crasse dresses, embroidered scarfs of the most exquisite description, not only as regards the material, but also the design and the combination of colours with the arrangements and disposition of the various materials employed; rendering many of these specimens of the utmost value to our manufacturers.

Many articles of dress from Damascus are not only for the higher, but for the industrious classes; and when it is remembered that many of these are the domestic production of the people, and made in their own cottages, too much praise cannot be bestowed on the skill, elegance, great usefulness, and durability of the goods exhibited.

The hosiery is of various kinds, the household produce of the Angora women. Some of the socks are as high as 10*s*. per pair, while the commoner ones, for the working-people, are produced at exceedingly low prices.

Prize Medals have been awarded to—

His Highness the **Sultan of Turkey**, for the collection (p. 1436).

Feruveladgi, The (Tailors' Association) of Janina (408 to 413 in the Turkish Catalogue, p. 1390), for Albanian costumes, male and female, of rich effect and excellent workmanship.

Sofialioglou's Daughter, Constantinople (874, 875, 876, in the Turkish Catalogue, p. 1393), for veils, embroidered in gold and pearls, with silver fringes.

The Jury make Honourable Mention of the following persons, whose works are exhibited in the Turkish Department:—

Bukudgy (The Girl), Constantinople (988, 989, Turkish Catalogue, p. 1394), for embroidered slippers, called ship-ship and filar.

Carabet's Wife, Constantinople (991, 995, Turkish Catalogue, p. 1394), for embroidered slippers.

Istche (The Girl), Constantinople (98, Turkish Catalogue, p. 1394), for embroidered slippers, called filar.

Terzy's Wife, Constantinople (986, 994, 996, Turkish Catalogue, p. 994), for embroidered slippers, called ship-ship.

Greece.

Greek dresses are exhibited in blue and silver; also red and gold dresses from different islands, of very good work, and elegant patterns.

India.

The Jury desire to recognise the articles exhibited in this division. These consist of cloth of real cashmere wool, extremely light, thin, and fine; various dresses exhibiting the Indian costume, in gold tissue and embroidered. There are also articles of dress from Cashmere, richly embroidered in needlework; and muslin, the produce of the country. The silks are stated to wash perfectly well. Acknowledgment is due to the **Honourable East India Company** (p. 857), for this contribution.

Canada.

The Jury desire to make Honourable Mention of—

Adams, W. H. F., Montreal (331, Canada, p. 968), for cloth made in Canada; his own production.

Barbeau, J., Quebec (Canada, 110, p. 965), for boots made of deer skins, very excellent in quality, cheap, and waterproof.

China.

Honourable Mention is due to the Exhibitor of the magnificent dresses for the higher classes of Chinese, in silk, very richly embroidered (28, p. 1424).

The Jury desire to record their opinion, that if Council Medals are awarded in similar cases, then they are eminently due to **His Highness the Sultan of Turkey** (p. 1385), and **His Highness the Bey of Tunis** (p. 1412), for the valuable contributions which they have made to the Exhibition.

T. CHRISTY, Reporter.

London, July 1851.

CLASS XXI.

REPORT ON CUTLERY AND EDGE-TOOLS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Right Hon. Lord Wharncliffe, *Chairman and Reporter*, 28 Lower Brook Street.
Joseph B. Durham, *Deputy Chairman*, 456 Oxford Street; Cutler.
C. Karmarsch,* Zollverein; Director of the Polytechnic Institution.
Nubar Bey, Egypt.
Alderman Charles Peace, Sheffield: late Cutlery and Edge Tool Manufacturer.
J. Le Play, France; Engineer-in-Chief of Mining School, and Professor of Metallurgy, Paris.

Associates.

Thomas de la Rue, 110 Bunhill Row; Ornamental Stationery Manufacturer. (Juror in Class xvii).
Thomas Hetherington Henry, F.R.S., 18 Lincoln's Inn; Analytical Chemist.
James Ragg, Sheffield; Scissor Manufacturer.
C. Venables, Plomer Hill House, High Wycombe; Paper Manufacturer. (Juror in Class xvii).

* Dr. Schafhäutl; Professor of Metallurgy. (Proxy for M. Karmarsch).

The Jury for Class XXI. think it desirable to preface their Report by some remarks on the extent and general characteristics of the Class submitted to their judgment, and to offer such general comment and analysis as may serve in some degree to present a connected view of the information therein conveyed, with respect to the progress and position of this species of industry among the countries whose contributions compose it.

There is one point upon which an explanation should be given at the outset. Two important sections of those articles which would ordinarily be comprehended under the designation of "Cutlery," are not here included—those of *surgical instruments* and of *weapons of war*. The objects therefore referred to this Jury consist of such as are designed either for common and domestic use, or for various manufacturing operations.

It appears, according to the information laid before the Jury, that there are altogether about 368 Exhibitors in this Class, distributed, very unequally, among twenty-two of the geographical divisions contained in the Official Catalogue. The United Kingdom, as was to be expected, has furnished a proportion amounting to not less than 45 per cent. of the whole list; and among these are to be found many contributors, on so extensive and varied a scale, that its share in the total display of these articles is much larger than the above numbers would imply. The second place is occupied by Austria, whose Exhibitors constitute 27 per cent. of the entire sum. After her the Zollverein States of Germany, furnishing about 8 per cent.—France about 3 per cent.—Sweden and Norway in nearly the same proportion. A very small number of Exhibitors from the remaining countries complete the list, though some of these national collections, however confined to few individuals, contain objects well worthy of attention.

These results must not be taken as any certain indication of the comparative proficiency of the respective countries in the production of commodities of this kind, or of the value of their contributions. It is probable that in some degree they may show the character and nature of the manufacture as carried on in these different states, and correspond with its subdivision among more or less numerous hands in comparison with its total extent. In Austria, for instance, we find by the Catalogue that the collections specified as assignable to each Exhibitor consist for the most part of one kind of manufactured article, scarcely any of more than two or three; and we may therefore perhaps venture to infer that the high number of those, as compared with some departments where they are individually more comprehensive, arises from a very different distribution of capital among their separate establishments in this branch of industry.

But this is not to be considered as a disparagement to their contributions. Such a condition of the manufacture may be best adapted to the supply of the particular demand for which it exists; and, as regards the present occasion, even apart from such considerations, the appearance of a numerous list of exhibitors from any one country may be reasonably taken as a gratifying evidence of the interest and activity awakened there by the invitation to co-operate in a display of the works of universal industry, and of an active desire to share in its honours.

The characteristics of the different national collections are, however, interesting in more than one point of view. We may detect in various instances indications of the peculiar condition and habits of the people whence they come, of their social and industrial wants and aims, as well as of their natural or acquired advantages.

In England the close proximity of coal and iron, together with abundant facilities for converting the latter into steel, gave, at an early epoch, to this branch of its manufactures remarkable energy and importance. Its steel wares had a wide-spread reputation even in the middle ages. The authority of Chaucer assures us that in the fourteenth century the "Sheffield whittle" was an article of choice estimation; and, within their respective spheres, the blades of Toledo and Damascus were scarcely more valued than the more homely cutlery of England. This pre-eminence the Jury can have no hesitation in pronouncing that she still retains to a very remarkable degree in the present Exhibition; though the general statement must now admit of modification, and it would be untrue and unfair to make it without adding, that she has in certain branches of the manufacture some formidable rivals. Still, the long-established trade of this country in steel goods of every description, and her ancient practice of forging them for the supply of all markets, are shown in the great variety as well as excellence of her contributions, which comprise specimens of almost every conceivable article of this description. But in other countries, where the manufacture has been of more recent growth, it is evident that the energies of their artizans have been directed, by a natural consequence, to the production of those particular article more especially called for by their individual position or exigencies. One of the chief objects of the German Customs Union, for instance, has been to encourage the supply from their own workshops of those commodities, of general and ordinary use, which were formerly in great part derived from importation. From the Zollverein States, accordingly, we find a mixed collection of that character, consisting mainly of common cutlery and simple tools, together with some few objects of the plainer kind for certain foreign markets. From Austria, where the mines and manufactures are in the immediate neighbourhood of a large agricultural and pastoral population, it is to be observed that the collection consists largely of scythes, sickles, and the simpler implements of husbandry. In Switzerland the traditional manufacture of fine watch-work renders delicate files a matter of primary necessity, and there is therefore a predominance of these among the better articles in this department. The Belgian collection is distinguished by "spiral cutters" of superior quality, required in the finishing of the woollen fabrics for which that country has long been famous. In France we of course find a very miscellaneous collection; but it displays in a marked manner productions indicating, on the one hand, the highest scale of social civilization and of manufacturing skill in certain spheres and localities, and, on the other, the simplest wants of a primitive provincial population; while in the United States and Canada, where the occupation of the population is an incessant war upon the forest, the manufacture of axes and woodmen's implements assumes an importance which has raised them to the highest perfection, and renders this class the most perfect part of the transatlantic exhibition. But it appears advisable to add some more precise notices of the peculiar contents of each national collection; and for this purpose it will be most convenient to take the two great divisions in the order adopted in the Official Catalogue.

First, then, with respect to the United Kingdom, we find that articles in the Class of Cutlery and Edge-tools have been sent from a great variety of places. In England, from London, Sheffield, Birmingham, Warrington, Stourbridge, and a few other towns of less note; from Glasgow and Edinburgh, but chiefly from the former, in Scotland; and from Cork, Clonmel, and Limerick, in Ireland. Among these seats of the manufacture there is none, as might naturally be expected, which for extent, variety, and excellence of collection, can compare with Sheffield,—its most ancient home. We here find every article, from the most exquisite razor down to the plainest pocket-knife, and from the finest saw or file to the most ordinary chisel, displayed, with various degrees of merit it is true, but with a large proportion of the highest. From this collection, the Jury have thought themselves justified in awarding for one remarkable object a Council Medal. Messrs. SPEAR and JACKSON (123, Class XXII., p. 606) have exhibited, among an assortment of edge-tools of great excellence, a cast-steel circular saw, of the large size of 5 feet diameter, and of such signal beauty and perfection that it stands far above comparison with any other in the Building. The mere excellence of its quality and workmanship, however, would not, the Jury are aware, have enabled them to distinguish it by a Council Medal, if they had not been able to satisfy themselves that its merit is the result of a new and peculiar process of manufacture. But they entertain no doubt, from the information they have received, that mechanical ingenuity of a novel and special character has been employed by these manufacturers for the production of such articles, without which they could not be carried to equal perfection; and they therefore consider them justly entitled to the highest mark of distinction.

There are two other contributions to which the Jury would have felt themselves called upon to award a similar honour, if they had been at liberty to regard singular excellence of workmanship and quality as of itself a sufficient title. Messrs. TURTON and Sons, of Sheffield (190, p. 614), and Messrs. STUBBS, of Warrington, (39, p. 392), each display a complete assortment of files of various sizes,—the former, for ordinary manufacturing purposes, the latter, for the finer operations of the watch-maker,—which, the one for large dimensions, and the other for minute delicacy, combined with the utmost strength and efficiency of material, far surpass any other objects of the same class. They would have deserved the highest assignable reward in respect of these points of merit. Prize Medals, however, have been awarded to them, in common with a number of associates not unworthy of their company. It will be found that the list of these contains a series of names of which many are of high note in the estimation of the public, and whose contributions—some extensive, and comprising in a high degree almost every variety of excellence, others limited, but of marked merit throughout—display the choicest productions in the most finished cutlery, and the finest mechanical tools.

The attention of the Jury was particularly called to one novelty exhibited by Messrs. BLAKE and PARKIN, of Sheffield, (193, p. 614–15), consisting of the union of two qualities of cast steel, hard and soft, in the same article; having carefully examined these specimens, which were manufactured with much skill, they have no reason to doubt that the process is peculiar to the Exhibitors; but they cannot satisfy themselves that it involves any clear advantage over the combinations of cast and bar steel, and of cast steel and iron, the methods of cementing which have been long known and practised.

The contribution from London is of course on a more limited scale than that from Sheffield; but it consists of that superior order of cutlery for which the Metropolis has a long-established reputation, and contains articles of high merit in this Class. Among the Exhibitors from London, Mr. DURHAM, of Oxford Street, (46, p. 593), would have been considered by his colleagues deserving of a Prize Medal, if his consent to act as a Juror had not disqualified him from accepting it.

The finer descriptions of cutlery are nearly confined, in England, to the Sheffield and London departments; but there are a few articles contributed by individual manufacturers from other places, whose names will be found in the Award List; and there are some also furnished from Ireland and Scotland, which, though not equal to the best from the chief seats of the manufacture, are still of considerable excellence.

Manufacturing tools are supplied largely from Birmingham, and sparingly from Scotland; scythes and files from Stourbridge and Warrington; which latter place furnishes the beautiful collection of watch-files by Messrs. Stubbs, already mentioned.

On the whole it appears that the British manufacture of cutlery remains still, as heretofore, mainly seated at Sheffield, though it has been established also to a limited extent in some other quarters. The same gradual change of circumstances which has operated to transfer, in a great degree, the silk and some other trades from London to the provinces, has had the effect of withdrawing much of this branch of industry from the capital; though a portion, chiefly directed to the production of the higher order of articles, still retains its footing there, and sustains its reputation. On the other hand, the manufacture of the coarser goods, such as tools and mechanical implements, is now extensively shared by several localities which afford the requisite facilities for its successful prosecution, and where the various other forms of industry which surround it create a continued demand for its productions.

Extending our survey beyond the limits of the United Kingdom, from its provinces to its dependencies, it will be found that these present aspects so very different, that certain distinctions are indispensable, with reference to a proper estimate of their position as exhibitors.

It is not to be expected that in infant communities, such as most of the Colonies, properly so called, a manufacture of this kind could have attained any considerable growth or perfection; though the greater progress and development of some few have enabled them to meet their peculiar local exigencies with considerable success. We find in this category a small contribution from the Cape of Good Hope, by the Missionary Station at Gnathendal, consisting of various forms of knives adapted to the uses of that country; and from Nova Scotia another, of cutlery made of Nova Scotia steel, though manufactured in Sheffield: both are creditable to these colonies. While from Canada (West) there is a larger assortment, consisting entirely of axes and tools, the former especially of excellent quality, and proving the skill and power of her artisans to supply those particular articles to which her physical exigencies give the highest importance.

On the other hand, there are contributions from dependencies which are to be considered in a very different light, not newly-peopled, but ancient communities, variously advanced in civilization, and having their own established and characteristic industrial pursuits, often of the highest order of manual dexterity. In this division there are some from the vast territories of the East India Company, which well deserve notice; and a small contribution from Jersey. The Indian department contains various Hindoo and Malay tools for the use of carpenters and workers in metals; and among them are found, from Moorshedabad, in Bengal, a set of the implements employed by the native artificers in carving the beautiful ivory articles which have so long been admired in the western world, and which present such rare examples of ingenuity, taste, and, skill.

Articles of this kind, however, are of so peculiar a nature, and of so limited an application, that they can scarcely be considered as bringing into play any principle of general competition or comparison. It is not so with the foreign neighbours of Great Britain, whose productions come next under notice. They will be found to extend, with various degrees of excellence, through all the class of commodities which proceed from the workshops of the United Kingdom, and to include some, also, of a peculiar and distinctive character.

Looking first to Europe, its foreign exhibitors may be classed under certain great subdivisions, which are naturally suggested by the position and relations of its different members, and may conduce to the clearness and convenience of the survey. Thus the several national departments, contained in the total list, may be advantageously connected as follows:—

1. France, Belgium, and Switzerland;
2. Austria, and the Southern States of Germany;
3. The Zollverein, and Northern States;
4. Denmark, Sweden, and Norway;
5. Russia;
6. Spain and Portugal;
   and finally,
7. Turkey, Egypt, and Tunis;
8. China; and
9. The United States of America, will complete the distribution over the remainder of the world.

1. From France there is an extensive assortment, ranging from the finest ornamental cutlery down to the rudest and cheapest articles for domestic use, which in general character is very good, and in some instances of superior quality. The greater portion appears to be supplied from Paris; but there are a few exhibitors also from the provinces—from Moulins (an ancient seat of this manufacture), from St. Etienne, and from places in the districts bordering on the Rhine.

In cutlery, the best specimens are those of razors, penknives, scissors, and table-knives, many of which are very highly finished and elaborately ornamented, and display great skill as well as superior quality. Among the tools and implements are to be found a very excellent circular saw, showing high proficiency in this branch of the manufacture; and assortments of files, also of considerable merit as to workmanship, though found, after a careful trial, to be not quite perfect as to the quality of the steel. On the other hand, they mention particularly the samples of "web-saws," which are of the very highest class, and, indeed, superior to anything of the same description contained in the English collection.

Belgium supplies cutlery, together with files, scythes, "ledger blades," and "spiral cutters." These last articles are portions of the machinery used in the dressing of cloth, and are of a high degree of merit. The cutlery, principally of the table kind, is well finished, but the metal is somewhat soft, and unequal to the workmanship. The same must be said of the scythes and files.

From Switzerland, the articles consist mainly of razors, and of small files adapted to the use of the watchmaker. The former are of fair quality; the latter of the most delicate workmanship, and well suited to the trade for which they are designed, and which has been long successfully pursued in that country.

The attention of the Jury was called, in the French department, to a collection of articles, as examples of remarkable cheapness, which they would not have deemed worthy of mention on any other grounds. These are a certain description of extremely rude pocket-knife, said to be in very universal use among the peasantry of France, for cutting their provisions, and other purposes. They are formed of a rough blade of soft iron, folding into an equally rough turned cylindrical handle of wood. It is obvious that, with such materials, their utility must be very limited; but they are sold for *five centimes*, or about *one halfpenny*, each, and are therefore in general use among the poorer classes.

In France, Belgium, and Switzerland, the manufacture of cutlery and edge-tools has greatly improved, and seems likely to continue to do so.

2. Of the subdivision of States which we have placed next in order, the same improvement may, to a considerable extent, be observed. If we include therein Austria, Wurtemburg, and Saxony, we find that the two latter, at least, exhibit specimens of general knife cutlery, and of hunting-knives, which, though they cannot be pronounced equal to the best English, are of very good quality, well finished (especially in the Saxon portion), and mounted with much costly ornament. From Austria the display is not of so high a class; the cutlery from that country is of a very ordinary description, chiefly the produce of Styria, and is stated to be exhibited, in a great measure, as an example of cheapness. After such consideration, however, as the Jury have had the means of giving to this point, they conclude that the price is not below what goods of the same quality might be produced for in other countries. The articles are very deficient in merit of any other kind, many of them not even being of steel.

These remarks apply in a great measure to the tools and implements in this department. There are some from Wurtemburg of fair quality; but the assortments of files and other such objects from Austria are indifferent, and not, apparently, very low in price. There is here, however, one description of article deserving of notice, as a curious example of the modification which all tests of merit must undergo when judged by the peculiar uses for which the production is designed. There are from the southern provinces of Austria assortments of scythes, worked thin, and with a concave surface, very difficult to forge, and therefore requiring much skill in the workmanship, but of metal so soft and inferior, that they would not have been considered worthy of any notice were it not that they are so made purposely to suit the particular habits of an agricultural population, who mow all crops, whether of grain or others, close to the surface of a soil generally abounding in stones. A scythe of hard steel, with a fine edge, though it might perform its work better where unimpeded, would be liable to constant injury, very difficult of repair, under such circumstances; whereas these Tyrolese or Styrian scythes yield at once to the blows which they receive upon their edge. The labourer carries with him a small hammer; and whenever the blade has so far lost its shape as to need renewal, he beats it out in a few moments to its original form; hence the softness of the metal, in most cases considered wholly inconsistent with excellence in this branch of manufacture, becomes an essential property.

3. From the States of the Zollverein, and from Hamburg and Mecklenburg-Schwerin, in Northern Germany, there is a collection of articles of almost every description. The two latter States contribute only on a limited scale; Mecklenburg some razors, and Hamburg also, together with a small collection of tools, of fair quality. The former commodities are not good of their kind, and those from Mecklenburg apparently very high in price. Of the cutlery from the Zollverein, much, though highly finished, is of an ordinary description, consisting of table and pocket knives in considerable variety; but there are also certain "spear knives," designed for fishing by the

natives in the South American rivers, and adapted for their markets, which deserve notice as of superior manufacture. Among the tools the same character prevails as in the cutlery, though there are certain "web-saws" which evince higher skill. There is an assortment of scissors, chiefly from Solingen in West Prussia, worthy of attention as being manufactured in great numbers from an ore producing a "natural steel," which is of such quality as to suffice for the purpose to which it is here applied, and to save the manufacturer the cost and labour of the converting process, thereby enabling him to produce such goods at a price much lower than would be profitable with the ordinary methods. The workmanship of these scissors appears to be fair; but the Jury were unable, after much attention to the point, assisted by the judgment of Mr. Ragg, an experienced workman, to satisfy themselves entirely as to the real quality of the metal, although the material from which they are said to be manufactured has been examined by Mr. Henry, and was pronounced by him to be steel.

4. The collections from Denmark, Sweden, and Norway are small, and contain little that requires notice. From the two latter countries the number of exhibitors bears a large proportion to the extent of the contributions, indicating establishments on a very limited scale; and although Sweden has long produced the most valuable iron, as the raw material of the finest steel and of the most finished cutlery, it does not appear that the manufacture itself has made any great advance. The collection consists of some razors, spring-knives, and other cutlery tools of an ordinary kind. From Denmark there is one singular article, a set of files, hollowed, and made to fit within each other: they are curious, and difficult of manufacture, but of no apparent utility.

5. Of the three contributions from Russia, one only is from a private individual, the other two are from imperial establishments. The former contributes a varied assortment of cutlery of all kinds, and of fair quality; the latter some tools, which cannot be ranked very high, and some scythes of the same kind as those whose peculiarities were described in the Austrian Department. The Russian implements of this description are the best.

6. From Spain and Portugal the contributions are very small. The former exhibits only an assortment of files from Placenzia, of very fair quality: the latter, some "agricultural implements," consisting of pruning-knives and scissors, probably adapted to the vine cultivation, but of little merit as manufactured goods.

7. Of the three States in the next division, Turkey, Egypt, and Tunis, the two latter are only slender contributors in this Class. One or two articles contained in the list furnished by the Egyptian Government, and a few pairs of Tunisian scissors of the roughest workmanship, constitute the entire collections. Turkey, however, appears with articles of greater interest, such as scissors and hunting-knives; few in number, but well made. The knives have blades of Damascus steel; the scissors are of a singular form, and well deserve notice. They are so fashioned that each blade is half of a hollow cone, and the two therefore produce an entire cone when closed. The sides of each of these halves form the cutting edges. They are well finished, and must have required much skill and great labour in their fabrication, rendering their cost high; but it does not appear that they possess any superior utility. It is not stated that they are so made for any special purpose; and if not, they involve considerable waste of toil and skill.

8. From China there are only a very few articles; but one of them is a singular instrument, and should be noticed, as characteristic of the people from whose workshops it proceeds. It is a small blade of a triangular form, 2½ inches long, 1¼ inches wide, and ¼ inch thick, folding upon a slender wooden cylindrical handle, and is used as a razor for shaving a part of the head, according to general practice among the Chinese. It is not easy for us to comprehend how the operation can be successfully performed with such an implement; but it is said to be in common use among the natives, and to effect its purpose in their hands with the utmost nicety and despatch, and it cannot, therefore, be ill-adapted to its object. The workmanship is, to European eyes, of a very rude description, and even the surface of the metal displays none of the finish which is so diligently bestowed on many Chinese productions; but the edge it carries is certainly good, and its quality, no doubt, surpasses its appearance.

9. Lastly, the opposite hemisphere supplies, from the United States of America, a collection which, though not very extensive, contains some signal proofs of proficiency in such manufactures, and is strongly characteristic of the natural and social exigencies of the people from whom it comes. It consists of a few articles of the finer cutlery, but mainly of assortments of the larger edge-tools and implements, such as scythes and axes, and other objects of that nature. The former are finished with great care, and decorated with much costly ornament; but the Jury cannot pronounce them to be of the first degree of excellence in workmanship, and their temper is wanting in the hardness proper to the best cutlery. With respect to the other articles, however, the case is different. There is a set of joiner's tools, which, though few in number, are excellent; and the same may be said of the scythes, which are of the best quality. Good as these productions are, they are perhaps surpassed by the axes, to which nothing of the kind can be superior; they are admirably finished, and at the same time display all those more valuable qualities which are the necessary conditions and evidence of perfection in such commodities. It is evident that the great prevailing want of the population has created and encouraged to perfection, in its own neighbourhood, the trade which was to supply it.

The Jury believe that in the above general survey of the contributions presented by this Class of the Exhibition, they have left nothing unmentioned of any note or merit; and having thus endeavoured to point out the several interesting features which belong to it, it only remains for them to add a list of the awards.

AWARDS IN CLASS XXI.

1. RECOMMENDATION FOR COUNCIL MEDAL, CONFIRMED BY THE COUNCIL OF CHAIRMEN.

Nation.	No. and Page in Catalogue.		Name of Exhibitor.	Objects Rewarded.
	No.	Page.		
United Kingdom -	113	608	Spear and Jackson (Cl. XXII.) - -	For exhibition of circular saws, particularly one 60 inches in diameter, of marked and very superior excellence, manufactured by a process of peculiar merit, the result of a novel application of mechanical ingenuity recently effected by themselves.

2. AWARD OF PRIZE MEDALS.

Nation.	No. and Page in Catalogue.		Name of Exhibitor.	Objects Rewarded.
	No.	Page.		
United Kingdom	23	591	Addis, J. B., jun.	Carving-tools.
France	753	1216	Arnheiter, M.	Cutlery.
United Kingdom	193	614	Blake and Parkin (Cl. XXII.)	Saws and files.
United Kingdom	110A	606	Brookes, W., and Son (Cl. XXII.)	Edge-tools.
United States	259	1452	Brown and Wells	Tools.
United Kingdom	18	591	Buck, J.	Turning and other tools.
United Kingdom	192	614	Butcher, W. and S. (Cl. XXII.)	Edge-tools and razors.
United Kingdom	240	619	Butterley, Richard (Cl. XXII.)	Sickles.
United Kingdom	115	606	Cocker and Sons (Cl. XXII.)	Files and edge-tools.
France	129	1177	Coulaux and Co.	Saws.
Wurtemburg	57	1117	Dittmar, Brothers	Cutlery.
United Kingdom	49	593	Eastwood, George	A plane.
United Kingdom	203	615	Eyre, Ward, and Co. (Cl. XXII.)	Cutlery.
United Kingdom	114	606	Fenney, Frederick (Cl. XXII.)	Razors.
Austria	420	1031	Fischer, A.	Files.
France	218	1184	Froely, A.	Fine files.
United Kingdom	194	615	Gibbins and Sons (Cl. XXII.)	Scissors.
France	851	1221	Goldenberg, G., and Co.	Saws and tools.
France	858	1221	Guerre, sen.	Cutlery.
United Kingdom	226A	618	Hague, S. (Cl. XXII).	Penknives.
Austria	517	1034	Haindl, A.	Cutlery.
United Kingdom	31	592	Hannah, A.	Augers, &c.
United Kingdom	146	609	Hardy, T. (Cl. XXII.)	Dressing-case instruments.
Turkey	1553	1397	Hassan	Scissors.
Wurtemburg	58	1117	Haueisen and Son	Scythes.
United Kingdom	135	608	Hawcroft and Sons (Cl. XXII.)	Razors.
Sweden & Norway	11	1350	Heljestrand, C. V.	Razors.
Prussia	187	1058	Henkels, J. A.	Cutlery.
United Kingdom	188	614	Higginbotham, G. and W. (Cl. XXII.)	Scissors.
Prussia	631	1085	*Hilger and Sons	Cutlery and scythes.
United Kingdom	47	593	Hill, Joseph V.	Saws.
United Kingdom	33	592	Hilliard and Chapman	Cutlery.
Prussia	637	1085	Hoeller, A. and E.	Cutlery.
United Kingdom	181	612	Howarth J. (Cl. XXII.)	Edge-tools (engraving).
United Kingdom	228	618	Hunter, Edwin (Cl. XXII.)	Scissors.
United Kingdom	215	617	Hutton and Newton (Cl. XXII.)	Scythes and reaping-hooks.
Russia	286	1375	Iakovleff, Mme. Catherine	Cutlery.
United Kingdom	191	614	Ibbotson, Brothers (Cl. XXII.)	Cast-steel scythes, &c.
United Kingdom	209	616	Ibbotson, Richard (Cl. XXII.)	Saws.
Russia	167	1372	Imperial Artinsk Works	Scythes.
United Kingdom	109A	605	Johnson, Cammell, and Co. (Cl. XXII.)	Files.
United Kingdom	5	591	King and Peach	Planes.
United Kingdom	161	611	Kirk and Warren (Cl. XXII.)	Files.
United Kingdom	14	591	Loy, William	Skates.
United Kingdom	15	591	Loy, W. T.	Cutlery.
United Kingdom	112	606	Makin, W. (Cl. XXII.)	Rag-engine roller-bars, bottom-plates, and rag knives.
Prussia	617	1084	Mannesmann, A.	Files.
United Kingdom	139	608	Mappin and Brothers (Cl. XXII.)	Cutlery.
United Kingdom	169	611	Marsden Brothers and Co. (Cl. XXII.)	Joiners' tools.
United Kingdom	132	608	Martin, Stephen (Cl. XXII.)	Razors.
United Kingdom	32	392	Mathieson, A.	Joiners' tools.
United Kingdom	181	430	Matthews, W. (Cl. X.)	Table-cutlery.
United Kingdom	7	591	Morton, J. and G.	Table-knives.
United Kingdom	13	591	Moseley and Sons	Planes.
United States	323	1455	North Wayne Scythe Company	Scythes.
United Kingdom	149	609	Nowill, J., and Sons (Cl. XXII.)	Cutlery.
United Kingdom	233	618	Peace, H., and Co. (Cl. XXII.)	Saws.
United Kingdom	641	465*	Philp and Whicker (Cl. X.)	Cutlery.
France	348	1194	Picault, G. F.	Cutlery.
France	969	1226	Proutat and Co.	Fine files.
United Kingdom	690	667	Rodgers, J., and Sons (Cl. XXII.)	Cutlery.
United Kingdom	198	615	Saynor and Sons (Cl. XXII.)	Gardeners' knives.
Prussia	673	1087	Schmolz, W., and Co.	Cutlery.
United Kingdom	10	591	Sharp Brothers and Co.	Table knives.
United States	119	1447	Simmons, D., and Co.	Edge-tools.
United Kingdom	208	616	Slack, Sellers, and Co. (Cl. XXII.)	Saws.
United Kingdom	204	615	Sorby, R., and Sons (Cl. XXII.)	Edge-tools.
United Kingdom	214	617	Staniforth, Thomas (Cl. XXII.)	Scythes and sickles.
United Kingdom	124	607	Steer and Webster (Cl. XXII.)	Scissors.
Switzerland	63	1270	Stotzer, Frederick	Fine files.
United Kingdom	39	592	Stubs, Peter	Small files.
Turkey	1550	1397	Tahir	Scissors.
France	1027	1228	Talabot and Co.	Scythes.
United Kingdom	129	608	Taylor, Henry (Cl. XXII.)	Engravers' tools.
United Kingdom	2	590	Thornhill, Walter	Garden tools.

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* Awarded a Prize Medal in Class XXII.

PRIZE MEDALS—*continued.*

Nation.	No. and Page in Catalogue.		Name of Exhibitor.	Objects Rewarded.
	No.	Page.		
United Kingdom	33	592	Tomlin and Co.	Sickles and shears.
Belgium	128	1156	*Troupin Brothers	Spiral cutters, &c.
United Kingdom	117	607	Turner, Thomas (Cl. XXII.)	Files, saws, and cutlery.
United Kingdom	190	614	Turton, Thos., and Sons (Cl. XXII.)	Files.
United Kingdom	159	610	Unwin and Rodgers (Cl. XXII.)	Cutlery.
United Kingdom	178	612	Unwin, W. (aged 16; Cl. XXII.)	Sportsman's knife.
United Kingdom	17	591	Waldron and Sons	Scythes.
United Kingdom	148	–	Walters, J., and Co. (Cl. XXII.)	Cutlery.
United Kingdom	196	615	Ward and Payne (Cl. XXII.)	Edge-tools.
Austria	448	1033	Weinmeister, G.	Scythes.
Austria	573	1036	Wertheim, F.	Tools.
United Kingdom	122	607	Wilkinson and Son (Cl. XXII.)	Sheep shears.
United Kingdom	175	612	Wilkinson, T. and G. (Cl. XXII.)	Scissors.
United Kingdom	195	615	Wilson and Sons (Cl. XXII.)	Shoe and butchers' knives.
United Kingdom	125	607	Wostenholm, G. and Sons (Cl. XXII.)	Cutlery.

* Awarded a Prize Medal in Class VI.

3. The Jury, however, scarcely feel that they should be doing complete justice to the spirit and exertions of some other exhibitors if they did not mention, that though their contributions have not appeared to be of quite such a character as to entitle them to the distinction of a Medal, they are still deserving of HONOURABLE MENTION; and they therefore desire to append the following list of names to which such special recognition is fairly due.

Nation.	No. and Page in Catalogue.		Name of Exhibitor.	Objects Rewarded.
	No.	Page.		
United Kingdom	11	591	Addis, S. J.	Carving tools.
France	4	1169	Alcan and Locatelli	Files.
United Kingdom	118	607	Algor, J. (Cl. XXII.)	Shoe knives.
United States	97	1439	Allen, A. B., and Co.	Tools.
United Kingdom	365	638	Atkin and Son (Cl. XXII.)	Joiners' tools.
United Kingdom	160	611	Atkinson and Marriott (Cl. XXII.)	Files.
United Kingdom	20	591	Baker, William	Awl-blades.
United Kingdom	37	592	Barker, R.	Butchers' steels.
United Kingdom	48	593	Beach, W.	Cutlery.
United Kingdom	232	618	Bell, J. (Cl. XXII.)	Silver knives.
United Kingdom	212	617	Biggin and Sons (Cl. XXII.)	Saws.
Prussia	623	1085	*Bleckmann, John Elias	Cutlery and files.
United Kingdom	130A (or 176)	612	Bloomer and Phillips (Cl. XXII.)	Joiners' tools.
Prussia	633	1085	†Boeker, R. and H.	Saws, files, &c.
United Kingdom	3	590	Bradford, R. and W.	Cutlery.
United Kingdom	26	592	Bradford, Samuel	Cutlery.
Prussia	621	1084	‡Braunschweig, J. A.	Tools.
United Kingdom	145	609	Briggs, S. (Cl. XXII.)	Awl-blades.
United Kingdom	171	611	Brookes, J. (Cl. XXII.)	Dressing-case instruments.
United Kingdom	182	612	Brown and Sons (Cl. XXII.)	Joiners' tools.
Austria	120	1013	Bubenitiscek, J.	Cutlery.
Switzerland	270	1183	Burkhardt, James	Razors.
United Kingdom	108	605	Carr, J., and Riley (Cl. XXII.)	Saws and files.
United Kingdom	142	609	Clayton, George	Table cutlery.
Prussia	628	1085	Coppel, A.	Pen and pocket knives.
United Kingdom	165	611	Cousins and Sons (Cl. XXII.)	Scissors.
United Kingdom	217	617	Cutler, John (Cl. XXII.)	Edge-tools and shears.
United Kingdom	157	610	Deakin, George (Cl. XXII.)	Scissors (horse).
United Kingdom	110	605	Deakin, G., and Co. (Cl. XXII.)	Table cutlery.
United Kingdom	120	607	Ellin, T., and Co. (Cl. XXII.)	Table cutlery.
United Kingdom	151	610	Elliott, J. (Cl. XXII.)	Razors.
United Kingdom	156	610	Ellis, J. (Cl. XXII.)	Cutlery.
Austria	501A	1034	Fischer, G.	Files.
United Kingdom	206	616	Fisher and Bramhall (Cl. XXII.)	Files.
United Kingdom	167	611	Flather, B. (Cl. XXII.)	Joiners' tools.
United Kingdom	219	617	Garfit and Son (Cl. XXII.)	Scythes and reaping-hooks.
Prussia	551 (or 872)	1097	Gerresheim and Neeff	Cutlery.
United Kingdom	123	607	Gilbert Brothers (Cl. XXII.)	Razors.
United Kingdom	187A	614	Jowitt and Battie (Cl. XXII.)	Files.
Turkey	1304	1396	Kirkar	Scissors.
United Kingdom	24	591	Knight and Sons	Turning-tools.
Saxony	30	1106	Krumbholz and Trinks	Cutlery.
Canada	121A (or 151)	967	Ladd, C. P.	Axes.

* Awarded Honourable Mention by Jury of Class XXII. † Awarded Prize Medal by Jury of Class XXII.
‡ Awarded Honourable Mention by Jury of Class XXII.

HONOURABLE MENTION—*continued.*

Nation.	No. and Page in Catalogue.		Name of Exhibitor.	Objects Rewarded.
	No.	Page.		
France	1641	1255	Lanne, E.	Cutlery.
Canada	124 (or 150)	967	Leavitt, G.	Axes.
Austria	496	1034	Lechner, M.	Files.
Switzerland	215	1280	Lecoultre, J.	Razors.
United Kingdom	225	618	Leon, A. (Cl. XXII.)	Bowie knives.
Saxony	31	1106	Levy, H.	Pearl-handle carvers.
United Kingdom	231	618	Linley, G. A. F. (Cl. XXII.)	Sheep-shears.
United Kingdom	128	608	Marples, R. (Cl. XXII.)	Joiners' tools.
United Kingdom	162	611	Marsh Brothers (Cl. XXII.)	Cutlery and edge-tools.
United Kingdom	35	592	Mathieson, T. A.	Plane.
United Kingdom	36	592	McPherson, C. and H.	Braces and bits.
Belgium	352	1162	Monnoyer, Joseph Peter	Table cutlery.
Denmark	22	1357	Naylor, J. W.	Files (various).
United Kingdom	133A	608	Newbould and Baildon (Cl. XXII.)	Table cutlery.
United Kingdom	137	608	Nicholson, W. (Cl. XXII.)	Cutlery.
Austria	444	1033	Offner Brothers	Scythes.
Austria	445	1033	Pamer, S.	Scythes.
United Kingdom	119	607	Parkin and Marshall (Cl. XXII.)	Table cutlery.
United Kingdom	233A	618	Peace, Henry (Cl. XXII.)	Files.
Austria	446	1033	Penz, J.	Scythes.
Prussia	619	1084	Pickardt, G.	Files.
Portugal	632	1314	Polycarpo, A.	Garden-knives.
Hamburg	43	1137	Ritter, W.	Augers, &c.
Austria	552	1035	Rossler, J.	Cutlery.
United Kingdom	34	592	Sanders, G.	Razor-strop.
Prussia	640	1085	Schwarte, J. D.	Cutlery.
Canada	122 (or 148)	967	Scott and Glasford	Axes.
United Kingdom	147	609	Sellers, J. (Cl. XXII.)	Cutlery.
Canada	123 (or 149)	967	Shaw, Samuel	Axes.
United Kingdom	158	610	Slagg, H. W. (Cl. XXII.)	Sickles.
Turkey	1303	1346	Sophia, Province of	Scissors.
United Kingdom	21	591	Stewart and Co.	Razor-guard.
Sweden & Norway	12A	1350	Stille, A.	Razors, &c.
Austria	559	1036	Stuckhart, John	Cutlery.
France	1496	1248	Tabourdeau, P.	Cutlery.
France	1024	1228	Taborin, P. F.	Files.
United Kingdom	205	616	Tasker, Henry (Cl. XXII.)	Saws.
United Kingdom	211	616	Taylor Brothers (Cl. XXII.)	Saws.
Prussia	671	–	Thomas, C.	Cutlery.
Canada	120 (or 147)	966	Wallace, A.	Planes.
United Kingdom	187	614	Warburton and Co. (Cl. XXII.)	Augers.
United Kingdom	631A	478	*Weiss and Son (Cl. X.)	Cutlery.
Austria	572	1036	Weiss, J., and Sons	Tools.
United Kingdom	134	608	Winks, B., and Sons (Cl. XXII.)	Razors.
United Kingdom	8	591	Wood, J.	Razors.
Spain	256A	1345	Ybarra, J.	Files.
Austria	450	1033	Zeitlinger, J. A.	Scythes.

* Awarded Prize Medal by Jury of Class Xc.

WHARNCLIFFE, REPORTER.

October 1851.

CLASS XXII.

REPORT ON IRON AND GENERAL HARDWARE.

The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Hon. Horace Greeley, *Chairman*, United States; Editor.
W. Bird, *Deputy Chairman*, 5 Martin's Lane, Cannon Street, City; Iron Merchant.
Arthur Adams, Walsall; Hardware Merchant.
— Auer, Austria.
W. Dyce, R.A., *Reporter*, 2 Fitzroy Square.
G. Goldenberg, France; Manufacturer; Member of Central Jury, &c.
Don Manuel Heredia, Spain; Merchant.
E. Stirling Howard, Sheffield; Sheffield Plate Manufacturer.
George Shaw, Cannon Street, Birmingham; Patent Agent.
Ferd. Spitaels, Belgium; Member of Senate, Vice-President of Chamber of Commerce, Charleroix.
Dr. F. Steinbeis, Zollverein; Member of the Board of Trade and Commerce.
Henry Van Wart, Birmingham; Merchant.

Associates.

Sir H. R. H. Bishop, 13 Cambridge Street, Hyde Park; Professor of Music at Oxford. (Juror in Class XA.)
Warren de la Rue, Ph. D., F.R.S., F.R.A.S., F.C.S, 7 St. Mary's Road, Canonbury, Islington; Manufacturer of Ornamental Stationery. (Juror in Class XXIX.)
A. W. Hoffman, Ph. D., F.R.S., F.C.S., Zollverein; College of Chemistry, Oxford Street; Professor of Chemistry. (Juror in Class XXIX.)
Chevalier Neukomm, Zollverein; 9 Carlton Terrace. (Juror in Class XA.)
Richard Redgrave, R.A., 18 Hyde Park Gate, South Kensington Gore, Artist. (Juror in Class XXX.)
Dr. Schafhaütl, Zollverein; Professor of Geology, Mining, and Metallurgy. (Juror in Class XA.)
W. Wyon, R.A., Her Majesty's Mint Medalist. (Juror in Class XXX.)

The range of Class XXII. may be said to be co-extensive with the employment of the baser metals in manufacture. In that respect it forms a *nucleus* round which, either wholly, or in certain particulars, various other classes, to the number of seven or eight, are distributed; and which are separated from it on grounds, partly of convenience, and partly of the subjection of metal-working, as such, to the purposes of specific branches of industry or science.

Owing, however, to the difficulty, in many cases, of making such a separation, the range of Class XXII. has been limited rather with respect to the number of objects embraced by it, than to their nature; among which, in point of fact, there are included examples either analogous to, or identical in all essential particulars with, a considerable portion of those exhibited in Classes I., V., VI., VIII., IX., X., XXI., XXIX., and XXX. Thus, for example, although it belongs to Class I. to determine the merits of iron, steel, copper, or other wire, under the head of "Metals in their progress to finished manufactures," the same wire, when twisted or woven, comes under Class XXII., in which its merits, with this new quality superadded, must again be tested by a rule involving a judgment on the material itself. Then again, Class XXII. abounds, if not with machines, at least with machine-like contrivances, and with implements and tools, which identify it with several of the Classes above enumerated. In the case of metallic sculpture, this identity with Class XXX. is especially to be remarked. As a general rule, it was thought that the Jury of Class XXII. might with advantage confine themselves to the consideration of art as it is applied to ornamental purposes; but practically it was by no means easy, if indeed it was possible, to define in every respect the limits between ornamental art and fine art; and besides, it was to be borne in mind, that statues in metal, and other similar works of art, while they are to be judged of æsthetically, are also, as the result of various metallurgic operations, amenable to the criticism of the founder and metal-worker, and may have, in that respect (as the Jury believe to be the case in more than one instance in the Exhibition) a merit, which, though not independent of artistic excellence, is nevertheless separable from it. On this ground, nearly the whole of the sculptures in metal have passed under the review of this Jury; and they would remark, with respect to this and other cases, that although their duties would have been lightened by a more exact definition of the limits of their Class, and, in all instances in which it was practicable, by a statement of the particular merit on which the exhibitor wished to found his claim to reward, yet the exhibitors of those articles which have undergone the scrutiny of more than one Jury, will have no reason to complain of an arrangement, which, at the least, must have tended to enlarge the grounds of criticism, and make more fully known their claims to notice.

The objects included in Class XXII., considered with reference to material, range themselves for the most part under the heads of:—

1. Brass Manufacture.
2. Copper, Zinc, Tin, Pewter, and General Braziery.
3. Iron-work.
4. Steel Manufactures.

The following particulars being comprehended under these heads:—

1. *Brass Manufactures.*

a. Cabinet and general brass foundery: consisting of hinges, fastenings, escutcheons, bell-pulls, brass foundery used in ships, knockers, door-springs, castors, &c.

b. Plumber's brass foundery: cocks, valves, pumps, water-closets, &c.

c. Stamped brass: cornices, curtain-bands, finger-plates, &c.

d. Gas fittings, brackets, chandeliers, pillars, gas-burners and consumers' meters, &c.

e. Tubing, plain and ornamental.

f. Metallic bedsteads.

g. Chandeliers, lamps and candelabra for oil, candles, or camphine, and lamp-chains.

h. Railway and carriage brass foundery, and signal lamps and lanterns.

i. Bronze figures, busts, and chimney ornaments.

k. Bells: house, church, ship, table, &c., and alarums.
l. Candlesticks: table and bedroom.
m. Monumental brasses and ecclesiastical brass-work.
n. Copper-plates for engravers.
o. Miscellaneous: including pins, nails, wire-gauze, bird-cages, hooks and eyes, wire baskets, and ropes.

2. *Copper, Zinc, Tin, Pewter, &c.*

a. Kettles, coal-scuttles, coppers, saucepans, steamers, plate-warmers, &c.
b. Bronzed tea and coffee-urns, kettles, &c.
c. Tubing: copper, tin, lead, &c.
d. Pewter, German silver and Britannia metal tea-pots, basins, dishes, spoons, ladles, inkstands, &c.
e. Coffin furniture: plates, escutcheons, &c.
f. Zinc articles generally.

3. *Iron-work.*

a. Stoves, grates, fenders, and fire-irons, kitchen ranges, cooking apparatus, smoke-jacks.
b. Warming apparatus for halls and rooms, ships, &c., either by water, coal, coke, wood, charcoal, or gas.
c. Shower, vapour, air, and warm-water baths.
d. Ventilators: metallic and others.
e. Pipes and gutters, &c.
f. Locks and hinges.
g. General ironmongery.
h. Ice machines.
i. Knife-cleaning machines.
k. Letter-copying machines and presses.
l. Saddlers' ironmongery.
m. Hollow ware, cast and wrought, tinned, and enamelled.
n. Spades, shovels, pickaxes, hoes, rakes, garden-rollers, &c.
o. Nails: cut, cast, and wrought.
p. Screws and railway bolts, &c.
q. Iron safes, cash boxes, fire-proof and others.
r. Horse-shoes.
s. Gates, railings, hurdles, and stable fittings.
t. Mangles, washing-machines, &c.
u. Iron bedsteads, garden seats, &c.
v. Castings in iron.

4. *Steel Manufacture.*

a. Tools and heavy steel toys, hammers, vices, &c.
b. Steel ornaments, light fancy steel toys, brooches, buckles, &c.
c. Steel pens and metallic pens of other kinds.
d. Needles, fish-hooks and fishing tackle.

Besides these, there must be included also a number of objects fabricated of mixed materials, such as buttons—metallic, Florentine, pearl, bone, &c.,—and other productions coming under the usual denomination of hardware.

Considered in another aspect, the articles comprehended in Class XXII. may be divided into those intended to supply the necessary and absolute requirements of large industrial populations, and generally to minister to the conveniences of society; and those which, either partially or wholly, are created to meet the demands of taste and refinement among the wealthier classes of the community.

A large proportion of its contents, accordingly, consists of articles of mere utility and convenience, the merits of which were to be tested by such considerations as fitness for their professed purpose, and excellence of material and workmanship.

To these tests the Jury believe it would have been advantageous to have added a comparison of prices; but they found it necessary to abstain from introducing this element into the grounds of their decisions, partly on account of the difficulty of doing so, and partly in deference to the instructions furnished to them by the Council of Chairmen.

They must also add, that, after much deliberation, they felt themselves compelled to adopt a rule for determining the merits of inventions, and of improvements on existing contrivances, which, in many cases, they admit to have been inadequate. Numerous instances, of course, there were of contrivances in which the adaptation of the means to the end was so obvious, that no question could be made of it. Others there were in which the actual working of the invention was witnessed; but there was a third class, respecting which the decisions of the Jury, it was felt, must be *pro tanto*, conditional and contingent on the efficacy of the contrivance, unless—and this was considered to be impracticable—they were enabled to form an opinion after actual experiment.

This question was, in the first instance, raised in the case of lamps for oil or camphine, on the occasion of a consultation between this Jury and the Jury of Class XXIX.[*] on that point; and it was subsequently decided, in the first place, that there were practical reasons, which it is here unnecessary to state, against undertaking a course of experiments on the comparative advantages in point of economy and the illuminating power of the lamps in question; and, secondly, that supposing it to be otherwise (though indeed the same or similar obstacles existed in other cases), the Jury must, in fairness to exhibitors in all the sections of this Class, have resorted to experiment where any doubt arose, and thus have protracted their labours to an inordinate length.

Among the cases to which the Jury refer, they may advert more particularly to contrivances for preventing smoke, kitchen ranges, professing great economy in fuel and other advantages, apparatus for heating and cooking by gas, and such like.

In some instances, indeed, experiment would have rendered no assistance. In the manufacture of steel pens, for example, the improvements introduced by particular houses (beyond a certain point of excellence long since passed by all) are, for the most part, merely differences of form, on the advantages of which, adapted as they are to suit different characters of hand-writing, very few persons would be found to agree. With respect, however, to all the cases to which they refer, the Jury believe that, short of actual experiment, they have neglected no means by which they were likely to arrive at a sound conclusion. And besides, it must not be forgotten, that even in these and similar instances, the invention or contrivance is not the chief, nor always the sole element of merit on which they were called upon to pronounce a judgment.

Next in order to articles of mere utility and convenience, may be ranked those in which use is combined with a greater or less amount of ornament. These constitute the largest proportion of the objects in Class XXII.; besides which there is a third section, which consists of articles either solely or chiefly ornamental; including such works of fine art as are or may be employed for decorative purposes.

The whole number of exhibitors in this Class is upwards of 1,200, including those who, chiefly exhibiting in other Classes, have also sent articles which more or less come under the denomination of hardware. This number also includes exhibitors of certain objects, such as metallic combs for weaving, and mangles, which were ultimately referred to other Juries.

The proportions in which various countries have contributed examples of all kinds may be gathered from the following statement of the relative number of exhibitors:—

Two-thirds of the whole number of contributors belong to the United Kingdom; the other third are thus distributed:—

From France - - - - -	about one-fourth.
From States of Zollverein - -	rather above ditto.
From Austria - - - -	about one-eighth.
From Belgium - - - -	about one-sixteenth.
From Canada - - - -	ditto ditto.
From United States of America -	ditto ditto.

And the remainder from India, China, Denmark, Spain, Sweden and Norway, Russia, Switzerland, Jersey and Guernsey.

From the extreme difficulty of classifying so multifarious an assemblage of objects as are included in this department of the Exhibition, an approximation only can be made to the proportions in which British and Foreign exhibitors have contributed examples in specific branches of industry; but the following table will, perhaps, suffice to show how the case stands with the more noticeable kinds of manufacture:—

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[*] See Appendix (A.), page 510.

NUMBER OF EXHIBITORS, BRITISH and FOREIGN, of the principal objects in CLASS XXII.

Kind of Objects.	No. of Exhibitors.	
	British.	Foreign.
Anvils, vices, &c.	4	3
Baths of all kinds	16	1
Bedsteads, metallic	15	7
Bellows, acoustic tubes, &c.	7	3
Bells, church, house, &c.	8	11
Bird-cages	6	6
Brass-foundery (various)	16	6
Bronzes, bronze wares, and castings	9	63
Buttons (various kinds)	20	13
Chandeliers, metallic	9	6
Copying machines, presses, &c.	18	[illegible]
Enamelled and tin ware	4	4
Filters	4	1
Gas meters	12	–
Gas stoves for cooking, &c., and gas fittings	14	4
Grates, fenders, fire-irons, cooking apparatus, iron castings, &c.	84	25
Hardware (various)	54	26
Horse-shoes	10	1
Japanned ware	6	6
Jews'-harps	–	5
Kitchen ranges	14	–
Knife-cleaning machines	4	–
Lamps (various)	28	15
Letter-boxes	4	–
Locks	39	25
Monumental brasses and ecclesiastical brass-work	9	1
Nails (all sorts)	4	24
Needles and pins	8	4
Ovens	4	4
Percussion caps	2	4
Pewter articles	2	1
Powde-flasks	2	1
Safes, &c.	8	5
Screws	4	4
Steel and other metallic pens	11	1
Steel wares	12	14
Stoves	37	25
Tea-kettles and urns	9	1
Tubing (various), copper, tin, lead, &c.	6	1
Water-closets	10	1
Wire gauge, wire cloth, wire ropes, netting, &c.	21	10
Zinc castings and general manufactures	4	20

The foregoing table includes those cases only in which a comparison of the kind proposed may be instituted, or in which the articles exhibited are sufficient in number to merit notice as the basis of such a comparison; but in both the British and Foreign Departments there is, besides, a great variety of articles of a miscellaneous description, such as specific inventions or contrivances; curiosities exhibiting the processes of particular manufactures or the skill of artificers; and, especially in the Foreign Department, examples, which, though unimportant in themselves, are interesting as giving completeness to the picture, which, in conjunction with others, they afford us of the entire character of the industry of particular localities. And with respect to these last, the Jury desire to express their appreciation of the liberal spirit manifested by those among the exhibitors of them, whose sole motive must have been to render the display of their national and local manufactures as complete as possible.

On a general review of the contents of Class XXII., the Jury observe first, that although the contributions from the United Kingdom are twice as great as those from all other countries, and, with trifling exceptions, consist of examples in all branches of metallic manufactures, the character of the contributions seems to indicate that British hardware manufacture is, at present, chiefly pre-eminent for excellence of workmanship and material, contrivance, ingenuity, mechanical skill, and other qualities, which, *independently of taste*, give value to productions intended to supply the every-day wants and conveniences of life. There seems to be no doubt that in this class of manufactures, in which taste is either not a necessary element or applicable only to a very limited extent, the palm of superiority must be accorded to the United Kingdom. In particular instances there are, of course, exceptions to this rule; but, on the whole, with the advantages of cheap material, superior and powerful machinery, and a commercial demand of such extent as to insure, while it invigorates and directs, the efforts to supply, British hardware of the commoner sort stands unrivalled in its variety, its utility and excellence of workmanship, and in its adaptation to the wants and wishes of every class of purchasers.

In manufactures of a higher order, which involve the application of tasteful design and ornamentation, the merit of British productions, though very unequal, is, on the whole, less pre-eminent. Whatever amount of evidence there may be that the persons who furnish the designs are deficient in artistic education and intelligence, it seems to be almost beyond question that the inferiority of British hardware, in point of taste, is, in many instances, more immediately traceable to other causes. One of the chief of these the Jury conceive to be the artistic ignorance of workmen. There may be observed everywhere the fruits of a disposition among artificers to consider the due development of artistic design less important than a kind of mechanical high polish and finish, which are in all cases thought to be essential to excellence of workmanship. The Jury are by no means disposed to undervalue beauty of workmanship; on the contrary, they consider it essential to the perfection of manufacture; but it is quite clear that in proportion as tasteful design becomes an element in that perfection, mechanical execution must be subservient to its due expression and development. Unless this subserviency be strictly maintained, no amount of skill on the part of the designer can avail. Accurate modelling, for instance, of the features of a face or the toes of a foot, is thrown away, if the workman, prepossessed with his peculiar notions of finish, is to be at liberty to obliterate both features and toes before he can attain the degree of polish which he deems creditable and necessary.

In the cases to which the Jury refer, it is obvious that the deficiency arises from a want of proper understanding between the designer and the parties who execute the work. In an early stage of society,—as indeed must always, to a great extent, be the case in the highest kinds of art,—the artist and artificer, the designer and manufacturer, are the same individuals. This state of things, though on the whole highly favourable to the influence of taste on works of industry is incompatible with low prices, or (which is the same thing) with extensive production. In particular, the difficulty and tediousness of the manipulation of materials so unyielding as metallic substances, while they place a limit on production as it respects quantity, have a tendency to confine the character of the things produced to the two extremes of rudeness and elaboration. So long as the cheapness of an article was attained, not by increasing the mechanical facilities for its production, but by diminishing the amount of hand-labour bestowed upon it, metal-working, so far as the mass of the people was concerned, could never extend itself beyond the few indispensable requisites of every-day life, which, to be cheap enough, must be of the rudest description,—such, in fact, as we still see in the specimens of household and other utensils among the Oriental manufactures now exhibited. With respect to the wealthier classes, on the other hand, the inducements lay in the opposite direction: it was the interest of the artificer to enhance the value of his productions by elaborate and varied workmanship of an ornamental kind, for which alone he was likely to obtain adequate remuneration. Thus every single production, on which labour beyond a certain indispensable amount was bestowed, partook more or less of the character of a specific work of art, identified with the producer as an artist, and reproducible only by a reiteration of the original process by the same or equally competent hands.

It is not difficult to anticipate the effects which the substitution of machinery for hand labour must produce on this *aboriginal* character of industry. However great the improvement likely to arise, both with respect to quality and cheapness, in the fabrication of objects of utility, it was inevitable that, for a time at least, a deterioration should take place in ornamented manufactures. The old relation, or rather identity, between the artist and artificer must cease to exist under a system, in which the application of ornament depended no longer solely on the skill of individual artist-workmen, but on the capabilities of mechanism, or chiefly so. The influence of taste, accordingly, had to be exerted by new methods, which, from the necessities of the case, could only develop themselves slowly.

In the first place, the earliest efforts of machine labour are directed to the production of objects in their simplest and least ornate form. Imperfection of machinery, and the primary purpose of machine labour, viz., cheap and extensive production, both tend to impose this condition, and to impart to manufactures a mechanical and *unartistic* character. It is not only the interest of the manufacturer, but matter of necessity, in the first instance, to exclude whatever cannot be easily and cheaply executed; and thus, on the application of machinery to any new branch of industry, there occurs in almost every case an interval during which the services of the designer are reduced to their *minimum*, even if they are not, for the time, virtually dispensed with. But apart from this consideration, it is to be remarked, secondly, that the application of machinery brings with it new difficulties in the way of taste. On the one hand, the conceptions of the designer are not, as before, limited solely by his skill as a workman. The capabilities of each particular process of manufacture have now to be studied; and the adaptation of design to these, forms, of itself, an art of considerable difficulty and of slow acquirement, fettered as it is by questions of economy in execution, and embarrassed and impeded by continual improvements, or, at least, changes in the machinery or process employed. On the other hand, the *mise en fabrique* and the finishing processes, if they do not necessarily in most cases fall into the hands of persons *artistically* disqualified, do so, at least, in the first instance; and this obstacle to the due execution of ornamental work not only becomes inveterate by use, but has mistaken views of economy in favour of its perpetuation.

It is, at least, a fact, that while the application of ornament to many hardware manufactures has gradually become more extensive and of a higher order, the character of the individuals employed in the workshops, with respect to artistic intelligence, has not been proportionably elevated. They, for the most part, retain the ideas belonging to the primary, mechanical, and generally *unartistic* condition of manufactures. While our designers have advanced, those who execute or finish their designs have remained stationary; hence the appearance, of which the Jury have so frequently had occasion to notice instances, of a mechanical high polish, which has obliterated or spoiled the details of form or surface, evidently intended by the designer.

This is not, however, an evil peculiar to the hardware manufactures of this country. In France, in particular, some years ago, the artistic ignorance of the workmen employed in the chiselling and finishing of bronze and other metallic wares, was found to be so serious an obstacle to improvement, that it was considered necessary to establish a school for the express purpose of affording to artificers instruction in drawing and modelling, combined with the practice of chasing, chiselling, and finishing castings in metal. And it may be noticed, that the Trades' Schools of Prussia and Bavaria are expressly based on a recognition of the principle, that if the modern exigencies of manufacture require a separation between the designer and artificer, the influence of the former can in no other way be duly maintained, than by teaching to the artificer so much of the design as will enable him to appreciate the intentions of the designer; and to the designer, so much of manufacturing processes as will secure the practicability and fitness of his designs.

The Jury are, however, by no means inclined to take a discouraging view of the position of the ornamented hardware manufactures of the United Kingdom. There was no reason to expect, on general grounds, that an entirely new system of manufacture should be perfected otherwise than gradually, or be exempt from the characteristics of progress which have always marked the advancement of art and industry. All experience would have been belied, had the progress of England, the parent of this new system, been other than it has. Our industrial system has been gradually and entirely remodelled. Step by step as machinery, and the various reproductive facilities of modern times, made their encroachments on the old methods of hand labour, we were, in every case, as it were thrown back on the primitive condition of labour. That very want of skill and inexperience which, in early stages of society, oblige men to busy themselves solely or chiefly about the necessary, the useful, or the convenient, restrained the earlier efforts of machine labour, and gave it the same bias. And if we consider the vast commercial advantages reaped by this country from unornamented machine-made wares, and that the deterioration of the ornamented sorts was, and is now, to a large extent, commercially speaking, of no importance, because counterbalanced in the eyes of the majority of purchasers, by other qualities more easily appreciated, we shall be at no loss to account for the present general inferiority of British hardware, in point of taste, to that of some other countries. It is obviously an inferiority, not so much positive and permanent, as arising out of a particular stage of progress. Commercial interest has not yet, in this country, forced on manufacturers the consideration of questions of taste, to the same extent as has been the case elsewhere. It is only, indeed, within comparatively a few years, that the national success in the market has been generally even suspected to be endangered by want of taste.

If, then, the due adjustment of the *mechanical* and the *artistic* elements of perfection in manufacture is a problem yet to be solved in this country, it is because the point of progress has not yet been reached at which its solution becomes possible; if that solution has been postponed beyond what may appear a reasonable period, it is because the mechanical element, bringing with it new and unheard-of advantages, commercial and utilitarian, has been borne along on an overwhelming tide of success, and carried beyond its proper bounds, closing up for the time, or obstructing more or less the avenues to the influence of taste. If due means for securing that influence have not been used, or only partially so, it is because the commercial necessity for using them has been either not felt at all, or felt partially. But there is nothing unhealthy in this state of things; the utmost that can be said, is, that the manufactures of the United Kingdom, with respect to taste, are in a state of transition. The artistic element has begun to assert its claims; and if its working is for the present uncertain, irregular, vague, and unequal; if British manufactures exhibit for the present, at once the most successful and the most abortive attempts at ornamentation; if the means used to obtain designs are often erroneous and illegitimate, and the modes of working them inadequate, it is the consequence of a state of transition resulting from the introduction of a new, and in some respects, antagonistic element, which has not yet secured its position.

These observations will, in part, have anticipated some of the remarks which, in the second place, the Jury have to make on the general aspect of the objects contributed to Class XXII., by the more eminent continental nations. It must be noticed, however, in addition, that as the industry of the United Kingdom owes its existence to private enterprise, so its course has been determined solely by commercial demand, and the current of ingenuity. Fiscal regulations may have impeded its extension in certain directions; but its condition is, to no appreciable extent, traceable to the direct fostering care, or to the controlling influence of the Government. It has taken its own course. It is a vigorous and independent manufacturing system arising out of the substitution of machinery for hand labour, wherever it was practicable; a system which, not only impelled by necessity, but induced by interest, developed itself solely or chiefly in the first instance in the direction of the indispensable, the useful, and the convenient; and which, by a natural progression, is tending towards the ornamental; and is now, in fact, exhibiting signs of the fermentation consequent on the insertion of the new leaven of taste and refinement. Whatever its progress in particular cases, it has followed this course on the whole; and in this respect it presents a contrast to the industry of some of the more powerful nations of the continent of Europe. That of France, in particular, may be said to have proceeded by an opposite course. It started with an artistic system of manufacture, patronized and supported by Government influence and resources; and its progress has, for the most part, been downwards from the supply of the artificial demands of luxury and refinement, to the necessary demands of utility and comfort. There can be no question whatever about the pre-eminent excellence of the national ornamented manufactures of France; but there is as little doubt that, commercially considered, this pre-eminence is to a great extent artificially maintained. It is not so much the result of a healthy, independent, self-relying, and self-supporting system of manufacture, of which machinery is the basis, and which owes its existence to private enterprise and capital, and its direction to commercial demand, as of a patronage and an expenditure, which disregard both cost and immediate profit.

The Jury, however, must not be considered to offer any opinion here on the question whether it be advisable in any case, that a Government should apply its influence and resources to the promotion of certain branches of industry, or to speak more strictly, should monopolise those branches:—they are desirous merely of directing attention to the fact that this is done in France, and some other continental countries (as, for example, in Prussia); because they believe that a strong characteristic of French industry is traceable to this source. It is to a great extent artistic, rather than workmanlike. The artistic element hinders the development of the mechanical; precisely the reverse of the case in the United Kingdom, in which the mechanical overwhelms or overspreads the artistic. In the former, artistic skill is the starting point; in the latter, mechanical. In the one, artistic skill is indigenous: mechanical, for the most part exotic; in the other, the reverse is generally true.

There are, of course, exceptions, some of them remarkable in both countries; but in general it will be found that in France there is a tendency to emulate the national manufactures, and to confine production to the supply of expensive luxuries, which is injurious to the development of useful industry; while in the United Kingdom the utilitarian principle has tended to hinder the development of taste. The exceptions are, however, hopeful on both sides; and if it cannot be said that as yet either has solved the problem how the *artistic* and the *mechanical* elements of industrial perfection are to be duly adjusted, a great step has been gained towards its solution by the opportunities of comparison afforded by the Exhibition of 1851, which, in that respect, the Jury are confident must prove beneficial to the general interests of industry and manufacture.

In the foregoing remarks on ornamented manufactures, reference has been chiefly made to those of France and of the United Kingdom, because the Jury conceived that, so far as the points under consideration were concerned, these two might be safely assumed as representatives of opposite systems, which are more or less followed, in either direction, by other countries. More obvious extremes might, perhaps, have been found in the United States of America, on the one side, and some oriental nations on the other; the former following almost exclusively the utilitarian and mechanical system —the latter, the artistic; but the examples adduced will admit of a sufficiently extended application.

It must now, however, be noticed that, in the view taken by the Jury of the contents of Class XXII., they have gone no further than the actual character of the objects brought before them. They have taken them as they found them; and, placing them all, for the time, on an equal footing, have estimated their merits by simple comparison. It was obvious, indeed, that the mere *actualities* of the Exhibition must, in the main, be the sole objects of their criticism: the actual merit of a work, independently of the circumstances under which it was produced, must be the ground of their award. No other course was open to them but this. Wherever merit appeared must be recognized for its own sake: when a comparison was instituted between the similar productions of different countries, the basis of such comparison must be confined within the walls of the Exhibition.

It is proper, therefore, to advert to some consequences resulting from this necessity imposed on the Jury.

In the first place, single specimens of a manufacture have come before them, of the highest merit in themselves, which, however, are unaccompanied by any evidence either that the high excellence they display is not exceptional, or that a profitable industry, of the kind to which they belong, has any existence in the country whence they are sent. Yet these single examples, perhaps the unusual fruit of individual skill, are brought into comparison and competition with works of the same sort produced in other countries in the ordinary course of commercial enterprise.

To take another case: contributions, which, though few in number, are yet sufficient to evince the existence of a branch of industry, come from countries where they can be produced only at a cost which places them beyond the reach of moderate fortunes. In such a case it is quite clear that the amount of hand labour bestowed on ornamentation and finish becomes a secondary consideration; yet these must be compared, in point of actual merit, with manufactures of the same kind produced under a rigid economy of material and labour, and intended for ordinary purchasers.

Or again: specimens of manufacture are contributed by Government establishments, in which the cost of production, and, at least, immediate profits are disregarded, which nevertheless enter into competition with the efforts of a self-supporting industry in other countries.

Cases such as these make it evident that an actual superiority in the specimens exhibited cannot be assumed as the index of an industrial and commercial superiority, unless it can be shown that those specimens have been produced under the ordinary conditions of commercial enterprise. No one doubts that a branch of ornamented manufacture may be carried to the highest perfection, both mechanical and artistic, in any country, provided due means are used for that purpose, with little or no regard to outlay and profit. It is almost a matter of course that manufactures so protected, should be superior to those which are carried on under all the difficulties and embarrassing obstacles that beset remunerative industry. The wonder is rather that the produce of the latter, having no allowance made for the disadvantages it labours under, should be able to bear so well a comparison in point of actual results.

The Jury, then, while they have willingly rewarded merit wherever it has appeared, have at the same time regarded that merit with greater satisfaction when it was found in the productions of a self-supporting and remunerative industry. They confess that they have looked with greater interest among the contributions from abroad for evidences of a healthy, useful, widely-extended, and self-supporting industry, than for remarkable proofs of skill in particular manufactures. On this point they wish that it had been in their power to have entered at some length; but so many questions are involved in the consideration of it which are foreign to the purpose of this Report, that they must content themselves with a very general statement of some observations they have made.

In Egypt, Persia, Turkey, Tunis, and India, metallurgy and a certain knowledge of alloys date from remote periods; but, as has been already noticed, productions in metal analogous to European hardware of the commoner sorts are of the rudest description, though excellent in material and generally graceful in form. For the most part there is no step between the manufacture of the rudest contrivances, and that of articles of the most costly and splendid character. The objects wrought in metal are either on the one hand as cheap as the material and the smallest possible amount of labour permit them to be, or on the other, as costly as elaboration can render them. It is to be regretted that the contributions from China are too incomplete to give an adequate idea of the hardware manufactures of that remarkable country. They certainly take a considerable range; and, considering the ingenuity, the inventive genius, and the peculiar domestic habits of the people, may with some reason be supposed to make a considerable approximation to the more or less utilitarian character of European manufacture.

In Greece and Italy the same stagnant traditional industry in metals seems to prevail. From the former nothing, and from the latter nothing of any note, is contributed to Class XXII. It is to be regretted indeed, that specimens of the rude, though in some respects, beautiful metallic manufactures of Italy, in use among the common people, such as lamps, braziers, brass, copper, and tinned-copper vessels, have not been sent. There is nothing, however, in their place to indicate the existence of a more advanced condition of this branch of industry. With Italy, Spain may be classed; a country so rich in metallic ores that the very backward state of its manufactures in metal may well excite surprise. The few contributions from Spain, however, give evidence of both the desire and the power to improve that kind of industry; and possibly, when means of easy and rapid transit are obtained, the natural advantages of the country may be turned to better account, and this species of industry rise to importance.

Austria, the States of the Zollverein, and Belgium afford ample proofs of activity. The first-named country, in particular, exhibits remarkable productive vigour, and her manufactures take a range which shows how firmly and deeply industrial and commercial tendencies have taken root. Iron manufactures appear to be in a most flourishing condition, to which the superior quality of Austrian iron, notwithstanding its costliness for ordinary purposes, no doubt contributes. Considerable surprise, indeed, has been created by the extent and the quality of production in the branches of industry employing iron, such as nail-making, the manufacture of scythes, pickaxes, hatchets, axes, saws, and other cutting instruments; shovels, hoes, and tools of various sorts.

One branch of hardware industry, viz., the manufacture of Jews'-harps, is represented solely by Austria; and, judging from the number of exhibitors, must form a trade of considerable extent.

The iron wire, wire ropes, wrought-iron tubes, and lead drawn pipes, enamelled iron ware, and wrought and cast iron generally, are particularly deserving of notice.

The contributions from the States of the Zollverein are also such as to indicate an active state of commercial enterprise in certain directions. They consist chiefly of cheap hardware, including toys and various articles made of japanned tin, lead, pewter, and other materials, common cutlery and ironmongery, buttons, &c., the cheapness of which, notwithstanding the generally high price of the raw materials, enables them successfully to maintain their place in neutral markets. Some excellent specimens of brass and iron wire, manufactured in various ways, also appear among the contributions from the States of the Zollverein.

Belgium, though not contributing largely to Class XXII., is distinguished, as will be noticed hereafter, for the great extent and excellence of her manufacture of nails, and the application of zinc to a variety of useful and decorative purposes. The latter is due principally to the efforts of the Société des Mines et Fondéries de Zinc de la Vieille Montagne, of Liége, which raises and manufactures the metal, and exports it to a large extent. The ores of Belgium and Silesia are abundant and easily worked; and the many uses to which the metal, its ores, alloys, and oxides may be applied, have created for it of late years a rapid and extensive consumption. In close proximity to Belgium, at Stolberg, in Rhenish Prussia, a district rich in blende and lead ore, there are the newly-opened, and at present actively-worked mines and manufactures of spelter; and also at Verviers, the Société de la Nouvelle Montagne and other Companies have been formed to meet the rising demand for this useful metal and its manufactures.

In the Department of the United States of America the Jury find but few objects belonging to their Class; those few, however, display energy, ingenuity, and the most perfect adaptation of the means to the end. They are mostly manufactures in iron, such as locks, cut nails, stoves, cooking apparatus, and other objects for ordinary use.

The Jury will now proceed to make such observations as they deem the purpose of their Report to require on certain branches of industry. For a detailed account of the contents of Class XXII. they must refer to the Descriptive and Illustrated Catalogue, already published; and it will be of course understood that the omission of any notice of specific manufactures by no means implies that those manufactures have been overlooked, but merely that the condition of them is satisfactory, or such as to call for no particular observation. In the list of the awards of the Prize Medal it has also been thought advisable to omit merely commendatory notices. The fact that a Medal has been awarded must be assumed as the highest commendation of the Jury; who have therefore contented themselves with a simple statement of the merit specially recognized in the award.

1. Brass, Copper, Zinc, and Tin Manufactures.

The brass-work of the United Kingdom is particularly distinguished for that beauty of workmanship which is generally characteristic of British wares. Excellence of material, solidity, brilliancy of polish, and flatness and equality of the "dead" or "frosted" portions, admirable fitting of the joints, and a certain appearance of thorough genuineness, are qualities pervading all the productions in this material exhibited by the manufacturers of Great Britain. These qualities appear to great advantage in certain branches of industry which admit of a moderate amount of ornamentation, in the shape of mouldings, twisted columns or tubes, corner-pieces, perforated plates, and the like, which machinery can readily execute. In such cases, in addition to very perfect workmanship, there frequently appears considerable evidence of a feeling for harmony, and for a just proportion and arrangement of parts. Eminent examples of work of this character occur in the collection of brass-work (chiefly bedsteads), exhibited by **Winfield** (373, pp. 639, 640), of Birmingham; and in the Mediæval Court, among the ecclesiastical brass furniture and utensils contributed by Messrs. **Hardman** (700, p. 668), also of Birmingham, which are remarkable besides for the perfect intelligence with which the ornamentation (entirely Gothic) is designed and executed.

Brass-work of a character solely or chiefly ornamental can scarcely, however, be considered to be on the whole in a very advanced condition. There are numerous examples of excellence in nearly all branches of industry employing this material; but there is, perhaps, scarcely any collection which displays throughout, whatever may be the amount of ornamentation, a uniform good taste and intelligence in design. It has been said that the vulgar taste in which certain articles are designed and executed finds admirers for whose predilections it is the interest of the manufacturer to provide; but the Jury believe that, even admitting the existence of a vicious taste among consumers, and giving due weight to the motives of self-interest, which of necessity actuate producers, that policy is very shortsighted, which, for the sake of a partial present advantage, sacrifices the general success of a branch of industry. They consider it very doubtful, besides, whether those who act on this view, do not in reality underrate the tastes of those for whom they profess to provide. Instances illustrative of these observations will be found among the innumerable applications of brass-work to which the use of gas has given rise; such as fittings, brackets, pedestal burners, chandeliers, table-lamps, &c., both for domestic use, for shops, and for public buildings, all of which are of excellent and substantial workmanship, but many marked by a vicious taste and the absence of artistic knowledge. Articles such as these being in common use, and constantly before the eyes, have a considerable influence on public taste, which it is accordingly in thepower of manufacturers to guide to a larger extent than they seem willing to suppose.

These remarks scarcely apply to English brass-work struck from dies. The cornices, curtain-pins and bands, finger-plates, &c., prepared in this manner are intended for purchasers chiefly belonging to the cultivated classes; yet the specimens exhibited are almost uniformly better in execution than design. This is the more to be regretted, because the merit of work of this kind, supposing no defect in the metal, due precision in the impression, and a proper colour in the lacquer, depends entirely on the excellence and propriety of the design. A good design, in fact, can be as easily and cheaply executed as an inferior one; and although the Exhibition furnishes a few creditable specimens, this branch of manufacture will no doubt advance as knowledge of art and good taste are cultivated. It is necessary, however, to observe, that the specimens on the French side are not on the whole superior to those of British manufacture; and possibly, sufficient attention has not yet been paid either in this country or abroad to the character of design, and the peculiar artistic effects which are compatible with the process of execution.

Bells and gongs coming to a certain extent under the description of Musical Instruments, the Jury considered it advisable to request the assistance of the Sub-Jury A. of Class X., who obligingly communicated to them a Report on the merits of the various bells exhibited. This Report will be found in the Appendix (B).

The ornamental brass-work of French manufacture, which, besides being the largest contribution from any foreign country, enters most successfully into competition with home manufacturers of the same kind, is generally remarkable for skilful and varied artistic treatment. It differs from the British rather in the uniform intelligence with which the ornamentation, whether little or much, is designed and executed, than in the absolute superiority of individual examples. The ornamentation is of every kind: ranging from profuse and heavy scroll-work to decoration in low relief; but there may be remarked, in particular, a taste for a peculiar treatment which produces a richly-studded or jewelled effect, with sharp, clear, and decisive shadows, approaching to the character of the work termed Elizabethan. The introduction of colour by means of jewels in paste, by enamelling, or by a difference of metal, is more frequently taken advantage of by French than by British manufacturers. By these aids, and the enrichment of surfaces by ornaments of a similar character, a picturesque and frequently brilliant effect is imparted. In careful finish, however, much is to be desired; the joints and fittings of separate portions being often so clumsy and unworkmanlike as to create dissatisfaction on a near examination. This deficiency may be exemplified by a comparison of the ecclesiastical brass-work exhibited by Poussielgue-Rusand (France, 1405, p. 1243), with articles of a similar character in the collection furnished by Messrs. Hardman, of Birmingham (532, p. 701), in the Mediæval Court. In this instance, besides, the French productions display far less intelligence in design than the English; the former being imbued to a considerable extent with the peculiar character proverbially, though now improperly assigned to Birmingham work; while the latter is entirely devoid of it.

French bronzes and small ornaments of mixed materials, *pendules*, dishes and vases for flowers, &c., are exhibited in great profusion, and on the whole merit high commendation. The spirit, fancy, and invention they display are unbounded. Here again the remark is applicable, that single examples on the British side, for instance, from the collections of J. A. Hatfield (135, p. 829), of Potts, of Messenger (323, pp. 630, 631), and of The Coalbrook Dale Company (641, pp. 660, 661), may be placed side by side with many of the French specimens with no disadvantage to the former; but that on the whole the French manufactures of this kind deserve the pre-eminence. It may be doubted, however, whether, in point of purity of taste, this praise which the Jury willingly accord does not require some qualification. They find in the bronzes of Prussian, German, and Italian manufacture, a purity of form and a uniform carefulness of design and finish, which they consider well worthy of observation; and which, on a comparison with French works of the same kind, give them an advantage over the latter in these respects. The questionable taste, in particular, in which many French *pendules* are designed, is scarcely compensated for by the obvious dexterity of the modelling and chasing.

The examples of zinc manufactures, castings, and galvano-plastic productions are more numerous from France, Belgium, and the States of the Zollverein, than from Britain. In this country the use of this metal has hitherto been chiefly confined to the manufacture of household utensils and conveniences, such as baths and vessels for culinary and other purposes, for alloys, galvanizing, and coating other metals, and as a substitute for lead in the roofing of houses, &c. On the Continent, in addition to the application of zinc to purposes of utility (which is carried on to the same, perhaps to a larger extent), the metal has also within the last few years been pretty extensively employed as a substitute for bronze in casting statues and other objects of art both on a large and small scale. For this purpose it appears to offer considerable advantages; though it may be doubted whether experience of its use is as yet sufficient to warrant a very decided judgment. The effect, however, of these castings, whether with a surface of zinc or with another metallic coating, is in general good; and at all events, the cheapness and comparative lightness of the metal seem to be in its favour as a means of forming cheap duplicates of objects of high art existing in the more costly materials of bronze or marble. The specimens exhibited by Geiss (1 Zollv., 267, pp. 1063, 1064), and Devaranne and Son, of Berlin (1 Zollv., 280, p. 1065), by Madame De Braux D'Anglure (France, 779, p. 1218), and by the Belgian Société de la Vieille Montagne (Belgium, 26, p. 1152), are the most noticeable. The latter, in particular, have most fully and successfully exemplified the various uses to which zinc may be applied; and the specimens exhibited are calculated to afford useful hints to the manufacturers of the United Kingdom. The use of zinc for preventing the oxidation of iron, its aptness for perforation, and its general application to domestic purposes, are already recognised in this country: but it is obvious that on many accounts it may be advantageously employed to a larger extent, especially in cases where the unyielding character of iron, and the high cost of copper, present obstacles to their use. The Jury believe that zinc has been scarcely, if at all, resorted to in this country for statuary and the casting of small groups of figures and ornaments.

In copper, zinc, and general braziery, the exhibitors are on the whole not numerous. On the French side Messrs. Estivant Brothers (1214, p. 1235) afford examples of brass caldrons of extraordinary excellence of workmanship; and from Belgium a nest of brass pans are sent in an unfinished state, which, however, favourably indicate the condition of that kind of industry. The coffee and tea-urns and kettles of this country present no striking improvement in form or in other respects: and the copper culinary utensils, although well executed, appear to be giving way to vessels of iron, which, owing to its cheapness and the recent improvements which have been made in tinning and enamelling, is likely to supersede the use of copper for these purposes: the objections formerly made to it on account of its weight and the risk of fracture, having been removed by the substitution of sheet for cast iron.

2. Iron and Steel Manufactures, Ironmongery, &c.

The iron manufacture of the United Kingdom may justly claim a very high place. The advantages afforded by a material so cheap and abundant are indicated by the vast extent and variety of its uses; and it may be safely affirmed that no branch of industry, employing iron, need ever languish on account of any scarcity, dearness, or uncertainty in the supply of this important metal.

The whole collection of steel and iron grates, fenders, and fire-places, kitchen ranges, stoves and apparatus for warming and ventilation, is considered by the Jury to constitute a most interesting, and on the whole, a highly-creditable and satisfactory exhibition of the state of those branches of industry in the United Kingdom. In that portion of it which includes tasteful design as an element of merit, the Jury regret to find instances in which a deficiency in that respect is but too apparent; but, on the whole, they are disposed to consider the manufacture of ornamental drawing-room and other grates and fenders, and decorated stoves, to be in a most promising condition in respect to taste. The grates of Messrs. **Hoole, Robson,** and **Hoole,** of Sheffield (140, p. 609), executed from designs by Mr. **Alfred Stevens** (140, p. 609), and those exhibited by Messrs. **Stuart** and **Smith,** of the same place (102, p. 603), may be adduced as evidence of remarkable advancement in tasteful design. The former display great beauty and artistic intelligence, while the latter, in some instances less eminent in those respects, are remarkable for general brilliancy of effect, great precision and excellence of workmanship, and certain novel applications of ornament. The Jury wish to notice, with special approbation, those portions in the grates of Messrs. Hoole, Robson, and Hoole, in which the castings remain in the state in which they leave the mould.

The progress of this manufacture in all respects is the more remarkable, considering the absence of foreign competition, and the comparatively short time that has elapsed since it began to assume its present highly-decorative character. It is only since the end of the last, or the beginning of the present century, that this branch of industry was introduced into Sheffield. Previously to that time it had been carried on in London and Edinburgh; and grates or fenders of an ornamental description still continued to be manufactured in those places for the first twenty years of the present century: about the end of which period, manufacturers began to establish themselves in various parts of the country. These, by employing greater artistic talent, became successful competitors with the London houses, whose trade from that time continued to decline, and Sheffield became the principal seat of manufacture for the better and more ornate sort of stove-grates and fenders. Of this sort some few still continue to be manufactured in London; but the London market is now, for the most part, supplied by the works in the town of Sheffield.

The trade in the commoner description of grates is more extensive, and is principally carried on by the Carron Company and other foundries in Scotland, by the Coalbrook Dale Company, and foundries in Northampton, Dudley, Rotherham, Birmingham, Mansfield, Nottingham, and Derby.

The Jury think it deserving of notice with respect to this branch of industry, that in all the communications which have been made to them by the persons engaged in it, they find observations commendatory of the School of Design in Sheffield, and expressive of the high sense they entertain of the services it has rendered to ornamental art, and in particular, to the manufactures of that place.

The articles of this description exhibited by continental manufacturers are few in number, being chiefly stoves; amongst which the grate contributed by **André** (France, 1053, p. 1229), and calorifères in brass and cast iron, by **Laury** (France, 563, p. 1205), are the most deserving of notice.

From the United Kingdom, examples of the ordinary kitchen range are numerous, and uniformly characterized by a sound and substantial workmanship. On the actual working merits of the various contrivances and arrangements displayed by them, the Jury do not feel themselves qualified to form a very decided opinion. They would, however, observe generally, that in many cases the massiveness, extent, and heavy character of the iron-work appear to be carried to excess, and a wider space sometimes assigned for fuel than is necessary, or consistent with economy. It is, doubtless, very desirable to give such a degree of strength to a kitchen range as shall insure it in all its parts against injury from fracture, which is in most cases difficult to repair; and, hence, economy of material is not to be regarded as a primary consideration; but the difference between the large extent and massiveness of some ranges, and smallness and chest-like appearance of others is so extreme, while the professed and possibly the real capabilities are about equal, that it is evident we have not yet arrived at very distinct conclusions respecting the exact adaptation of the means to the end in this branch of industry. Much of the variety in size, and as a consequence of this, in arrangement, is no doubt due to the necessity of providing for the different sizes of kitchens and fire-places; a necessity which must, on the whole, tend also to maintain high prices. It must be admitted, besides, that obstacles to improvement and the speedy adoption and testing of new contrivances arise out of the arrangements current in England between landlord and tenant. A kitchen range comes under the description of what are termed "landlord's fixtures," and in many, perhaps the majority of cases, has been selected more on the ground of economy in the first outlay, than with any view to the excellence of the contrivance or the permanent comfort and convenience of the occupant, who, though dissatisfied, finds it difficult on several accounts to disturb the agreement he has come under.

In Scotland, grates are the property of the occupant, but it is doubtful whether this circumstance contributes on the whole, to improvement. A large majority of tenants are more able to pay annually a small addition to their rent as interest for the outlay of the landlord on grates, than to incur that outlay themselves; and hence with such persons, economy outweighs all other considerations.

Taking all the circumstances into account, the Jury think that the attention of our kitchen-range manufacturers might be advantageously directed to the production of one which, compact, moderate in size, economical in fuel, and answering all the ends of convenience that must be provided for in the majority of cases, might be sold at a low price. They are unwilling, as has been remarked, to offer any decided opinion on the comparative merits of the ranges submitted to them, more especially as those merits are so generally uniform; but if they were to make a difference, they would say that the kitchen range of **J. Flavel,** of Leamington, Warwickshire (38, p. 596), for appearance of workmanship, economy of fuel, and its combination of the stove and open fire seems deserving of special notice. The cooking stove of **Evans** and **Son** (103, p. 603) exhibits a somewhat novel, but not unsuccessful attempt to apply to that kind of manufacture a moderate amount of appropriate ornamentation.

The Jury observe with regret that there is no cooking stove or apparatus of first-rate manufacture or extent exhibited among the productions of the Continent. Foreign hotels and large establishments must be furnished with such; and it certainly would have been both interesting and instructive to our manufacturers, to have been able to examine the contrivances by which cooking on a large scale is conducted in countries remarkable for their culinary skill.

The contrivances recently invented for cooking and heating by gas, of which a considerable number are exhibited on the British side, appear to be well made and constructed; but the Jury are unable to pronounce any united opinion on their efficiency. The chief advantage professed by them is economy; and there seems to be no reason to doubt the justness of their claim to that advantage, if other more necessary conditions are complied with; but it would appear that as yet, more unquestionable success has attended the application of gas to warming apartments, than to cooking, or heating water for baths. It would, however, be unreasonable to expect the entirely successful application of a new *calorific* power, with an experience so limited as we now possess of the conditions under which it may be rendered available; and the Jury accordingly refer to these contrivances less for their present completeness and efficiency than for their probable future importance, which, some of its members believe, can hardly be over-estimated.

Casting in iron forms a large and important branch of industry wherever the advantages of iron and fuel are possessed to an adequate extent. Owing to the variety of coal-fields, abundance of the mineral, and improved modes of smelting, England is distinguished above other nations for the exuberance and cheapness of her supply of iron, and for the extent to which it is employed in casting. If, however, the quality of articles produced by casting be considered, the contributions from France, Belgium, Prussia, and Austria, will show that she has powerful rivals to contend with in that respect. The iron castings from these countries display a sharpness, cleanness, and closeness of texture, and a good taste and intelligence in design, which afford much reason to doubt whether any pre-eminence can be accorded to this country, except so far as mere quantity is concerned. It is, of course, not to be forgotten, that the comparison can only be made within certain limits. The iron castings of this country, if they do not actually take a wider range than the continental, do so in the Exhibition; but still if the comparison be confined to objects of a similar character, the Jury believe that the palm of superiority must be assigned to the continental specimens, which on the whole are distinguished more highly for skilful casting and intelligent and appropriate design. Among the most eminent in these respects they rank the cast-iron bedstead of J. P. V. ANDRÉ (France, 1053, p. 1229), which is exhibited in the state in which it comes from the mould, as a pure casting to which the file has not been subsequently applied. The founder, in this instance, has succeeded, either by attention to the quality of the sand, or to the temperature of the metal, in producing impressions of the most beautiful distinctness. Some of the castings of MOREL (France, 1666, p. 1256) have also much elegance and lightness. It may be added that the railings, and generally the iron castings exhibited on the French side, are light and graceful in appearance; and the Jury believe it extremely probable, that if the iron founders of France, with their facilities for obtaining tasteful designs, enjoyed the advantage of a larger supply of cheap material—either by improvements on their mode of smelting, or by the removal of impolitic restrictions on the importation of foreign iron—they might, besides greatly increasing the demand at home, become successful exporters to this country, where ornamental castings of really excellent design and low price are by no means largely supplied.

THE ROYAL PRUSSIAN IRON FOUNDRY (1 Zollv., 271, p. 1064) also exhibits specimens of iron casting of a very high order. The minute and delicate castings, consisting of trinkets, small chimney ornaments, and figures, executed at Berlin by private enterprise, are already favourably known in this country. They are, it is said, the produce of small furnaces, from which, by great care in the choice of iron and other precautions, the founders are enabled to obtain the metal in a degree of fluidity necessary to fill the minute and sometimes intricate moulds employed. The more important works contributed by the Royal Prussian Iron Foundry sustain the reputation of Berlin iron casting. In particular, the Jury notice with approbation two cast-iron pedestals with figures and scrolls in high relief, surmounted by equestrian statuettes, works which they consider most spirited and beautifully cast.

A bust of the king of Spain, cast at the ROYAL ORDNANCE of TRUBIA, may also be noticed on account of the delicacy and precision of the impression (Spain, 280, p. 1347); and for the same reason, busts of the king and late queen of the Belgians, by the firm of VAN DER BRANDEN and Co., of Brussels (Belgium, 363, p. 1162).

The iron casting of the United Kingdom, though already, as has been observed, of great extent, might doubtless be more largely employed for purposes both of use and ornament. It is probable that the expense of new moulds, the difficulty of obtaining appropriate designs, and a prejudice existing against iron on account of its liability to fracture and oxidation (though the latter fault may possibly be obviated), present in many cases obstacles to its more extensive use in construction and decoration. That it is susceptible, in casting, of the most perfect and sharp impressions, is clearly evinced by the examples already noticed; and the successful rendering of Mr. J. BELL's statue of "The Eagle Slayer," by the COALBROOK DALE COMPANY (641, p. 659), shows that the cost of many public monuments might be reduced by bringing into use, as a substitute for bronze, a material cheaper than zinc, and more easily procured in this country. On the whole, and considering the comparative merits of British and foreign iron casting with respect both to execution and design, the inferiority of the former may be said, as in other cases, to be general, and on an *average* rather than special. There are examples from the United Kingdom which, in all respects, may challenge comparison with the productions of any country; but the average merit of British iron castings of an ornamental kind is lower than that of France or Prussia; and it will probably be found that the pre-eminence of those countries is due rather to the employment of better artists for the preparation of designs, and artisans more intelligent in design, than to any superiority in the mere process of casting. In other respects, some of the continental nations labour under disadvantages which do not affect the United Kingdom; and if our iron castings are in any respect inferior, the blame rests with our founders, who neglect to avail themselves of all the means necessary to the perfection of their art.

In the manufacture of locks, Wolverhampton still sustains its ancient reputation. Excellence of workmanship, lowness of price, and an adequate degree of security, characterise the contributions from that place, and prove the advantage of the peculiar division of labour which is adopted in the manufacture. The specimens of locks throughout the Exhibition generally evince that the art is in a very advanced state, both here and on the Continent; but still it is impossible for the Jury to ignore the fact, that the present condition of lock-making is traceable to English ingenuity and invention; and they believe that on the whole the collection of locks on the British side deserves the place of pre-eminence. The lock on the very well-made safe of SOMMERMEYER, of Magdebourg (1 Zollv., 802, p. 1094), may be noticed honourably; and the bank lock of Messrs. DAY and NEWELL, of New York (United States, 298, p. 1453), is remarkable for ingenuity of principle, and for combinations and arrangements which seem to render it impregnable. Locks of this description, if they could be sold at a moderate price, and made available for ordinary purposes, would no doubt be favourably received, and remunerate the inventor. It is, however, a serious objection to any lock, notwithstanding its ingenuity and security, that the key should be so ponderous and bulky as to require for itself a separate place of deposit and safe keeping. The smallness of the key in proportion to the size and strength of the lock is particularly remarkable in the locks of Messrs. BRAMAH (653, p. 664) and of Messrs. CHUBB (646, pp. 663, 664), besides those merits in other respects, which public opinion has so long and so amply recognised.

On the comparative security afforded by the various locks which have come before the Jury, they are not prepared to offer an opinion. They would merely express a doubt whether the circumstance that a lock has been picked under conditions which ordinarily could scarcely ever, if at all, be obtained, can be assumed as a test of its insecurity.

In connection with locks, the Jury may refer to iron safes and treasure-chests, of which a large number is exhibited, and which for the most part are of about equal merit, so far as the chances of security offered by them are concerned. It seems doubtful whether much of the ornamentation and expensive polished work which some of them display, might not be dispensed with. Any addition of that description to the expense, necessarily considerable, of a safe or treasure-box seems quite gratuitous, more especially since it has become usual, and is considered most secure, in large banking and other establishments, to preserve safes in fire-proof rooms or vaults, into which they are lowered at the close of business.

The locks and general ironmongery of France are inferior in many respects to the productions of the same kind from other continental nations. There appears to be a desire to extend manufactures in metal, but it is rendered powerless by the restrictions imposed on the importation of the raw material into France. It is impossible, under present circumstances, for the manufacturer to reduce the price of his productions to such an extent as to afford him adequate remuneration. Since 1844, the manufacture of iron-tin plates and steel has been more than doubled in the United Kingdom. This, on the one hand, has reduced the price of the raw material, and, on the other, has stimulated those engaged in working it up to supply their goods at a cheaper rate, and to find new markets. This branch of industry, accordingly, with us presents a healthy and growing appearance which contrasts strongly with the stunted condition which seems to characterise the corresponding manufactures of France. On the stall of JAPY BROTHERS (France, 275, p. 1190) the Jury find several articles of tin-ware manufactured from the most expensive charcoal iron, in a mode that so far economises labour, as to overcome the formidable expense of the material:—machinery enabling them to sell a saucepan for 6*d.* which is made from charcoal iron at 30*l.* per ton. But in other cases, they are obliged to use the same costly iron without the facilities afforded by machinery, and the consequence is, that prices are too high to insure a large consumption, and industry stagnates.

The enamelled ware of Paris and the coating of tin by the new process of BOUCHER (France, 776, p. 1217) both appear to be deserving of notice. The process by which the former is produced has been employed in this country by the Birmingham Patent Lap-welded Tube Company, who find it extremely valuable as a preservative of their tubes from the action of water in locomotive boilers; iron tubes being variously affected by the different qualities of the water used. The process is also largely employed in Austria and the Zollverein States.

The ironmongery trade of Germany and the States of the Zollverein exhibits far greater activity. The contributions from Iserlohn, Hagen, Barmen, and other places in Westphalia, indicate the existence of a large and profitable industry; and the difference between the price of steel and iron goods in these countries and Birmingham is not so great as to affect its growth and strength. To all parts of the world, and even largely to England, common articles for *sale* rather than *use* are exported, and are vended by hawkers and pedlars through this country. The higher cost of the raw material in Westphalia is compensated for by the cheapness of labour, and the manufacture being an ancient, not a modern one—Westphalia having for centuries been celebrated for ironmongery and tin goods—the common wares sent to this country are sold at very low prices. On weighty articles of iron, however, such as anvils, vices, and heavy tools, the difference of price between Sheffield or Birmingham and Hagen, is about the amount per cwt. of the duty on iron; and such articles as these are accordingly precluded from competition with the British of the same description in foreign markets.

A new use of sheet-iron, prepared by a coating which imparts to it a surface that takes freely the mark of a slate-pencil, is exhibited, from Wurtemburg. It is much lighter and much less liable to injury than common slate, and appears to be a clever adaptation of iron to an everyday purpose. Along with this may be noticed a singular illustration of the pliability of sheet-iron exhibited by T. L. PALMER (France, 942, p. 1225). It is a quart bottle very perfect and without seam, such as might be employed with advantage for the conveyance of mercury, instead of the heavy cast-iron bottles now used for that purpose.

Among the manufactures of iron sent from the Continent, none are more remarkable than the hand-made nails of Belgium. This branch of industry in Belgium is of very large extent:—no less than from 8,000 to 9,000 tons being exported annually, principally of the small sizes called "Flemish tacks."

Belgium approaches more nearly than any other country to the United Kingdom in the quantity and price of its iron; the difference in favour of the latter averaging about 20*s.* per ton on the principal sorts of iron. It is worthy of notice, however, that the price of "nail-rods," the kind used in the manufacture of nails, is lower in Belgium than in England; a fact which seems to indicate that a constant and regular demand for one description of iron will not only insure its supply but diminish its cost possibly by the inducement held out to the exercise of ingenuity on the means of economising the cost of production.

The sorted samples of hand-made nails exhibited by the SOCIÉTÉ ANONYME DE COUILLET (Belgium, 120), were considered by the Jury to be so excellent in every respect that they were desirous of according to that Society the highest mark of commendation in their power; but they were prevented from doing so from the circumstance that M. F. Spitaels, President of the Société de Couillet, is also one of their members, and on that account precluded from entering into competition.

The hand-made nails of Austria, which do not appear to be exported to any extent, are also of excellent quality, and remarkable for a peculiar twist given to the shank of the nail, which is said greatly to increase its tenacity. For railway spikes this twist has been in use, though not generally, in the United Kingdom; but its application to the small sizes, including those termed "pointes de Paris," is shown only in the samples from Austria. Of these, the productions of the establishment belonging to COUNT DUBSKY (456, p. 1033) deserve particular notice.

The machine-made nails of the United States must also be referred to. This trade is of very great importance: at the least from 35,000 to 40,000 tons being manufactured annually. For this and other purposes, such as ship-building, boiler-making, &c., large quantities of cheap iron are imported from Great Britain, which, owing to the wide extent of American sea-board, can be supplied to most of the southern states of the Union, at a cheaper rate than would be the case even were the prices in Pennsylvania and in Great Britain the same at the works.

With respect to articles of a miscellaneous description, the Jury must refer to the explanatory Catalogues already published. They would merely observe that, on the evidence furnished by the Exhibition, there can be no doubt that the hardware manufactures of the United Kingdom are alone co-extensive with the wants, the comfort, and the conveniences of civilized life. In some countries refinement and taste are more amply provided for; but at a comparative sacrifice of the interests of the many. In other countries particular branches of industry of a useful and ornamental, and sometimes of a useless though profitable kind are cultivated to a considerable extent; others appear to be entirely devoid of any industry but such as either supplies the mere necessaries of life, or ministers to the artificial and expensive wants of an aristocracy. In the United Kingdom alone industry has no exclusive bearing. Cheapness and abundance for the many, are as much its rule, as splendour and costliness for the few. It alone exhibits an effort to meet every possible demand which taste, refinement, comfort, convenience, economy, or necessity can make upon it. The extent to which that effort has been successful, in certain directions, admits of question; but that the effort has been, and continues with untiring energy to be, made, is beyond all doubt.

The following are the awards which have been made by the Jury:—

I. THE COUNCIL MEDAL.

1. ANDRÉ, J. P. V. (France, 1053, p. 1229).—The high excellence of the castings by André has already been

noticed. The end of a bedstead in cast-iron is considered by the Jury to be one of the most faultless castings in iron contributed to the Exhibition. The design is in good taste, and the sharpness and soundness of the casting extremely perfect. A cast-iron fountain in the East Nave is also a meritorious work; though it may be doubted whether cast-iron is a material suitable for such a purpose, unless protected from the action of water by some hydrofuge.

2. Aubanel (France, 1055, p. 1229)—This exhibitor has given the highest evidence of his skill, in a group of an Eagle and Lamb, a bronze gilt chimney-piece, and a gilded cast-iron door. The latter is extremely well designed and beautiful in execution. These, and the above-mentioned works of André, evince with equal success the applicability of cast-iron to artistic uses.

3. Barbedienne and Co. (France, 1709, 1723, p. 1258).—This firm exhibits a magnificent collection of artistic works in bronze, consisting for the most part of reductions by mechanical processes from ancient and modern works of sculpture. The processes are the invention of Collas, the bronzes finished by the sculptor Clesinger. The Jury consider that the whole collection displays a carefulness, completeness, and beauty of execution which place it in the first rank (Joint Medal with Class XXVI.).

4. The Coalbrook Dale Company (641, pp. 659–661).—The vast extent of the contributions by this Company, their variety and very general excellence, whether as objects of utility or ornament, seen to claim for them a very prominent place in the awards of the Jury.

This Company, one of the oldest in Great Britain, carries on the largest manufacture of iron and iron trade in the world; the works producing the almost incredible amount of 2,000 tons of finished iron per week.

On a small scale iron works seem to have existed in Coalbrook Dale from a remote period, but the records only extend to the reign of Charles II.

The works of the present proprietors date from the beginning of the last century, since which time they have gradually attained their present magnitude. In the earlier half of the last century the first iron railroad for waggons, ever known in England, was laid down at these works; and its efficiency being proved, the furnaces at the top of the Dale were connected by railway with the foundry at the centre, and the line continued from thence to the stores and wharf on the Severn; from which the products of Coalbrook Dale still continue to be sent down the river in barges for export to their several destinations.

In 1779, the Company had the merit of erecting the first iron bridge ever constructed in England, viz., that over the Severn, near Madeley; the position of which was so advantageously chosen, that a populous and thriving market-town arose in the neighbourhood, and now bears the name of Ironbridge.

The Company is besides remarkable for the introduction of improved modes of smelting, and economy in the manufacture of iron.

The products of the Coalbrook Dale works, now of all descriptions, were, until about twelve years ago, chiefly confined to the manufacture of bar iron, beams, pipes, castings for bridge-work, agricultural implements, and the hollow ware, consisting of culinary utensils, brewing vessels, sugar pans, &c., for which Coalbrook Dale originally obtained its celebrity. Since that period, the attention of the Company has been directed to the production of ornamental castings; and the success which has seconded their efforts is fully exemplified in their numerous contributions to the Exhibition. There is, perhaps, no establishment in which so many different kinds of labour are applied:—its operations extending from the first raising and smelting of the ore, to the ornamenting and burnishing of highly-finished works in iron and steel.

5. J. Hardman and Co. (700, p. 668).—Such of the productions contributed by this firm as belong to Class XXII. are admirable in workmanship, and unrivalled for perfect development of the mediæval design and taste in which they are executed. The designs have been for the most part, it is understood, prepared by Mr. A. W. Pugin, and reflect great credit on that gentleman; but the Jury are more particularly impressed with the very perfect manner in which Messrs. Hardman have developed the artist's conceptions. It evinces a skill in manipulation which might, they conceive, be exhibited to still greater advantage in brass-work of a more varied and ornate style than may be admissible in the particular species of mediæval art to which they have confined themselves.

6. Hoole, Robson, and Hoole (140, p. 609).—The beautiful grates, fire-places, and fenders contributed by this firm have already been noticed. They are designed chiefly in the Italian taste of the earlier half of the sixteenth century, and display a subserviency of the execution to the intentions of the artist, to a degree which places them among the most remarkable contributions from the United Kingdom. The castings on some of these grates have been before alluded to; and it may be added here that there are, besides, some detached specimens shown as they come from the sand, which appear to be quite faultless. On the whole these works are distinguished for a higher and purer taste, and the application of a more artistic ornamentation, than productions of a similar kind have yet exhibited.

7. C. S. Matifat (France, 923, p. 1224).—The Jury consider the contributions by this exhibitor to be of a very high order. They are chiefly works in bronze, and bronze gilt and silvered, consisting of chandeliers, candelabra, candlesticks, stands for gold fish and for flowers, and various caskets, and chimney and table ornaments; which, for the most part, are designed in good taste, and admirable in execution. The chasing, chiselling, and finishing of these works, the Jury believe to be without parallel in their class. In that respect they would advert more particularly to the stand or fountain for gold fish, a small bronze of a lion and lamb, a casket in bronze and hard-wood, and a lofty candelabrum in bronze. They may also mention (though it can scarcely be reckoned in Class XXII.) an unfinished *pendule* in ivory and bronze gilt, designed by Dieterle, with figures sculptured by several artists from a model in plaster, by Schoenwerk. It is a work of great beauty.

8. Ferd. Miller (Bavaria, 90, 2 Zollv., p. 1102).—The heraldic lion cast in bronze by Miller, of Munich, from the model by Professor Halbig, is regarded by the Jury as a most admirable example of successful casting.

It is said to be one of a pair cast at the same time from the same furnace, and to weigh about six tons. Ample details of the history of this work are already before the public. It may be sufficient, therefore, to notice that the difficulties of casting in bronze, in this instance so successfully overcome, become greater in proportion to the size of the mould to be filled. The liability of the metal to "blow," the precautions necessary to obviate a change in the character of the alloy which takes place owing to the rapid oxidation of the tin, to secure the perfectly-uniform dryness of the mould, and to preserve the mass of molten metal at the high temperature required—are difficulties which it is scarcely possible to over-estimate in a case like this; and the Jury are persuaded that public opinion will justify the high place which they assign to this work as a specimen of bronze casting.

9. The Royal Prussian Iron Foundry, at Berlin (Prussia, 271, p. 1064), has been already adverted to.

10. Société de Mines et Fonderies de Zinc de la Vieille Montagne (Belgium 26, p. 1152) has already been mentioned with high commendation.

11. Stuart and Smith (102, p. 603).—The Jury have had occasion, in a previous part of this Report, to remark the peculiar beauty of workmanship and general brilliancy of effect, for which the contributions of this firm are distinguished. In this respect they stand pre-eminent; and it deserves also to be noticed that this house has, perhaps, more than any other, contributed to impart the highly-ornate character which the stove-grate manufacture possesses at the present time. The grates exhibited by them are for the most part manufactured on "Sylvester's plan;" by which the combustion of the fuel takes place on a metal plate which extends into the room and lies on the surface of the floor. In proportion as custom deviated

from the primitive practice of making the fire upon the hearth, it lessened the comfort arising from a proper distribution of heat. When grates were placed so high as has until very recently been customary, the greater part of the heat evolved passed up the chimney, leaving the lower stratum of air (the coldest part of a room) in contact with the legs and feet. This is obviated by Sylvester's plan, which, besides, affords the advantages of greater cleanliness, and the facility with which the same grate can be adapted to burn either wood or coal. The metal plate on which the fire is made, extending as it does from the fire-place to the fender, admits of being highly ornamented; and Messrs. Stuart and Smith have shown how skilfully they are able to take advantage of its capabilities in that respect.

The Jury have only to add with regard to this award and No. 6, that the fact of their having recommended the award of Council Medals to two exhibitors of articles in the same branch of manufacture, must be assumed as evidence of a well-considered opinion that both exhibitors have pre-eminently distinguished themselves, though by the development of different qualities of beauty and excellence in their several productions.

12. R. W. WINFIELD (373, pp. 639, 640).—Reference has already been made to the collection of brass-work contributed by this exhibitor, as displaying very perfect workmanship with a moderate amount of ornamentation; particularly in the manufacture of metallic bedsteads, for which he has earned a deservedly-high reputation. His improvement in the construction of these by means of a continuous post which obviates unsteadiness and loosening of the joints, is deserving of attention, as well as the twisted, spiral, and plain tapered pillars or tubes employed for that and other purposes, which are produced in a peculiarly-ingenious manner, invented by one of the workmen of the establishment.

This house has also had the merit of introducing the combination of plain opal or coloured glass with brass-work, by which flowers, blossoms, buds, or leaves in glass, are made subservient to purposes both of utility an ornament, in the manufacture of cornice-pole ends, curtain-holders, door-handles, &c.

II. PRIZE MEDAL.

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	265	Abate, P.	Specimens of a new art termed Metallography.
United States	462	Adams and Co.	Bank lock.
United Kingdom	300	Allen and Moore	Metal buttons.
——	150	Armitage, M. and H.	Anvils, &c.
Prussia	189	Arnheim, S. J.	Iron safe bureau.
United States	138	Arrowsmith, G. A.	Permutation locks.
United Kingdom	283	Aston, W.	Buttons.
——	663	Aubin, C.	Locks.
——	805	Baily and Sons	Cast-iron staircase work, brass work, &c.
——	319	Baker and Co.	Flower-stand and cages.
——	287	Banks, E.	Buttons.
——	34	Barnard and Bishop	Wrought-iron hinge.
——	695	Barron and Son	Locks.
——	329	Bartleet and Sons	Needles and fish-hooks.
——	25	Bartrum and Pretyman	Wrought copper nails, &c.
——	361	Bedington and Tonks	Brass-work (various).
Prussia	407	Beissels' Widow and Son	Needles of English steel.
United Kingdom	98	Benham and Sons	Cooking apparatus.
——	606	Bentley, W. H.	Cooking apparatus.
Prussia	310	Blaeser, G.	Bronze statue of Beethoven, &c.
France	28	Blanzy, Poure and Co.	Metallic pens.
United Kingdom	349	Blews and Son	Ship lamps and bells.
Prussia	633	Böker, R. and H.	Hardware (various).
United Kingdom	353	Bolton, T.	Brass and copper tubes.
——	680	Boobbyer, J. H.	Locks.
France	776	Boucher, E., and Co.	Culinary vases, tinned by a new process.
United Kingdom	330	Boulton and Son	Needles and fish-hooks.
——	653	Bramah and Co.	Locks and castings (and Special Approbation).
France	437	Bricard and Gauthier	Locksmiths' work, &c.
United Kingdom	458	Bright, R.	Carriage lamps.
——	364	Brisband, H.	Buttons.
——	477	Brown and Redpath	Stoves for ships.
——	633	Burney and Bellamy	Tanks for oil, water, &c.
France	1129	Cain, J.	Bronzes,—birds in nests, &c.
United Kingdom	655	Carpenter and Tildesley	Locks.
——	459	Childs, J.	Brass lamp for lighthouses.
United States	417	Chilson, Richardson, and Co.	Hot-air furnace.
Russia	365	Chopin, Felix	Bronze candelabrum.
United Kingdom	646	Chubb and Son	Locks and safes (and Special Approbation).
——	446	Clarke and Restell	Lamps, gas-burners, and locks.
——	657	Clarke, T. and C., and Co.	Enamel ware.
——	434	Cochrane, J.	Gas-meter.
——	115	Cocker, S., and Sons	Needles.
——	234	Cocker and Sons	Needles.
——	27	Coombe and Co.	Iron and copper netting.
——	255	Cope and Collinson	Brass work (various).
——	416	Corcoran, B. and Co. (Cl. VI.)	Metallic cloth.
United States	46	Cornelius and Co.	Chandeliers.
United Kingdom	698	Cottam and Hallen	Gates, cast iron, and enamelled cast-iron horse-mangers.
——	307	Cotterill, Edwin	Locks.
——	63	Cottingham, N. J.	Brass lectern.

PRIZE MEDAL—*continued.*

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	62	Cowley and James	Beds and steam tubes.
——	244	Crook, W.	Cooking apparatus.
United States	298	Day and Newell	Parautoptic permutating locks (and Special Approbation).
United Kingdom	186	Deane, Dray, and Deane	Stove grates.
Belgium	361	De Bavay, Paul	Pointes de Paris nails, &c.
France	779	De Braux d'Anglure	Statues of galvanized zinc, bronze busts, &c.
Wurtemburg	71	Deffner, C.	Hardware (various).
United Kingdom	482	Defries, N.	Gas meter, bath heated by gas, &c.
——	800	De la Fons, J. P.	Locks.
Belgium	363	De Latour, Albert	Iron castings.
Spain	260	De Miguel, F.	Iron bedsteads, &c. (and Special Approbation).
Belgium	365	De Rosée, Baron A.	Brass caldrons, &c.
France	1588	Desjardins-Lieux	Medallions, &c.
Prussia	280	Devaranne and Son	Castings in zinc.
France	188	Dietrich and Son	Specimens of iron castings, &c.
United Kingdom	797	Dixon, J., and Son	Powder flasks.
——	476	Dowson, J. E.	Cundy's hot-air ventilating stove.
Prussia	638	Dreyse and Collenbusch	Copper rivets.
Belgium	353	Drion, E.	Wrought nails.
Austria	456	Dubsky, Count	Wire tacks, twisted nails.
United Kingdom	350	Dugard, N. and H.	Carriage lamps.
——	89	Duley, J.	Cottage cooking-stove.
——	336	Edelsten and Williams	Pins.
——	51	Edge, J.	Pit chains.
——	441	Edge, T.	Gas-meter.
——	387	Edwards, F.	Arnott's stove.
Prussia	200	Egells, F. A.	Cast-iron chimney-piece.
Austria	435	Egger, J. B.	Leaden pipe, 1,800 feet long, in one piece.
Prussia	762	Einsiedel, Count G.	Cast-iron goods, &c.
United Kingdom	302	Elliott and Son	Buttons.
——	103	Evans, J., Son, and Co.	Cooking apparatus.
——	352	Everitt and Son	Brass and copper tubes.
Belgium	154	Falisse and Trapmann	Percussion caps.
United Kingdom	444	Faraday and Son	Gas chandelier on Professor Faraday's principle.
——	686	Feetham, Miller, and Sayer	Stove grates, &c. (and Special Approbation).
——	161	Firmin and Sons (Cl. XX.)	Buttons.
Austria	420	Fischer, A.	Malleable cast iron.
Prussia	296	Fischer, C. H.	Figures in bronze, &c.
United Kingdom	38	Flavel, S.	Cooking apparatus (and Special Approbation).
France	1227	Fontaine, P.	Brass pans.
Prussia	293	Franz, J.	Bronze figures of Victory, &c.
——	289	Friebel, L.	Bronze Newfoundland dog, &c.
Austria	412	Fürstenberg, Prince	Stoves, monuments, crucifix.
France	227	Gagneau Brothers	Lamps, bronzes, &c.
United Kingdom	556	Gardener, M.	Chandelier.
——	483	Garton and Jarvis	Stoves.
Austria	703	Gasser, J.	Bronzes.
Prussia	267	Geiss, M.	Statues in zinc, "Eve," &c. (and Special Approbation).
United Kingdom	652	Gerish, F. W.	Locks and hinges.
France	520	Gervais, —	Copper boiler with grate.
United Kingdom	654	Gibbons, J., jun.	Locks.
——	324	Gillott, J.	Metallic pens.
——	438A	Glover, T. (Cl. I.)	Gas-meter.
——	380	Goddard, H.	Cooking apparatus.
——	481	Goodbehere, G. T.	Ships' stoves.
——	335	Goodman, G.	Needles and pins.
——	405	Gray, J., and Son	Locks.
——	262	Gray and Son	Fire-irons, &c.
——	518	Gray, T. W.	Brass-work (various).
——	66	Green, T. (Cl. IX.)	Aviary.
——	39	Greening and Sons	Strong wire cloth, woven by steam-power.
——	254	Griffiths, T. and F.	Tin and enamel ware.
France	1617	Grignon, M.	Bronzes, &c.
Saxony	37	Gruhl, F.	A bell (very fine tone).
United Kingdom	524	Guest and Chrimes	Water-closet and fire-cocks.
France	255	Hadrot, L., jun.	Moderator lamps.
United Kingdom	563	Hale, J.	Curb chains.
——	282	Hammond, Turner, and Sons	Buttons.
——	82	Handyside, A.	Cast-iron fountain.
——	616	Hanson, J.	Manufactured lead.
——	211	Harding, T. (Cl. XX.)	Buttons.
——	284	Hardman and Iliffe	Buttons.
——	660	Harley, G.	Locks.
——	636	Hart and Sons	Door-plates.
——	421	Haslam, W.	Wrought-iron hinges, &c.
——	52	Hatfield, J. A.	Statue in bronze.
——	318	Hawkins, J.	Brass, copper, and iron screws and bolts.
——	97	Haywood, J.	Church stove.
——	647	Haywood and Son	Locks, gilding, &c.

PRIZE MEDAL—*continued.*

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	331	Hemming, H.	Fish-hooks.
——	316	Henn and Bradley	Taper screws, &c.
United States	124	Herring, S. C.	Salamander safe.
United Kingdom	351	Hetherington, T. and C.	Carriage lamps.
Prussia	631	Hilgers and Sons	Hardware.
United Kingdom	326	Hincks, Wells, and Co.	Metallic pens.
——	519	Hodges, T.	Bells.
——	348	Holden, H. A.	Carriage lamps.
——	1	Hood, S.	Cast-iron enamelled stall and manger.
——	275	Horne, T.	Curtain poles, &c.
——	334	Horsfall, H.	Pins, and wire for fish-hooks.
United States	486	Howland, C.	Bell telegraph.
United Kingdom	649A	Huffer, J.	Locks.
——	609	Hughes and Kimber	Copper and steel plates for engravers.
——		Ibbetson, Capt., LL.B.	Bronzing, iron and metallic castings—new method (and Special Approbation).
——	304	Ingram, T. W.	Buttons.
——	317	James, J.	Fish-hooks and needles.
——	237	Jeakes, W.	Stove grates (and Special Approbation).
——	810	Jennings, G.	Water-closet.
——	106	Jobson and Co.	Radiating stove.
Prussia	285	Kalide, T.	Boy with swan, in bronze, &c.
France	1632	Karcher, H., and Westermann	Articles in stamped iron.
United Kingdom	76	Keep and Watkin	Anvils, vice, &c.
——	601	Keith, G.	Refrigerator.
——	327	Kell, A., and Co.	Metallic pens.
——	804	Kennard and Co.	Stoves and iron castings.
——	360A	Kenrick and Son	Enamelled ware.
——	553	Kent, G.	Knife-cleaning machine.
——	489	Kepp and Co.	Copper bath.
Prussia	299	Kesseler, C.	Bronze statue of Polyhymnia.
United Kingdom	96	Kirby, Beard, and Co.	Pins, &c.
Austria	434	Kitschelt, A. (Cl. XXIV.)	Cast-iron vases, &c.
United Kingdom	689 & 694	Knight and Forster	Metallic pens.
——	289	Knowles, H.	Buttons.
Russia	287	Krumbigel, —	Gilt bronze candelabra.
United Kingdom	32	Kuper, W.	Metal ropes.
France	1284	Lacarière, A.	Lustres, chandeliers, &c.
United Kingdom	534	Lambert, T.	Water-closet and diaphragm valve.
France	293	Laureau, L.	Figures, in a galvanized compound of bronze and pewter.
——	568	Laury, G.	Stove-grates and stoves (and Special Approbation).
United Kingdom	54	Lawrence, T. B.	Perforated zinc, &c.
——	665	Lea, W. and J.	Lock with bolts, &c.
France	1644	Lecocq, H.	Ornaments in stamped brass, hot-air stoves, &c.
Belgium	354	Lefebvre, V., and Co.	Wire nails and rivets.
——	381	Limelette, F.	Wrought nails.
United Kingdom	357	Lloyd, G. B.	Iron lap-welded tubes for steam boilers.
——	105	Longden and Son	Cooking apparatus.
——	382	Love, J.	Gas stoves.
——	346	Lowe, J. and H.	Carriage lamps, &c.
France	1340	Mallat, J. B.	Metallic gilt pens, &c.
United Kingdom	370	Maplebeck and Lowe	Cooking apparatus.
France	607	Marchand, J. B.	Bronzes (various) (and Special Approbation).
United Kingdom	510	Marr, W.	Safes.
——	363	Marrian, J. P.	Naval brass-work.
——	795	Marriott, W.	Weighing-machine.
France	332	Marsaux and Legrand	Stamped copper for decoration.
United Kingdom	332	Martin and Gray	Carriage lamps.
——	416	Massey, W., and Co.	Brass flower-stand.
——	634	Masters, T.	Ice apparatus.
Switzerland	41	Mathey and Son	Cylinder of rolled steel for watch-springs.
Belgium	359	Mathys, J.	Strong box, and polished stoves.
United States	20	M'Gregor and Lee	Bank lock.
United Kingdom	684	Mears, C. and G.	Bells.
France	630	Mêne, P. J.	Bronzes of boar-hunt, &c.
United Kingdom	340	Messenger, Samuel	Bronzed and lacquered lamps (and Special Approbation).
Austria	413	Metternich, Prince	Stove for hunting-seat.
United Kingdom	645	Miller, Geo. Alex.	Signal-lamps, &c.
——	642	Milner and Son	Safes.
——	339	Mitchell, J.	Metallic pens.
——	328	Mitchell, W.	Metallic pens.
——	274	Moore, P., and Co.	Iron and brass hinges.
France	1666	Morel Brothers	Moulded cast iron, &c.
United Kingdom	610	Morewood and Rogers	Galvanized tinned-iron sheets.
——	204	Mossman, W. (Cl. XXX.)	Brass candlestick.
France	934	Muel-Wahl, and Co.	Chandeliers, fountains, &c.
United Kingdom	683	Murphy, J.	Bells.

PRIZE MEDAL—*continued.*

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	338	Myers and Son	Metallic pens.
——	638	Naylor, J.	Lamps for pillars and wall brackets.
——	36	Newall, R. S.	Metal ropes.
——	87	Nicholson, W. N.	Anglo-German cooking stove.
——	332	Nicklin and Sneath	Wire weaving.
——	491	Noirsain, J.	Ventilating stoves.
——	424	Paddon and Ford	Gas-meter.
France	671	Palliard, E.	Copper and zinc frames for mirrors, &c.
United Kingdom	447	Palmer and Co.	Candle lamps.
France	942	Palmer, J. L.	Drawn wire.
Tuscany	116	Papi, Clement	Basket of flowers, cast from nature.
France	1379	Paris, E.	Galvanized sheet iron, &c.
United Kingdom	659	Parkes, H. W.	Locks.
——	649	Patent Pointed Screw Company.	Pointed screws cast out of malleable iron.
France	946	Paublan, —	Safes and locks.
United Kingdom	688	Perry and Co.	Metallic pens.
——	61	Perry, E.	Japanned ware.
Netherlands	78	Petit and Fritsen	Bells with suspending apparatus.
United Kingdom	371	Peyton and Harlow	Metallic japanned bedsteads.
——	107	Pierce, W.	Cottage grate.
France	963	Poirier, L.	Copying presses.
United Kingdom	323	Potts, W.	Bronzes and lacquered lamps, &c. (and Special Approbation).
——	64	Purdy, C. W. (Main Avenue West.)	Gothic ornament.
Belgium	356	Puissant, F.	Wrought-iron crucible and ornaments.
Wurtemburg	72	Rau and Co.	Japanned tin plate.
Netherlands	99	Regout, P.	Chandeliers (2 large and 2 small).
United Kingdom	315	Reynolds, J.	Cut nails.
——	433	Rickets, C.	Gas stoves.
——	637	Riddle, W.	Apparatus for extinguishing fires in ships, signal-lamps, &c.
France	1440	Robert, A., and Co.	Roll of tinfoil, &c.
United Kingdom	189	Robertson, Carr, and Steel	Stove grates.
Wurtemburg	73	Rometsch, C.	Metallic writing slates (and Special Approbation).
United Kingdom	278	Rowley, Charles	Buttons.
Austria	430	Salm, Prince	Cast-iron statue of Radetzky, considered as a specimen of casting (and Special Approbation).
United Kingdom	343	Salt and Lloyd	Bronze and lacquered lamps.
——	270	Simonite, J.	Tin and enamel ware.
Spain	259	Sanchez Pescador	Bedstead of cast steel, with bronze ornaments (and Special Approbation).
Prussia	405	Schleicher, C.	Galvanized steel wire.
France	370	Schmautz, C., sen.	Letter-press rollers.
Prussia	644	Schmidt, Caspar	Kitchen stove.
Netherlands	98	Schutz, L. N.	Zinc castings.
United Kingdom	90	Shave, W. J.	Stoves and ovens.
——	243A	Sherwin, J.	Kitchen range.
——	66	Shoolbred and Co.	Japanned ware.
Russia	370	Shtange and Verfel	Bronze candelabrum.
United Kingdom	435	Siebe, A.	Rotatory syringe.
——	321	Simcox, Pemberton, and Sons	Brass-work (various).
——	295	Smith, Kemp, and Wright	Buttons.
Prussia	802	Sommermeyer and Co.	Iron safe, ornamented (and Special Approbation).
United Kingdom	60	Steele, W. and P.	Cooking apparatus.
——	—	Stirling, Morries J. D. (Main Avenue West).	Alloy bell, for cheapness. Patent.
Prussia	199	Stobwasser, C. H., and Co.	Japan articles, &c.
United Kingdom	422	Stocker Brothers (Cl. v.)	Beer machine.
Wurtemburg	60	Stohrer, J. F.	Brass and steel wire, &c.
Prussia	779	Stollberg-Wernigerode, Count	Cast-iron Gothic vase, &c.
United Kingdom	443	Strode, W.	Gas stove.
France	1023	Susse Brothers	Bronze candelabra, fountains, &c.
United Kingdom	507	Tann and Sons	Safes.
——	622	Taylor, J.	Locks.
——	682	Taylor and Son	Bells (and Special Approbation).
——	705	Thompson, T. H.	Sanatory trap, &c.
——	312	Timmins and Sons	Vices, hammers, &c.
——	55	Treggon, H. and W.	Zinc window blinds.
France	700	Trelon, Weldon, and Weil	Buttons and China knobs.
——	1512	Tronchon, N.	Iron articles of furniture, &c.
Spain	280	Trubia, The Royal Ordnance	Iron bust of King of Spain.
United Kingdom	550	Tupper and Carr	Wire fencing (galvanized iron).
——	202	Turner, H. and W.	Fire-irons.
——	63	Tylor and Pace	Perforated metals.
——	401	Tylor and Son	Bronzed ware and baths.
France	1517	Vantillard and Co.	Tinned-iron pins, &c.
——	1705	Verstaen, L. N.	Strong boxes and safes.
United Kingdom	381	Wakefield, F.	Cooking apparatus.

PRIZE MEDAL—*continued.*

Nation.	Number in Catalogue.	Name of Exhibitor.	Objects Rewarded.
United Kingdom	29	Walker, E.	Perforated brass.
——	242	Walker, R. (Cl. VIII.)	Metallic pens.
——	62	Waller and Co. (Main Avenue West.)	Monumental brass.
——	670	Walters, B. and P.	Locks.
——	69 & 701	Walton and Co.	Japanned ware.
——	798	Warner and Sons	Bronzed-copper ware and bells.
——	290	Wells, J. T.	Buttons.
——	600	Wenham Lake Ice Company	Refrigerator.
——	667	Whitehouse and Co.	Iron tubes and fittings.
——	356	Whitfield, Samuel	Brass cornices and safes.
——	242	Whitmee and Chapman	Coffee mills.
——	30	Wilkins and Weatherly	Metal ropes.
——	490	Wilson, R. and W.	Baths (various).
——	668	Windle and Blythe	Locks and steel pens.
——	75	Wood Brothers	Chain cables.
——	664	Yates, H.	Locks.
——	384	Yates, Haywood, and Co.	Stove grates.
——	348	Zuccani, B. (Cl. XXX.)	Aviary.

III. HONOURABLE MENTION.

Prussia	214	Action - Verein, Wilhelmshütte.	Enamelled stoneware.
United Kingdom	687	Aldridge, J. M.	Door pivots.
——	253	Allday, W.	Bellows.
——	65	Archer, J. W. (Main Avenue)	Monumental brass.
Austria	665	Arrer, J.	Pearl buttons.
United Kingdom	301	Aston, J.	Silk buttons.
——	681	Bamber and Son	Mortice night bolt.
Prussia	760	Baum, E.	Stove (as a man in armour).
Austria	438	Beitl, F.	Two iron cash boxes.
United Kingdom	438	Biddell, G. A.	Gas burner, self-regulating.
——	297	Biddle, J.	Letter clips, &c.
——	650	Bigford, H.	Lock.
——	267	Bird, A.	Hydrostatic syphon.
——	464	Black, B.	Ornamental carriage illuminator.
Prussia	623	Bleckmann, J. E.	Tools, locks, &c.
Wurtemburg	94	Blumhardt, H.	Fire tongs.
France	769	Boche, M.	Powder flasks, &c.
——	770	Boeringer and Co.	Door security bolt.
United Kingdom	426	Botten, C.	Protector gas-meter, for preventing fire-damp.
France	433	Boulonnois	Various bronzes.
United Kingdom	575	Bradnack, J. R.	Knocker and letter-plate for door.
Prussia	621	Braunchweig, J. A.	Tools.
United Kingdom	500	Bray, C.	Cooking utensils, &c.
——	247	Burton, W. S.	Ornamental fenders.
France	1132	Carle, A. T.	Specimens of brass founding.
Prussia	655	Caron, J. M., and Co.	Samples of buttons, plated.
France	1135	Carrier-Rouge	Bronze, chandeliers, &c.
United Kingdom	592	Carson, —	Machine for preserving meat.
France	117	Charles and Co.	Machine of galvanized iron, for washing.
——	449	Chauvin, G.	Purse trimmings.
Canada	151 155 156 159	Cheney, G. H.	Stoves, &c.
United Kingdom	11	Chopping and Maund	Concave horse-shoe.
——	158	Cochrane, A. (Cl. VII.)	Lock and ventilator.
——	100	Collier and Son	Coffee-roasting apparatus.
——	573	Collinge, C., and Co.	Patent door-hinge.
——	16	Cook, William	Improved horse-shoe, for general use.
——	320	Cooksey, H. R.	Coffin furniture.
——	57	Crook, F. (Cl. XXX.)	Wrought-iron water lily.
France	134	Cadrue, F.	Window-rod fasteners.
——	99	Cugnot, A.	Locksmith's work and ironmongery.
United Kingdom	754	Culverwell, W.	Portable vapour bath.
France	1168	Daniel, E., jun.	Ornamental steel purse.
United Kingdom	445	Debaufer, H.	Concentrating gas lamp, for the exterior illumination of shop-windows.
France	1582	De la Cour, L. F.	Bronze and cast-iron articles, &c.
Russia	324	Demidoff, Messrs.	Malachite vases.
France	145	Dervaux-Lefebvre	Chains, bolts, &c.
——	1483	De Sérionne, Loin, and Co.	Buttons, &c.
——	819	Deydier, Madame	Zinc dormer windows, &c.
——	824	Ducel, S. J.	Iron castings of statues, animals, &c.

HONOURABLE MENTION—*continued.*

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
Prussia	641	Dültgen Brothers	Pad and portfolio locks.
Jersey and Guernsey	9	Du Pre, W. H.	Wind guard, &c.
France	151	Duval and Paris	Bronze lamps, &c.
Austria	427	Eberstaller and Schindler	Iron and steel wire, &c.
United Kingdom	241	Edwards, D. O.	Atmopyre hoods and gas stove.
——	345	Edwards, E.	Inkstands, glass screws, &c.
Prussia	660	Eichelburg, H. D., and Co.	Window curtain, in frame of brass.
United Kingdom	86	Ellis, W.	Kitchen range and bath apparatus.
Austria	457	Ernst, P.	Nails (assorted).
United Kingdom	560	Farrow, C.	Machines for wine and other liquors.
Belgium	380	Fauconier-Delire (Widow)	Wrought nails.
United Kingdom	502	Faulding, J.	Portable vapour bath by spirit lamp.
France	1691	Faye, P. G.	Bronze clocks, &c.
——	1601	Fetu, J.	Bronze chandeliers, &c.
United Kingdom	508	Fisher, J. N.	Cash-box.
——	13	Fogarthy, J.	Horse-shoes.
France	508	Fondet, sen.	Warming apparatus.
United Kingdom	35	Fox, T. H.	Bird cages.
France	513	Fumet, C. F.	Apparatus for artificial ice.
Prussia	193	Gaertner, A.	Parrot cage, German silver.
France	225	Gaillard, jun.	Wire gauze, &c.
United Kingdom	556	Gidney, J.W.	Wire fencing.
France	849	Gillot, F.	Clocks, &c.
United Kingdom	238	Glenton and Chapman	Polished register stove.
Belgium	357	Gob, J.	Wrought-iron strong box.
United Kingdom	374	Gorton, G.	Stove grate and fender.
——	66	Gould, —.	Monumental brass, inlaid steel figures.
Austria	469	Grabner, F.	Jews'-harps.
France	1256	Grangoir, J. M.	Locks, &c.
United Kingdom	431	Grant, D.	Gas stoves.
Prussia	653	Greef, jun.	Samples of buttons.
France	252	Guinier, T.	Water-closets and cocks.
United Kingdom	4	Guy, S.	Horse-shoes.
——	432	Haldane and Rae	Water-closets, &c.
——	486	Hale, T., and Co.	Bells, kettles, &c.
——	612	Hampden, J., and Co.	Enamelled zinc.
——	263	Hands, J.	Brass-work, cornices, &c.
——	555	Harrison, W.	Enamelled frying-pans.
Sweden and Norway	11	Hedlund, J.	Padlock.
United Kingdom	271	Hickman and Clive	Coffin furniture.
——	65	Hill, E., and Co.	Patent bedstead, with iron pillars, &c.
——	355	Hill, J.	Stamped brass ornaments.
——	15	Hillman, J.	Improved horse-shoes.
——	450	Holgate, J.	Signal lamps.
——	448	Holliday, R.	Gas lamp.
——	12	Holmes, Capt.	Improved horse-shoes.
Prussia	648	Hosterey, G.	Samples of buttons (plated).
Austria	428	Hueber, F.	Iron and steel wire.
France	880	Huet, J.	Purse-trimmings, &c.
Prussia	632	Huth, Fried, and Co.	Vices, &c.
United Kingdom	406	Huxhams and Brown	Stoves.
——	236	Huxley and Heriot	Gas stoves, hydraulic stoves, &c.
——	311	Jackson, W.	Tools for tin and copper ware.
France	887	Jaudin, A.	Tinfoil and coloured spangles.
United Kingdom	14	Jones, G.	Improved horse-shoes for frosty weather.
——	407	King, S.	Stove grates (ventilating principle).
Prussia	196	Kolesch, H.	Iron safe.
Canada	151A	Ladd, C. P.	Balance scale.
France	288	Lang, L.	Wire gauze, &c.
United Kingdom	506	Leadbeater, J.	Fire-proof safes.
——	108	Leale and Albrecht (Cl. XXIX.)	Cake moulds and temple.
Prussia	197	Lehmann, A. F.	Iron crucifix, &c.
France	1315	Lemaire, A.	Brass curtain ornaments.
United Kingdom	673	Lewis, G.	Lock on circular levers.
——	503	Longfield, W.	Ornamental iron safe.
France	1332	Luce, P.	Mantelpiece, ornamented with a mirror.
Netherlands	100	Lurasco Brothers	Bronze statues, &c.
Belgium	378	Macquinay Brothers	Wrought nails.
United Kingdom	639	Machell, J. C.	Patent portable steamer-bath.
——	261	Malin and Sons	Brass-work, cornices, &c.
——	313	Manly, J., jun.	Ornamental nails.
Belgium	120	Marcinelle and Couillet Smelting Company.	Samples of nails, &c.
France	614	Martin, O., and Very Brothers	Cast-iron ornamental work.
Austria	698	Metzner, W.	Pearl buttons.
United Kingdom	9	Miles, W.	Horse-shoes (various).
Austria	467	Mitterberger, J.	Shoe-tips and heels.
United Kingdom	663	Moreton and Langley	Lock, and general hardware.
France	931	Morisot, N. J.	Bronzes, &c.
United Kingdom	333	Morrall, A.	Needles.
——	104	Morton, J.	Fenders and cast-iron table.

HONOURABLE MENTION—*continued.*

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	498	Moss, P.	Copper vapour-bath by spirit-lamp.
Prussia	287	Müller, —	Ornamental castings in bronze.
United Kingdom	793	Murray, W.	Tubular filter.
——	285	Neal and Tonks	Buttons.
——	388	Nettleton and Son	Gothic church-ventilating stove.
France	662	Neuberger	Lamps, &c.
United Kingdom	640	Nixey, W. G.	Patent till.
——	249	Onions, J. C.	Bellows.
——	658	Osmond, G.	Sash-fastenings, &c.
France	683	Paul Brothers	Braziers.
United Kingdom	73	Perry, J.	Copying-press.
France	954	Petithomme, L. A.	System of suspension for bells.
United Kingdom	281	Pigott and Co.	Buttons; naval buttons.
Austria	433	Pleischl, A.	Sheet-iron saucepans in non-metallic enamel.
United Kingdom	17	Plomley, W.	Model of an improved horse-shoe.
United States	414 434	Pond and Co.	Cooking-stoves.
United Kingdom	243	Pope and Son	Double-action rarefying stoves.
——	239	Prideaux, J. S.	Grate, feeding at bottom: draining machine.
——	465	Pyrke and Sons	Bronze urns, &c.
France	975	Rebert, C.	Door-fastenings.
——	979	Regniaud, J.	Copper cake-moulds.
United Kingdom	449	Rettie and Sons	Signal-lamps.
Wurtemburg	62	Rexer, C.	Brass and steel wire and gauze.
Canada	150A	Rice, W.	Wire fencing.
Hamburgh	50	Richster, J. M. S.	Brass parrot cage.
Prussia	639	Ritzel, L. (Widow)	Metallic buttons.
France	1447	Robin, L.	Bronze cups, &c.
United Kingdom	437	Roper, J.	Transparent gas-meter.
——	436	Ryan, J.	Transparent gas-meter.
Austria	429	Schedl, C.	Iron and steel wire.
Prussia	646	Schmidt, P. L.	Iron and brass wares.
Austria	470	Schwarz, C.	Jews'-harps.
——	471	Schwarz, F., jun.	Jews'-harps.
——	472	Schwarz, F., sen.	Jews'-harps.
——	473	Schwarz, J.	Jews'-harps.
United Kingdom	480	Searle, C., M.D.	Tabulated solid brick-heating stove.
Grand Duchy of Hesse	50	Seebass, A. R.	Cast-iron and steel ornaments.
United Kingdom	438A	Shears and Son	Patent dry gas-meter.
——	243A	Sherwin, J.	Economic range, hot closet, and bath.
Belgium	358	Sieron, L.	Nails, termed "Clous de Paris."
France	1017	Sirot, P., sen.	Copper and steel pegs for shoes.
United Kingdom	220	Skeltons, S. and R.	Shovels and spades.
——	452	Smiths and Co.	Carriage, rail, &c., lamps.
——	354	Souter, W.	Copper-bronzed urns.
——	430	Sparkes, J.	Cash-box for railways.
——	451	Squire, R.	Signal-lamps.
——	7	Stevens, H. R.	Horse-shoes and plates.
——	252	Stokes, J. C.	Water-closet, brass taps, &c.
France	1497	Tachy, A., and Co.	Needles for blind people.
——	1039	Taillefer, A., and Co.	Galvanized needles and pins.
United Kingdom	251	Taylor, S.	Ornamental bellows.
Prussia	624	Thomas, Christian	Hardware.
Austria	419	Thuruschelz, Count G.	Steel and iron for nails.
France	703	True, —	Lamps, &c.
Prussia	636	Turk, P. C. (Widow)	Metal buttons.
United Kingdom	—	Turner, —	Post-office window, double-action fastenings.
——	279	Twigg, G. and W.	Naval buttons.
Prussia	355	Ullenberg and Schnitzler	Screws and wire.
Austria	460	Vingert, A.	Nails (assorted).
Belgium	355	Vandercamer, J. A.	Zinc vessels.
France	1531	Voizot, E.	Steel for jewellery.
United Kingdom	413	Wallace and Son	Cooking apparatus.
——	248	Warriner, G.	Gas cooking stove.
Prussia	634	Wescher Brothers, & Strassmann.	Buttons, &c.
United Kingdom	656	Whitley, J.	Wrought-iron hinges.
Jersey and Guernsey	12	White, George	Ventilator and guard.
United Kingdom	10	Whitehead, —	Horse-shoes.
Prussia	282	Winckelmann, J.	Electrotypes.
United Kingdom	525	Wiss, R.	Self-acting water-closet.
——	276	Wolverson, E.	Lock.
——	8	Woodin, D.	Horse-shoes (various).
——	33	Woods, W.	Hooks and eyes, chains.
——	347	Woolridge, J.	Brass fittings, &c.
Denmark	23	Wulff, —	Two brass tea-urns, executed by hand.
United Kingdom	442	Young, W.	Vesta lamps.
Frankfort-on-the Maine.	19	Zimmermann, E. G.	Iron and zinc ware.

London, October 1851. W. DYCE, R.A., REPORTER.

APPENDIX.

(A).

Extract from Minutes of the Jury for Class XXIX.

"Messrs. Hoffman and De La Rue report, that they have conferred with the Chairman and Jurors of Class XXII., from whom they learn that in the English and Foreign Sections there are no less than 46 exhibitors of lamps. As it is clearly impossible to examine and test experimentally so large a number of lamps, Messrs. Hoffman and De La Rue suggested that the Jury of Class XXII. should select three lamps only which they considered ought to be so tested. The Jury of Class XXII. explained that much difficulty might arise in such a selection on their parts, as the exhibitors whose productions were not tested might complain that justice was not done them. Messrs. Hoffman and De La Rue fully agree in this view, and therefore for the present leave the decision of the proper course to be pursued, to the Jury of Class XXII., expressing at the same time their willingness to aid them to the best of their ability in any experimental inquiry which time will allow."

(B).

REPORT OF SUB-JURY A. OF CLASS X. ON "BELLS."

The Jurors of Class XXII. having requested the assistance of the Jury, Class XA., in the examination of Bells, those Jurors of Class XA., who attended for that purpose, have to submit the following Report:—

Bells examined, June 4th, 1851.

MEARS.—A large bell (in key of F), excellent.

MURPHY (Dublin).—A large bell of very fine tone.

MURPHY (Dublin).—A large bell in the East Nave, connected with clock (said to have been "cast in tune"). Very fine tone.

HODGES.—Four ship bells; good tone and powerful. The *brass* bell of remarkably pure and good tone, and of great power.

TAYLOR (Loughborough).—Two bells, excellent.

WARNER.—Three bells. The middle one is of a very pure tone.

PETIT and FRITSEN (Netherlands).—Bells with suspending apparatus. Good, though if considered as a *scale* of bells, some of them are not perfectly in tune.

F. GRUHL (Saxony).—A bell in East Nave. Very fine tone.

F. GRUHL (Saxony).—A bell and frame, in gallery. Tone pure and good.

HODGES (Dublin).—A large bell. Excellent.

N.B. The *Gongs* in the Chinese Collection are reported upon by Class XA. as belonging to a certain class of musical instruments.

(Signed) H. BISHOP, KNT., CHAIRMAN.

CLASS XXIII.

REPORT ON WORKS IN PRECIOUS METALS, JEWELLERY, ARTICLES OF VIRTU, &c.

[The Figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Albert, Duc de Luynes, *Chairman and Reporter*, France; Member of Institute, &c.
Henry Hope, M.P., *Deputy Chairman*, Piccadilly.
Don Francisco Eloiza, Spain; Colonel of Artillery.
James Garrard, Prime Warden of the Goldsmiths' Company.
John Gray, 5 Billiter Square, City; Silversmith and Plater.
L. Grüner, Zollverein; Architect.
Earl Lovelace, Turkey.
Westley Richards, Birmingham; formerly Plater and Jeweller; Chairman of the Birmingham Exhibition in 1849.
Charles Sallandrouze de Lamornaix, France; Commissioner-General of Government; Member of Council of Manufactures and of Central Jury, &c.
Robert Younge, Sheffield.

Associates.

William Thomas Brande, Royal Mint; Professor of Chemistry.
Nicolas Francois Le Dagre, Judge of the Tribunal of Commerce of the Seine, and Member of the Chamber of Commerce at Paris.
George Mathey, 57 Hatton Garden; Metallurgical Chemist.
Percival Norton Johnson, 57 Hatton Garden; Metallurgical Chemist.
Thomas Vasey, Monmouth Court, Whitcomb Street; Setter of Diamonds.

Works in all kinds of precious metals occupy a considerable place in the Exhibition. It would, however, be difficult to form from them an exact idea of the relative production of different countries in the various branches of this class of manufactures. Germany has contributed to a very limited extent; Spain has sent but one specimen of her beautiful workmanship in gold and silver for church-service: several French manufacturers of gilt bronzes have not exhibited at all: the Dutch jewellers' work is represented by only a single exhibitor: from Sweden, Denmark, Bavaria, and the kingdom of Naples, nothing has been received: America has furnished but an insignificant display: and other exhibitions, hurriedly formed, do not truly represent the actual production of the respective countries. Thus, China offers a miscellaneous collection of objects, some of them made several centuries ago, others of English manufacture, or borrowed from private individuals. The Indian exhibition is a treasury of riches accumulated by the East India Company, belonging to widely-different epochs, amongst which it would be difficult to distinguish at once what is modern. The Ionian Islands are represented by a few specimens only.

From the above it is evident that the Jury were compelled to be on their guard against error in their general appreciation of the productions—error which the uncertainty of a first experiment of a Universal Exhibition, the remoteness of some countries, and the reluctance of some manufacturers to come forward, must of necessity entail. The information asked for of the Foreign Commissioners would have been very useful towards drawing up more exact commercial observations; but not having received it in time to be of service, the Jury have confined themselves to the Exhibition itself.

It is sufficient to cast a glance upon the exhibitions of India, Turkey, Egypt, and Tunis, to be convinced that these nations have remained stationary from a very early period of manufacture. Some of them, indeed, develop ideas full of grace and originality; but their productions are always primitive and imperfect, and the skill of the workman is called in to make amends for the inadequateness of the manufacturing resources. Their exhibitions might, nevertheless, afford a lesson to the European manufacturers, for they display a natural grace in the arrangement of ornaments most happily conceived. Jade, inlaid with precious stones by means of golden bezils, as shown upon some of the very ancient articles in the Indian exhibition, is an elegant and skilful work of art. The filigree from the same country is as perfect as that from China; and the Indian enamels, though for the most part coarse, exhibit, nevertheless, much merit in design and harmonious arrangement of colour.

The European nations must, by the means here afforded for comparing their productions, render each other mutual service. France and Germany will borrow from England whatever is worthy of imitation in her manufacture of plate for useful purposes; while England may derive instruction from the gold and silver smiths of the Continent, in reference to objects of ornament cast or *repoussé*, and finely chased. Gilt bronzes likewise may become better appreciated, and be manufactured upon a larger scale. In the setting of precious stones, jewellers will call to mind the beautiful productions sent by Russia. Regarded in an artistic point of view, the French, German, and Russian exhibitions will leave permanent traces behind them; and every nation, according to the amount of its genius for imitation or invention, will easily discern the onward path it ought to follow. The same advantage will arise from the improved or novel processes brought to bear upon the working of precious metals. Every nation has its peculiar methods of casting, mounting, fitting up, and finishing, which have not escaped the attention of manufacturers and intelligent artizans. Gold-plating, silver-plating, the electro process, stamping, the imitations of gilding and silvering, maintain an important position in industry and commerce. The inferior metals or alloys, bronzed, silvered, or gilt, the imitation jewellery and artificial stones, are estimated according to their quality, and are largely used in European commerce, and as articles of export. The working of precious metals under their various forms is applied to objects of domestic use and sanatory purposes, and to the fine arts. In this respect, the Exhibition offers every advantage for the instruction of practical men, and of those who have a just appreciation of traditional taste and the demands of civilized society.

Elkington, Mason, and Co., New Hall Street, Birmingham (1, p. 671). Messrs. Elkington and Mason are the first who introduced into England the application of the electro process to gilding and silvering. Their collection includes objects most varied in their forms and dimensions, intended for table service and for purposes of ornament, executed for the most part in copper, or in a compound metal alloyed with nickel, called German silver, and coated with silver by their electro process. The designs are generally produced in copper by the electrotype process, and afterwards wholly or partially gilt or silvered by means of electricity combined with the alkaline salts of gold and silver.

Several vases, such as copies of the cups from Herculaneum and Pompeii, and various articles of ornament, are made entirely of pure silver deposited by the action of electricity. They are usually lined with wrought metal, either to give them regularity of form in the inside, or to render them fit for use. The Jury have particularly noticed, among the works of Messrs. Elkington and Mason, the beautiful group entirely of cast silver representing Queen Elizabeth on horseback, between a gentleman in waiting and a page, after a model executed by M. Jeannest, a French artist. This group is, in the opinion of the Jury, a very choice work of art: but they specially recommend for the Council Medal the large jewel-case of gilt and enamelled copper, ornamented with portraits upon porcelain of the Royal family, and with figures in full relief after designs by M. Grüner; and also the large circular plate called the Shield of the Amazons, a reverse copy of the original work, silvered and gilt in parts. These works of art and ornament offer the best specimens of the application of the electrotype process for the exact reproduction of objects in copper, and of precious metals to ornamental purposes.

The Jury, however, desire to guard against being considered as expressing an opinion on the merit of the application of the electro process of *silver* plating to objects of domestic use. They desire only to commend the artistic application of this discovery, to which alone they are inclined to think it adapted. At the same time they acknowledge that the application of *gold* by this process is a highly-meritorious invention, tending alike to the economy and durability of the metal applied, and to preserve the health of the artizan from the dangerous emanation of quicksilver vapours.

Morel, J. V., and Co., 7 New Burlington Street, London (117, p. 603), exhibit a small number of objects, the greater part of which are worthy of attention from the care and taste displayed in their execution. Among these are different pieces of plate for table-service, including a centre-piece in the style of Louis XV., executed with much care: a bouquet in rubies and diamonds of the first quality, representing a rose, a tulip, and a volubilis—this can be taken to pieces by a very ingenious contrivance, and transformed into a stomacher, head-dress, brooches, and bracelet; the rubies, which are of a very even colour, are set in bezils of gold:—a vase of silver gilt, ornamented with a silver bas-relief, the subject of which is a hunt amongst branches of oak, executed in the style of Albert Durer; the chasing of the bas-relief is admirable:—a silver-gilt sugar-basin, with cover, of faultless shape, and chased with ornaments in relief, very much deadened and of rare perfection. But the principal object of the Jury's approbation is the rich and handsome series of chalices and cups of various kinds in precious materials, ornamented with enamels, exhibited by Messrs. Morel and Co. They would instance especially a cup of Oriental agate, the gold mountings of which are composed of enamelled ornaments and birds of paradise: the pillar is ornamented with chimera in relief, enamelled, surrounding the escutcheon of H. I. H. the Hereditary Grand Duchess of Russia; and the foot is covered with beautiful arabesques enamelled: the taste displayed in this article is excellent, its composition is original, and it is very well executed after models by M. Méville. A nautilus shell of lapis-lazuli, supported by two enamelled figures of Tritons entwined with marine plants and flowers, and resting upon a rock covered with water and coral: the handle is formed of a chimera exquisitely enamelled, a copy of one on a celebrated cup in the Louvre: the manner in which this article is executed gives evidence of as much skill as taste: the model of the Tritons is the talented work of M. Constant Sévin. In the same rank must be placed another cup in Oriental agate, made in the form of a sea-shell (*plagiostoma*). The pillar is composed of a female figure, borne by a Triton with horse's fore-legs: at the back part of the shell is the handle of the cup, formed by another female figure sitting upon a dolphin and holding her flying drapery, the extremities being supported by Cupids: all these figures are enamelled with superior taste. Two other vases in rock crystal also merit special mention. The first is a ewer with its dish of the same material, engraved with fine arabesques: this portion of the article is in the style of the sixteenth century: the mounting is copied from the celebrated ewer in the museum of the Louvre, the enamelled gold mountings of which have served as the model: this is a masterpiece of imitation, and has been executed by the order and under the direction of Mr. Webb, an enlightened lover of the fine arts. A vase, mounted in gold and enamel, is remarkable for the extreme delicacy of its carved enamels, and for the skilful execution of the figures and ornaments. Many other articles of the same description and of similar quality constitute a whole which the Jury regard as worthy of a Council Medal.

Weishaupt, C. M., Sons, Hanau (Prussia, 412, p. 1073), exhibit a set of chess-men and board, the pieces in gold and silver, partly enamelled, and representing the Courts of Charles V. and of Francis I. They are entirely cast and nicely executed. The board exhibits superior qualities. It is made of silver, supported by four mermaids of silver gilt and enamelled in parts: from their shoulders hang garlands of enamel, ornamented with rubies and pearls, held up by gilt figures of children standing upon tortoises. Upon various parts of the garlands are placed herons of silver with blue enamelled wings. The squares of the chess-board are composed of mother-of-pearl and tortoiseshell. The whole is remarkable for its choice workmanship, and for the very skilful combination of silver with enamel and fine stones: the garland especially is executed in excellent taste, and must have presented considerable difficulties in mounting and enamelling. The Jury consider Messrs. Weishaupt deserving of a Council Medal for this happily-conceived and well-executed work.

Garrard, R. and S., and Co., Panton Street, Haymarket, London (98, pp. 688, 689), exhibit a collection of articles in precious metals and in jewellery, the *ensemble* of which is extremely rich, proving the immense extent of the manufacture of works in gold and silver in England.

There is, among the articles made in silver by Messrs. Garrard, a complete tea-service, consisting of seven pieces including the tray, in the Persian style, of very fine workmanship, the whole, with the exception of the small figures on the covers, made of silver in *repoussé* work. A table-candlestick with three branches, in the Queen Anne style, well conceived and very finely executed. A candlestick without branches, of a hexagonal shape, very well made, in *repoussé* work. A candelabrum with six branches, ornamented with foliage and fruit, of elegant design. A tea and coffee-service in *repoussé* work, with cast handles, which, though of a style rather undecided, is of very appropriate workmanship. Several other durable and well-made trays and tea-services. A large ewer for a race-cup, representing Hercules combating the horses of Diomedes, and surrounded by ornaments and emblems symbolical of the labours of Hercules. The handle represents the hydra of Lerna. This piece of plate, entirely cast, has a grand effect, and its *ensemble* gives it a real importance: the subject is well chosen, and the composition original. Several covered dishes, one of them of hexagonal shape, the others of the patterns known as the "bead and scroll" and the "bead and shell," show the care and solidity with which plate for the table is made in England.

Annexed is an abridged catalogue of the principal articles of jewellery exhibited by Messrs. Garrard:—

Necklace, stomacher, earrings and bracelet, in magnificent opals and brilliants, a noble and tasteful set:—a very rich set of magnificent sapphires, pearls, and brilliants:—a tiara enriched with fine oriental pearls, and large brilliants of great purity, with a brooch to accompany it:—an elegant gold bracelet of Gothic design, on which are chased out, upon a trellis-work of gold on blue enamel carved in the style of the fifteenth century, two angels holding a pearl and a ruby, and capable of being detached; the design by Mr. Smith:—a pearl necklace, with a circular medallion of rubies and brilliants, well made and in good taste:—a pendant in the Renaissance style, with figures in gold, rubies, brilliants, and pearls, upon green and red enamels, of fine workmanship:—a gold chased bracelet with a centre of emeralds and brilliants; the stones are fine and pure, and the bracelet is well chased. Another bracelet of bright gold, its centre ornamented with rubies and brilliants in imitation of the sculptures of Nineveh, a curious and carefully-executed copy, singular for the great antiquity of the model from which it has been taken: several brooches and rings, of which fine and scarce stones are the principal ornaments. This exhibition, taken as a whole, indicates manufacturing capabilities of the highest order, and an attentive study of all that can conduce to progress in this branch of national industry; and for these reasons the Jury recommended Messrs. Garrard for the Council Medal.

Hunt and Roskell, 156 New Bond Street, London (97, pp. 687, 688).—The exhibition of Messrs. Hunt and Roskell presents an assemblage of articles of rare magnificence. The Jury, being required to point out those which they prefer, would direct attention to certain objects of special excellence, and particularly to some very beautiful bracelets, one in emeralds and diamonds; another in opal and emerald, with white enamel; a third, which has a charming effect, composed of a fine opal, surrounded by brilliants and small emeralds upon white enamel, with foliage of gold. The Jury also mention with praise a bouquet of diamonds, as rich as it is elegant; which can be entirely taken to pieces, even to the petals of the flowers, for the purpose of cleaning, and for forming into seven brooches; and which but for its weight would defy criticism. The Jury, however, prefer, among all the articles in Messrs. Hunt and Roskell's exhibition, the vase executed in *repoussé* silver by M. Vechte, which was shown several years ago in an exhibition at the Louvre, representing the fight between Jupiter and the giants. The deity, represented sitting upon his eagle, forms the cover of the vase: upon the body and handles are the giants endeavouring to scale the heavens, and hurling trees and rocks at Jupiter: at the foot lie allegorical figures in alto-relievo: other figures are engraved upon the ground of the vase in very low relief, with a matted background. The same artist, M. Vechte, has commenced for Messrs. Hunt and Roskell a large shield, in three oval compartments, representing the apotheosis of Milton, Newton, and Shakspeare. The Jury recommended a Council Medal to be awarded to Messrs. Hunt and Roskell for the Jupiter vase and for the bouquet of diamonds.

Hancock, C. F., 39 Bruton Street, Berkeley Square, London (112, p. 692).—The articles shown by this exhibitor are to be noticed, not for the large number displayed, but for their peculiar qualities considered in an artistic point of view. Mr. Hancock, while respecting the traditions of English art, has been desirous of introducing into it improvements of a special kind; and by the variety and versatility of style observable in his works, he seems to have attained this object. The principal articles are:—a round ebony table inlaid with silver, upon which is a silver vase in the form of an antique hydra with three handles, covered with palm-leaf ornaments and burnished foliage upon a matted ground; all the ornaments are made separately, and soldered to the vase, which is hammered out of a single plate; the table is inlaid with much care and taste; the feet are in German silver electroplated. Two groups for racing-prizes, in good taste, and carefully executed. The first represents Queen Elizabeth on horseback, accompanied by a page and a gentleman in waiting, with two greyhounds following, executed after a model by M. Marochetti, the dogs after models by Mr. Macarthy: the second, Robin Hood contending for the archery-prize in presence of the sheriff of Nottingham, after a drawing by M. Eugène Lamy. An ebony box mounted in silver, after drawings by M Eugène Lamy, remarkable for its fine *ensemble* and for its silver mountings, and beautifully sculptured and of good effect, in the style of Louis XIV. Upon the lid is a large water-colour drawing, representing genii bearing the colours of the 79th Cameron Highlanders, to whom the box was presented by M. Demidoff; and on the inside of the lid is a fine water-colour drawing of the rock of Gibraltar. Several other articles exhibited by Mr. Hancock are worthy of being mentioned; such as the group in silver of a knight combating a dragon and a lion, after a model by Mr. Macarthy: a dessert-plate, with knife, spoon, and fork, the whole ornamented with vine leaves, and wrought in silver carefully and gracefully: a good silver candelabrum, in the foliated style of Louis XIV., with five branches formed of acanthus leaves; and several other articles in the ornamental style for table use. The whole of Mr. Hancock's exhibition shows an accurate knowledge of the silversmith's craft, and of the resources which art can apply to this branch of industry when it is properly brought to bear upon it. The Jury are of opinion that on these grounds Mr. Hancock is deserving of the Council Medal.

Marrel Brothers, 27 Rue de Choiseul, Paris (331 France, p. 1194).—The principal article exhibited by Messrs. Marrel is the vase representing the combat of Theseus with the Amazons, after the celebrated picture by Rubens. This copy in alto-relievo of a picture as much noted for its composition as for the complex character of the scene represented, offered considerable difficulties to the artist, which he has surmounted with unquestionable success. The bas-relief is in bronze silvered: it is repeated upon the two sides, and fixed to the frieze of the vase. The vase itself is executed in bronze gilt, in the Louis XIV. style, and bears the arms of its owner, His Royal Highness the Duc d'Aumale: the handles represent Amazons upon sea-horses. A silver cup, in the Renaissance style, richly ornamented with figures:—another by the same artist, with medallions of bacchanalian figures, partly in *repoussé* work and partly chased and gilt:—another of silver gilt, inlaid with arabesques of blue enamel: these form but a portion of this remarkable collection. The Jury would further mention a very beautiful silver hunting-knife, the hilt of which represents St. Hubert standing within a niche: the cross is ornamented with a fox at bay, defending itself against several dogs: upon the chape of the sheath is a handsome bas-relief, representing the conversion of St. Hubert, and lower down is a hunting trophy. The execution of this hunting-knife leaves nothing to be desired. The same maker shows some seals ornamented with beautiful little figures, office articles, scent-bottles in lapis lazuli, Venetian aventurine, jasper, enamels, snuff-boxes and other boxes of most varied styles and perfect workmanship, both in enamelling and chasing. Notwithstanding the merits of the other pieces, it is especially for this latter portion that the Jury recommended Messrs. Marrel for the Council Medal.

Rudolphi, J. F., 3 Rue Tronchet, Paris (1465 France, p. 1246).—The articles exhibited are of a most varied description: among others is a Byzantine casket in the form of a shrine; the portion of the lid forming the roof is ornamented with blue enamels, and the sides with other enamels of figures of angels upon golden and green backgrounds: upon the summit of the roof is a representation of the coronation of the Holy Virgin, accompanied by two angels, the whole in full relief, and made of silver gilt: the enamels are fine, and the casket ornamented with rock crystal, cut and set in coloured foil, has a remarkable effect. A bracelet of oxidised silver represents three children contending for some birds, which one of them is carrying off: M. Le Roi is the author of this beautiful design. Another bracelet in oxidised silver, from the design of M. Masson, represents two Cupids playing amongst the stalks of the vine, and holding up a sapphire, with four pearls in the form of a claw—very finely chased, and in good taste. A small group, formed of irregular-shaped pearls, of two gentlemen in doublets fighting a duel with sword and dagger, has good action and distinctness of character, and is executed in a very pleasing manner: it serves for a paper-weight. The Jury also point out a large concave plate representing the triumph of Amphitrite, after a model by the late Wagner. A charming oval casket, the cover ornamented with a female figure reclining upon a panther, entirely in silver, after a model by Geoffrey de Chaume. A round table of cast silver, composed of a hollowed flat plate, in the centre of which is the front face of the head of a Naiad, surrounded by Titans and Naiads, with Hylas and a Nymph: the hollowed portion and the border are ornamented with heads, birds, and foliage, after models by the late Wagner: the leg of the table is formed of the stem of a reed and foliage, ornamented with a kingfisher: upon the three claws are the bird's nest attacked by a rat, and intoxicated infant Bacchantes, after the model of M. Geoffrey de Chaume, chased by M. Poux. The entire collection shown by this exhibitor appears to the Jury to be deserving of a Council Medal.

Gueyton, A., 11 Rue Chapon, Paris. (1619 France, pp. 1254, 1255).—The variety of objects exhibited by M. Gueyton bespeak great fertility of invention and a felicitous application of old as well as novel processes. The Jury would mention particularly the History of the Horse represented on seven medallions upon a cup of cast and chased silver of very good shape. A cup of cast silver, partially gilt, representing subjects of the chase, and having at the bottom a medallion of Diana of Fontainebleau. A perfume-burner, with a garland of oak intermingled with objects of inanimate nature, its lid formed of a vulture. An oblong casket, the sides encrusted with rubies, and the lid ornamented with the figure of a Grecian female adjusting her earrings, while a Cupid holds her mirror: this piece is in cast silver, and chased in a very artistic manner. Several boxes and cigar-cases, ornamented with handsome bas-reliefs, in cast and chased silver, very light, or produced by the electro process in silver and also in copper silvered. A beautiful bouquet in alto-relievo, made in copper, and also silvered by the electro process. A group in cast silver of an Egyptian holding in a rearing horse, one-fourth the natural size. All these articles, especially those that are chased and those produced by the electro process, pertaining at once to works of jewellery and of the silversmith's art, give M. Gueyton a very honourable position among the exhibitors, and have induced the Jury to recommend him for the Council Medal.

Froment-Meurice, 52 Rue St. Honoré, Paris. (1720 France, p. 1258.)—The articles exhibited by M. Froment-Meurice consist entirely of gold and silver smith's work, trinkets, and jewellery, artistically treated. Among them are to be remarked two elegant brooches in the Renaissance style, in rubies and opals, with brilliants arranged in the form of a fringe, one of them being very large, the other smaller. A beautiful bracelet, in the same style, in blue enamel, gold, and brilliants. A brooch, in the shape of a cross, in black enamel, having a sapphire in its centre, with branches and garlands of brilliants, upon which is a bird with a body of pearl. The Pope's chalice, the ornamenting of which is at once elegant and novel, is executed with remarkable and appropriate taste. The toilet-table of Her Royal Highness the Duchess of Parma is a remarkable work, in which M. Froment-Meurice has overcome all the difficulties of the silversmith's and jeweller's art, in cast silver, *repoussé* work, enamelled and inlaid enamelled work, and engraved steel. But the attention of the Jury has been arrested by a centre-piece, representing Ceres, Bacchus, and Venus, standing upon the terrestrial globe, which is encircled by the zodiac, and around which fly small figures in relief of the genii of Plenty, Music, and Concord. The globe is supported by male and female snake-footed giants, and rests upon a base decorated with ornaments and foliage. This piece, executed after models by M. Feuchère, is in style and execution such as in the estimation of the Jury merits a place in the first rank. It is entirely made in *repoussé* work, with the exception of the figures of the giants. It is sufficiently light to be easily portable; and the mounting is so arranged that the principal portions may be taken asunder with ease, without in any way affecting its solidity. For this article the Jury decided upon recommending M. Froment-Meurice for the Council Medal.

Wagner, Emil August Albert, Berlin. (840 Prussia, p. 1096.)—The Jury recommend for a Council Medal M. Wagner, the maker of a silver centre-piece for the table, having three stages one above another. The one forming the base consists of a plinth, supported by lions. Upon the plinth are represented figures of the human race in its primitive condition, seated and grouped at the foot of an oak tree, and accompanied by animals and implements characteristic of the chase, of pastoral life, and of fishing. Above these, three female figures, standing against the pillar, represent Agriculture, Horticulture, and the cultivation of the vine. These figures support a bowl, the sides of which are formed in *repoussé* work, and ornamented with numerous figures of children, or small genii of industry, the Sciences and the Arts, gracefully grouped, and forming very animated compositions. From the centre of this bowl rises a palm-tree, surmounted by a winged figure, representing the genius of civilization, and the subduer of evil, which is typified by an expiring hydra. The whole of this piece, with the exception of the bas-relief of the bowl, is cast and chased: the composition is entirely M. Wagner's. The figures of the genius, and the three females standing against the pillar, have been modelled by Professor Fischer. The *repoussé* bas-relief of the bowl, which is not quite finished, is M. Wagner's own work. The Jury recognise in this centre-piece a fine style, an exalted character, excellent sculpture, and good effect. The most studious care, united to extreme skill, has guided the execution of the whole of this work, which is worthy of the high position held by the arts in Germany, and worthy of the Exhibition it adorns.

The King of Prussia's shield. (98 Main Avenue).—**His Royal Highness the Prince of Wales** (p. 110), exhibits a shield, presented to him by the King of Prussia upon the anniversary of his christening. His Majesty furnished the general plan of the work: the drawings for it were designed by the celebrated painter Cornelius, the architectural ornaments are by M. Stüler, the modellings by M. Fisher, the goldsmith's work by M. Hossauer, the *repoussé* by M. Mertens, and the engraving of the stones by M. Calandrelli. In the centre is the head of Christ in gold alto-relievo, in a round concave medallion bordered by a wreath of acanthus leaves, which stand out upon a circle of blue enamel, with golden stars, the whole upon a large Greek cross, which is covered with the following gilt bas-reliefs: Justice, beneath which is a round medallion of St. Mark, surrounded by four chrysoprases; Prayer, beneath which is St. Matthew; Religion, with St. Luke beneath; and Charity, beneath which is St. John. Between the arms of the cross are four bas-reliefs,—Moses striking the rock, the Lord's Supper, the fall of manna, and the baptism of Christ. Around this cross is a frieze of blue enamel, ornamented with vines, with peacocks, and foliage of palm-leaves. Between these enamels are cameos upon German onyx, representing the twelve Apostles. The next circle is composed of oval-shaped ornaments of white enamel, between which are green cinque-foils with golden pearls, the mounting of which is golden foliage upon a background of white enamel with small green leaves, around which is a twisted border. The large bas-relief which surrounds the shield represents the entry of Christ into Jerusalem, Judas betraying Christ to the Pharisees, the burial of Christ, the Resurrection, the descent of the Holy Ghost upon the Apostles, and the birth of the Prince of Wales. Upon the next bas-relief is represented the arrival of the King of Prussia in England; his galley steered by angels, and propelled by a personification of steam; he is welcomed by St. George, by an allegorical representation of the Thames, by the Duke of Wellington and by Prince Albert. The exterior edge is decorated with interlacings of white and green enamel, with buttons of flowered glass. Lastly, the concave edge is ornamented with inlaid enamel-work, in the form of a garland of fruits, grapes, and ears of corn.

This shield, worthy of remark for its composition, and for the beauty of its sculpture, enamels, cameos, and fittings, merits, in the opinion of the Jury, a Council Medal, as a reward for the talent of the artists, who have executed the orders and carried out the idea of the King of Prussia.

Sazikoff, Ignack, Moscow (366 Russia, p. 1384), exhibits several articles in silver, consisting of vases of varied and original forms executed with much care: of very elegant statuettes in cast silver, especially one of a female figure reclining upon the brink of a well, and looking at her image reflected in the water; the cylinder of the well is hollow, and gilt inside, forming, when reversed, a drinking-cup: another work represents a female figure leaning against a cask and pouring out beer, a cat is shown climbing up the cask behind her; this piece forms a teapot, the cask serving to contain the liquid, the vase held by the female figure being the spout. These two compositions are perfectly original, and the workmanship is gracefully and carefully executed. The talent of M. Sazikoff is, however, especially displayed in a large centre-piece representing a fir-tree, at the foot of which the Grand Duke Dmitry Donskoy, sitting wounded, is learning from his soldiers that he has gained the victory. The composition of this group is excellent: the chasing possesses great fulness, and is, at the same time, most carefully executed: the figures, fine in composition and superior in execution, possess a great degree of originality, and are arranged in a natural manner; and the character as well as the merit displayed in this group place it above anything hitherto produced in this description of manufacture. The Jury recommended a Council Medal for M. Sazikoff.

Kaemmerer and **Zeftigen**, St. Petersburg (376 Russia, p. 1384), Jewellers to the Imperial Court of Russia, have exhibited a diadem wreath in imitation of the leaves and fruit of the bryony. The leaves are in diamonds, and the fruits in emeralds cut in very elongated pear-shaped forms. The different portions of this wreath can be taken apart and used separately: 2,836 rose-diamonds, 129 brilliants, and 12 emeralds, are contained in this beautiful ornament. Next is to be observed a "berthe" formed of bouquets of currant-branches in diamonds, the fruit formed of polished uncut rubies suspended at different points upon a double string of diamonds, and arranged alternately with flowers in brilliants: its effect is excellent. The Jury have further remarked two other articles in the same collection, a bouquet of eglantine and lily of the valley entirely in brilliants and roses; also a brooch representing a branch of the ipomea in diamonds and beautiful turquoises. The importance of the articles in this collection, the superior taste in composition, and, above all, the perfection of the settings, not excelled by the works of any jeweller in the Exhibition, have induced the Jury to recommend that to Messrs. Kaemmerer and Zeftigen be awarded a Council Medal.

Lemonnier, G., 6 Place Vendôme, Paris (304, p. 1191).—The collection exhibited by M. Lemonnier has constantly and justly attracted considerable attention. The qualities which eminently distinguish the jewels belonging to the Queen of Spain are a very decided and elevated taste in the composition, an imposing aspect, and great skill in giving effect to the materials at the disposal of the jeweller. M. Lemonnier has executed two sets of jewels for the Queen of Spain. The first consists of a diamond necklace in the form of a ribbon, interlaced with foliage of emeralds. The stomacher and shoulder-knots, from which are suspended very large emeralds with clusters of brilliants, are in the same style, and in them the jeweller has overcome considerable difficulties presented by the design. The bouquet is formed of lilies of brilliants, the leaves of emeralds and ribbons of brilliants, with pendants of pearl. The crown is in the same style, with aiguillettes in the form of flowers having stamens in pearl. The bracelet is likewise a ribbon of brilliants, interlaced with emeralds. The whole of this collection displays, in the great harmony and simplicity of its arrangement, much adroitness on the part of its inventor in making use of a profusion of precious stones without allowing their immense number to mar the general effect. The same may be said of the set of jewels made in diamonds and sapphires, also belonging to the Queen of Spain. The crown is composed in the heraldic style: in the centre of the diamond flowers is a sapphire; a beautiful wreath of brilliants accompanies the crown, with which the stomacher and the necklace match perfectly; upon them are flowers of brilliants with centres of sapphires with garlands and long-shaped pendants. The whole of this set presents an *ensemble* worthy of the talent of M. Lemonnier. It is impossible to speak of other articles of secondary importance to those just described, though they would elsewhere be deserving of notice. M. Lemonnier has thoroughly attained the end which should be kept in view in the execution of jewellery, to strike and gratify both the eye and the imagination. As a setter of stones he is excelled by many other jewellers; in point of invention and decoration he stands unrivalled in the Exhibition. The Jury recommended him a Council Medal.

Vittoz, G. T., 10 Rue des Filles du Calvaire, Paris (1530, p. 1250).—The attention of the Jury has been attracted by the bronzes and the works in gilt bronze, exhibited by M. Vittoz. They can only speak of the bronzes which are either wholly or partially gilt, to which they are limited by their instructions. They have observed a clock in gilt bronze, called the "three hours of the day:" it is ornamented with Cupids upon a cloud, and supported by a pedestal of white marble. The Cupids are in bronze, and the style of Louis XVI. is preserved with much taste and care in the execution. The same clock is exhibited in double the size. A console candelabrum, in the Louis XIV. style, entirely in gilt bronze, is composed of three rich volutes springing from the foot, and entwined with garlands of oak, the whole supporting branches of lilies and mallows. This article is executed in remarkably good style, and the gilding has an excellent effect. A bronze figure of a child, of the size of life, bearing a basket from which issue fruits, flowers, and branches, gilt, presents a rich *ensemble* by the contrast of the bronze with the gold, and is of excellent workmanship. The group of children in bronze, half the size of nature, carrying bunches of grapes and resting upon a rich stand in gilt bronze, is, in the estimation of the Jury, the best piece in this collection so distinguished by the choice of models taken from the most skilful artists, and for execution with a care which no other maker has surpassed: the whole of the gilding is effected by the electro process, and appears to be executed in the best manner. The articles noticed claim from the Jury a recommendation for a Council Medal.

Moratilla, F., Madrid. (Spain, 261, p. 1345).—It is to be regretted that Spain, a country renowned for its works in precious metals adapted for the purposes of Divine worship, should have sent but one article of this description to the Exhibition. The Jury have nevertheless seen, with satisfaction, the monstrance exhibited by M. Moratilla. This choice specimen of the silversmith's art stands about 6 feet 6 inches high: it is made of silver gilt, in the florid style of the fifteenth century. At the base are four bas-reliefs in silver, representing the Lord's Supper, Christ bearing His Cross, the Garden of Olives, and the entry into Jerusalem. Upon the platform are four figures in silver of angels in the attitude of prayer, their faces turned towards the octagonal base of the monstrance, the shaft of which is ornamented with figures of the four Evangelists in full relief beneath Gothic turrets. The monstrance itself is radiated in the form of a double wreath composed of vine branches, clusters, and brilliants. Surrounding it are fourteen stars or comets composed of brilliants, topazes, amethysts, and emeralds: the cross is composed of brilliants and amethysts. The *ensemble* of this large work presents a fine effect. The Jury have particularly remarked the regularity of adjustment of the various parts, so difficult to carry out properly in a work elongated in the form of a Gothic spire, and conceived in a style of architecture which demands this very regularity as an absolute condition of good execution. On these grounds, the Jury proposed that a Council Medal should be awarded to M. Moratilla; which being refused by the Council of Chairmen, a Prize Medal was given.

Paillard, V., 8 Rue St. Claude au Marais, Paris

(France, 1713, p. 1258), exhibits some bronzes which the Jury have examined with a great deal of interest; especially a beautiful figure of a child, of the size of life, crowned with vine branches, and holding a rich candelabrum of gilt bronze. It rests upon a three-fronted pediment of gilt bronze, in Louis XIV.'s style, which has a fine effect. A large clock, with candelabra in gilt bronze, in the style of the latter part of the reign of Louis XIV. Two vases of porcelain, the backgrounds of which are of turquoise blue with rich mountings of gilt bronze, composed of a grooved moulding around the neck of the vase, handles formed of infantine vintagers climbing upon a volute; beneath are heads of chimeras, from which a garland proceeds to the centre of the vase. Lastly, a pair of candlesticks, in the style of Louis XV., with twisted stems, the feet ornamented with escutcheons. It is principally as an artist in gilt bronze for room decorations, that M. Paillard has distinguished himself in the Exhibition; and it is on this account the Jury recommended him as deserving of a Council Medal, which having been refused by the Council of Chairmen, a Prize Medal was awarded.

The Jury award the Prize Medal to Messrs. West and Son, of Dublin (15, p. 675), for their brooches and trinkets in gold, copied with much taste, yet not servilely, from the antique fibulæ found in Ireland; also for their necklaces, in which they have turned the almost forgotten style of the mediæval age to a very good account.

The Jury award the Prize Medal to Lambert and Rawlings, Coventry Street, London (102, p. 690), for their carefully-executed, elegant, and novel silversmith's work,—in particular, for a round flattened vase, with a long neck and a lid, in the Oriental style, the body and the neck ornamented with leaves, with gilt veins, and gilt and burnished bunches of grapes: also, for a centre vase, melon-shaped and flattened, having a long neck, the divisions of the side and the neck ornamented with thistles in bas-relief: the silver is of a beautiful dead brightness, which would appear to be very durable.

John Hardman and Co., Mediæval Court (532, p. 761), exhibit a rich collection of articles for church use, in silver, and in silver gilt and enamelled. They have adopted the mediæval style. The workmanship is good, bold, and well defined. Two large closets contain the communion cups, croziers, monstrances, pyxes, and crucifixes; for which the Jury award them the Prize Medal. (Awarded a Council Medal by Jury of Class XXII.)

The jewellery and trinkets of Rowlands, C. and W., 146 Regent Street, London (118, p. 693), are remarkable for their fine execution, particularly a blue enamel brooch with a large polished and uncut garnet, two beautiful bracelets, and a brilliant and emerald stomacher. A Prize Medal is awarded for the carefulness and elegance of their workmanship.

Creswick, T. J. and N., Sheffield (45, p. 680), exhibit articles important in size and of good taste. They are of plated silver, plated by the old process of uniting the metals by heat: the edges and mountings are of silver. The Jury have remarked among other things some plain candelabra, one of them of antique form, one of the style of Louis XIV., and another of the style of Louis XV. The workmanship of their dish-covers, tea-pots, and trays, is as carefully executed as this style requires, and perfectly adapted for long use. The Jury award Messrs. Creswick the Prize Medal.

A Prize Medal is awarded to Angell, J., 10 Strand, London (111, pp. 691, 692), for his enamelled articles; especially a ewer vase with silver ground, dotted with burnished embossings, and ornamented with turquoise-blue enamels; also another silver-gilt vase, with vine-shaped handle, and burnished and engraved medallions, with enamel ground of green and turquoise blue and cobalt blue; a gold bracelet, with a round medallion of gold, and turquoise blue and red enamel, the chain of which is very beautiful, and another bracelet in the Elizabethan style in gold, brilliants, and light-blue enamel.

Dixon and Sons, Sheffield (38, p. 679). These manufacturers have exhibited a collection of coffee and tea services made of Britannia metal, an imperfect imitation of silver, as are all the compounds used for that purpose; but the forms are as varied as they are well chosen, and might be very advantageously imitated for the same articles in silver: the workmanship is very good, and the Jury award the Prize Medal in consequence.

S. H. and D. Gass, 166 Regent Street, London (83, p. 683), exhibit an article of jewellery in the renaissance style, representing the figure of Britannia, the face and hands of which are of silver, and the drapery of rubies and diamonds: it stands beneath a canopy supported by four columns of garnets with pendants of pearl. The art with which these precious stones are mounted appears to the Jury to be deserving of the Prize Medal, which they award to Messrs. Gass for their skilful workmanship.

J. Keith, 59 Britannia Terrace, City Road (121, p. 694). The communion services exhibited by Mr. Keith are five in number, of silver gilt, and in the mediæval style, well engraved and enamelled. They are rewarded with a Prize Medal.

Watherston and Brogden, 16 Henrietta Street, Covent Garden (105, pp. 690, 691). The Jury have remarked as deserving of the Prize Medal a vase in the ancient style, entirely of gold, enamels, and precious stones. It is in the shape of a covered cup, surmounted by a group in gold representing England, Scotland, and Ireland. The body is a cylindrical bas-relief in gold, unfinished, the subject of which is the landing of the Romans, and the battle of Hastings. Upon the handles are the figures of St. George and St. Dunstan; beneath are two figures of Fame crowning the busts of Nelson, Wellington, Milton, Shakspeare, Newton, and Watt; and on the foot are the figures of Truth, Prudence, Industry, and Valour. The vase weighs 95 ounces; it is decorated with very varied ornaments in enamel, relieved by precious stones and diamond festoons.

J. B. Durham, 456 New Oxford Street. (Class XXI., 46, p. 593.) Amongst the articles made of steel submitted to their examination, the Jury have remarked a beautiful chatelaine, entirely of wrought steel: it is composed of twelve pieces, adjusted with extreme care, and covered with faceted ornaments; several of the pieces, such as the étui, the key, the tablets, and the almanack, have required very long and skilful work, and twelve months were required to complete this chatelaine. It was made entirely in London, and not a single piece of it was stamped. The Jury award Mr. Durham the Prize Medal.

Heeley and Sons, Mount Street, Birmingham. (Class XXII., 305, p. 628.) The Jury likewise award the Prize Medal to these exhibitors for their chatelaines, purse-ornaments, and buckles, made entirely of steel, and of very perfect workmanship.

Leuchars, W., 38 Piccadilly, London. (Class XXIX., 44, p. 791.) The silversmith's work in the dressing-cases of Mr. Leuchars is well made, elegant, and solid. A lady's dressing-case of walnut wood, mounted in the mediæval style, with pierced silver fittings, is particularly to be remarked. The Jury award Mr. Leuchars the Prize Medal.

Capt. L. L. Boscawen Ibbetson, Clifton House, Old Brompton (Class XXX., 323, p. 841), has exhibited some very delicate objects, principally of natural history, botany, and entomology, which he has covered with a metallic coating, sufficiently thin to preserve their details, and of sufficient strength to admit of their being moulded in sand. The casts taken from objects thus prepared retain the exactness of the original, everything on which may be minutely traced by the aid of a magnifying glass. This process combines in its results economy of time and of expenditure with the most desirable accuracy. The Jury award the Prize Medal to its inventor.

E. S. Marshall, 31 John Street, Tottenham Court Road, London (Class XXIII., 104, p. 690), exhibits a collection of gold leaf of all colours. The specimens are fourteen in number. This article is used in various departments of industry. The gold of the same exhibitor for the use of dentists has appeared to the Jury to combine all the desirable qualities of purity and malleability. Samples of platina, palladium, zinc, cadmium, and tin, in leaves of extreme thinness, show to how many different metals the processes of the goldbeater may be applied.

The productions of Mr. Marshall combine all the conditions of evenness and perfection in the work. The Jury award him the Prize Medal.

Wild and Robinson, Oberstein. (Prussia, 889, p. 1097.) The manufacture of articles in onyx and agate, in their natural state or coloured of various hues by artificial processes, has become a large branch of industry at Oberstein. In the collection of Messrs. Wild and Robinson are to be remarked two very beautiful flower-vases of black onyx, coloured, with natural white veins; two large cups of red chalcedony, coloured; large square links of chalcedony, connected together without joints, and alternating in colours,—very curious as regards both the work and the material; also a very beautiful snuff-box of green jasper. This remarkable manufacture claims at the hands of the Jury the Prize Medal.

Brahmfeld and Gutruf, Hamburgh. (54 Hamburgh, p. 1138.) A silver inkstand is exhibited by Messrs. Brahmfeld and Gutruf, in the shape of an oak, at the foot of which are a stag and a doe; near them are two trunks of trees, cut horizontally, serving for the ink-bottle and sand-box. This work, which is cast, is elegant and natural. The Jury award the Prize Medal.

G. F. Haulick, Hanau (413 Prussia, p. 1073), exhibits a carnation in brilliants and rubies, with gold mountings enamelled green. This may also be used as a pin for the hair. It is planted in a small vase of turquoise blue enamel upon gold, with buttons of blue and red enamel, and gold lions' heads bearing garlands; the base is ornamented with green and red oval-shaped ornaments. The Prize Medal is awarded for the *ensemble* of this work.

Strube and Son, Leipzig. (33 Saxony, p. 1106.) A burnished silver vase, its body encircled by carnations, and containing a bouquet of fifteen silver flowers, executed with so much lightness that they appear as if they had been produced by the same process as artificial flowers. This bouquet is an original work of Messrs. Strube and Son, and the Jury deem it deserving of the Prize Medal.

The Royal Prussian Iron Foundry, Berlin (271 Prussia, p. 1064), has contributed a large vase and two candelabra of cast iron inlaid with silver. The vase represents Alexander's entry into Babylon, after Thorwaldsen, and the candelabra support groups of Amazons on horseback and on foot. Judging of these articles as specimens of inlaying with silver, they are deserving of the Prize Medal.

Keller and Co., Oberstein. (888 Prussia, p. 1097.) The Jury award the Prize Medal to these exhibitors for their tea-service of coloured cornelian, consisting of two pots, a sugar-basin, twelve cups and saucers, twelve small plates, and twelve spoons; and for their jewel-cases in green moss-agate. The workmanship, the quality of these objects, and their unusual dimensions, are worthy of attention and approbation.

A. Dutertre, Geneva. (219 Switzerland, p. 1280.) The watch-cases, some in enamel, some ornamented with gold and diamonds, and two engraved gold plates, have attracted the attention of the Jury, who admire the delicacy and correctness of their execution. The gold plates, one of which represents an incident in the life of William Tell, the other a tree with a landscape background, are engraved with extreme precision and delicacy by Mr. Fritz Kundert; the tree, in particular, is of workmanship which will bear the minutest examination with a magnifying-glass. The Jury award M. Dutertre the Prize Medal.

P. H. Grandjean, Serrenoud, Chauxdefonds, Neuchâtel (46 Switzerland, p. 1269), exhibits a gold plate, upon which he has engraved, on a very small scale, a forest, which appears to be copied from an engraving by Kolbe. Its execution is as fine as it is perfect, and has been awarded a Prize Medal.

A. Dubois, Chauxdefonds, Neuchâtel. (43 Switzerland, p. 1269.) Another engraver, M. Dubois, exhibits a gold plate, representing ornamental objects of fruit and flowers, placed upon a console table, supported by Atlases, the whole in the style of Lepautre, engraved so finely that the plate at the first glance resembles a photographic proof. The Jury award him the Prize Medal for this faultless work.

L. A. Golay, Seresche, Geneva (220, p. 1280), has exhibited a small souvenir pocket-book, with cover engraved on white and green enamelled gold, with two medallions upon enamel, one of which represents two Italian women playing with a child, and the other a landscape after Calame. The perfection of these enamels and their beautiful effect merit a Prize Medal.

J. Bennati, Genoa (59, p. 1304). The Jury award the Prize Medal to M. Bennati, manufacturer of silver filigree work, for a statuette of Christopher Columbus discovering a part of the globe by lifting up a veil which covers it. Notwithstanding the boldness of the idea of executing such a subject in filigree, he has shown so much skill and taste in overcoming this difficulty, that his success is surprising, and attributable to the clever arrangement of imperceptible threads, imparting to the *ensemble* of the figure a form at once *indecisive* but correct.

J. Loleo, Genoa. (58 Sardinia, p. 1304). Another manufacturer of filigree, M. Loleo, has executed a column commemorative of the Exhibition, not very durable, but of very choice workmanship. The Jury attach more importance to the beautiful manufacture of trays, scent-boxes, *vide-poches*, sugar-basin with tray, cigar-cases, fans, baskets, and garlands for ladies' head-dresses, which are of perfect execution, of very good taste, and have been rewarded with a Prize Medal.

H. Ratzersdorfer, Vienna. (577 Austria, p. 1036). M. Ratzersdorfer exhibits a toilet-glass, the frame of which is entirely of massive silver, richly decorated with various ornaments, and with numerous groups and single figures. This frame, of elaborate and choice workmanship, merits, in the opinion of the Jury, the Prize Medal.

D. Romain, Rotterdam. (104 Holland, p. 1148). The celebrated Dutch setters of precious stones are represented at the Exhibition by M. Romain alone, who has made a stomacher, consisting of a portrait painted in enamel and surrounded by a bouquet, capable of being divided into three parts, and very cleverly mounted in rose diamonds and pearls, for which a Prize Medal is awarded.

J. Falloise, Liège. (384 Belgium, p. 1163.) It is only a few years since the art of inlaying and damascening iron and copper has been revived in France, Spain, and Belgium. M. Falloise, of Liège, exhibits many different articles, to which he applies this description of decoration. Particularly worthy of remark are—a steel bracelet, with a bas-relief representing a Nereid in silver, with drapery of green and yellow shades of gold, mounted upon a dolphin, and standing out from the ground of inlaid steel in very high relief; two covered cups of copper (*patiné*) inlaid with silver, in the Oriental style; three vases, in the Renaissance style, ornamented on the tray and the stem with flowers, foliage, birds, and masks, inlaid in silver, in relief and engraved; a steel chalice, upon which are numerous tasteful ornaments in gold and silver, inlaid and engraved. These remarkable articles entitle their maker to the Prize Medal.

E. Zuloaga, Madrid. (264 and 264a Spain, p. 1346.) Don E. Zuloaga has exhibited arms, and a cover for a book, of iron and black oxidised steel, richly decorated with bas-reliefs and with damascened ornaments in gold and silver. The pistols, daggers, and sword are exactly of the same style as the book-cover; the latter, intended to contain a Castilian title of nobility, is ornamented on one side with figure-subjects, on the other side with escutcheons and devices. The old Spanish models have served for patterns to all these works, in which the sculpture is deficient in grace and elegance, but its combination with a very beautiful damascening produces such a good effect, that artists are already engaged in copying the articles exhibited by Don E. Zuloaga, to whom the Jury award a Prize Medal:—

Jahn and Bolin, St. Petersburgh. (322 Russia, p. 1377.) The Jury award a Prize Medal to Messrs. Jahn and Bolin, of St. Petersburgh, for their beautiful exhibition of jewellery, as rich as it is perfectly set. Those especially worthy of notice are—A sparkling diadem, containing 11 very beautiful opals, 67 rubies, 1,814 brilliants, and 1,712 roses,—a bracelet of turquoises and diamonds, and a brooch, in the shape of a knot, composed of 754 turquoises,—with a pair of earrings of small turquoises, 709 in number. The settings of these latter objects are almost invisible. The execution of the jewellery work cannot be better.

F. Durand, 41 Rue du Bac, Paris. (1595 France, p. 1253.) A Prize Medal is awarded to M. Durand for a tea-service, consisting of seventeen pieces mounted in stages, forming a pile of silversmith's work, supporting four tea-pots, as many sugar-basins, cake-baskets, and milk-jugs, all in silver, partly oxidised. The silver tea-kettle is heated by a lamp. Around are four niches, with female figures; above the tap, between the niches, there are figures of syrens; in the lower niches there are other female figures. Small Triton Atlases support the milk-jugs. The trays are inlaid with enamel, gilt and ornamented; the whole of the ground is in *repoussé* work, and richly ornamented. The models of the figures have been made by M. Klagmann. M. Durand exhibits besides a table centre-piece of silver, with infantine figures representing the four seasons, water and wine, in the style of Louis XV.; and a racing-cup, with subjects relating to tournaments and carousals in silver gilt, ordered by the late Duke of Orleans.

Odiot, —, 26 Rue Basse du Rempart, Paris. (1671 France, p. 256.) The articles exhibited by M. Odiot consist of large and medium-sized pieces of silversmith's work in the English style, and of workmanship which this skilful silversmith deems best adapted to table-services. All the pieces are of silver, mostly cast, burnished, matted or engraved, and manufactured with care and solidity. The principal articles are—a large vase, with marine divinities, about 4 ft. 6 in. in height; the table-service of M. de la Biboissière, all the covers of which are richly ornamented with sculpture of animals or of inanimate nature; an Arabian coffee-pot, with its *finjams* in burnished and gilt silver; a chestnut plate, representing a damask table-napkin; a coffee-pot and chocolate-pot ornamented with spiral groovings, burnished and beautifully executed; a table centre-piece, representing a wild boar at bay; a large candelabrum, with bacchanalian figures; fine specimens of knives, forks, and spoons, &c. The Jury award the Prize Medal to the exhibition of M. Odiot.

Charles Christofle and Co., 56 Rue de Bondy, Paris. (1562 France, p. 1251.) Messrs. Christofle and Co., who are licensed to work the patent of Mr. Elkington, exhibit a valuable collection of silversmith's work in copper electro-plated with silver, of all sizes. The principles laid down, as to articles of every-day use being made of electro-plate, are applicable to all the exhibitors who have had recourse to this process, and the Jury can make no exception in favour of Messrs. Christofle. They award the Prize Medal to the ornamental articles only which these manufacturers exhibit, such as a centre-piece representing Cupids fishing with a net around a group of trunks of trees, and candelabra, in the same style, of agreeable and animated sculpture.

Constant Valès, 161 Rue St. Martin, Paris. (707 France, pp. 1212-13.) The Jury have noticed with satisfaction the artificial pearls exhibited by M. Constant Valès, who displays great skill in overcoming the difficulties of workmanship, and producing a superior imitation of natural pearls. They award to M. Constant Valès a Prize Medal.

Bouillette, Hyvelin, and Co., 46 Rue St. Avoye, Paris. (1107 France, p. 1231.) The articles exhibited consist of beautiful artificial stones tastefully set, amongst which a stomacher in diamonds, pearls, and emeralds is especially worthy of notice. These manufacturers make the materials themselves, and work for exportation. The Jury award them a Prize Medal.

Truchy, E., 18 Rue du Petit Lion St. Sauveur, Paris. (1045 France, p. 1228.) M. Truchy confines himself especially to the manufacture of imitation pearls, and makes remarkable imitations of those called black pearls, for which the Jury award him the Prize Medal.

F. Dafrique, 8 Rue Jean-Jacques Rousseau, Paris (1575 France, p. 1252), exhibits a collection of jewels, bracelets, chains, brooches, and especially of polychromic cameos, with metal and enamel ornaments,—a happy invention, well carried out, and for which the Jury award him a Prize Medal.

A. Savard, 22 Rue Saint-Gilles, Paris. (1476 France, p. 1246.) This exhibitor cultivates a peculiar branch of manufacture, that of plating gold on red copper. In order to obtain it cheaply, his plates undergo a very accurate process of stamping in steel matrices, which are engraved with great accuracy; and they come out so perfect that they only require to be put together, which M. Savard does with extreme skill. He exhibits miniature frames, bracelets, brooches, and the most delicate ornaments. The Jury award him a Prize Medal.

Savary and Mosbach, 2 Rue Vaucanson, Paris. (368 France, p. 1194.) The imitation stones of Messrs. Savary and Mosbach comprise samples of various descriptions, executed as well as possible, especially their imitation diamonds. The emeralds, and particularly the sapphires, are hardly so perfect, but hitherto manufacturers have been unable to attain perfection in this description of stones. The settings are in very good taste, and very carefully executed. The Jury award them a Prize Medal.

F. A. Thouret, 31 Place de la Bourse, Paris. (1702 France, p. 1257.) M. Thouret exhibits various articles of silversmith's work in copper electro-plated; but the Jury exclusively notice among the productions of this manufacturer the objects of art obtained from antique models with great exactness by means of the electrotype process, such as the Cup of Fulda, and the one representing the Rape of the Sabines: perfectly clean moulds, taken in gelatine from the originals, have served to reproduce these charming models in copper deposited by electricity; the deposits are beautiful, and are silvered and gilt. The Jury have also remarked a beautiful cover for a primer, produced by the electro process, ornamented with subjects from the Old and New Testaments, with superimposed medallions. The Prize Medal is awarded to M. Thouret.

Aucoc, —, sen., 6 Rue de la Paix, Paris. (1052 France, p. 1229.) The beautiful fittings for travelling cases, exhibited by M. Aucoc, containing very important articles of silver and silver-gilt worked in the English style, are worthy of particular notice, and have been awarded a Prize Medal.

Lerolle Frères, 1 Rue de la Chaussée des Minimes, Paris. (1318 France, p. 1239.) The articles exhibited consist of bronzes, clocks, candelabra, groups and figures mostly gilt, and silvered in parts. Their display of articles is considerable, and nothing which they have sent has been made for the occasion. The Jury, though observing in the productions of Messrs. Lerolle Frères a certain degree of negligence of style, deem them nevertheless deserving of the Prize Medal.

Miroy Frères, 10 Rue d'Angoulême-du-Temple, Paris. (646 France, p. 1209.) A considerable assortment of decorative articles in zinc and alloys of common metals, bronzed, gilt, or silvered, constitutes the exhibition of Messrs. Miroy Frères. This branch of industry places within the means of all classes, and at very low prices, ornaments of rich appearance, such as statuettes, candelabra, clocks, &c. &c.: the greater part of these figures are cast in reverse, the bronzing, gilding, and silvering, being obtained by the electro process, the effect of which is remarkable in this description of articles, wherein it is desirable to combine effect with economy. The Jury award them the Prize Medal.

V. P. Boyer, 38 Rue Saintonge, Paris. (70 France, p. 1175.) The Jury award the Prize Medal to M. Boyer for his bronze figures electro-gilt, in which the gold is very well employed, exhibiting fine, burnished, dead, yellow, and green gold in large surfaces, or in imitation of damascening.

A. Lacarrière, 9 Rue Saint Elizabeth, Paris. (1284 France, p. 1238.) Amongst the imitations of precious metals there are two large candelabra in cast-iron, partly bronzed, and partly gilt with varnish, exhibited by M. Lacarrière. These candelabra, adapted for burning gas, of large size and very beautiful execution, are exceedingly good imitations. The same manufacturer exhibits beautiful gas-fittings well put together, gilt by the same process as the candelabra, adapted very skilfully to ornamental purposes, and to the conveying of the gas. The Jury award M. Lacarrière the Prize Medal.

F. Villemsens, 57 Rue Saint Avoye, Paris. (1707 France, p. 1258.) The principal gilt bronzes manufactured by M. Villemsens are a tabernacle, having enamels on the door and on the rose-work, in the Gothic style,—a ewer with tray, in which the carved work of the helmet and shield of Francis I. is introduced with great ability and judgment,—also two candelabra with branches, the bases of which are ornamented with the trophies of the Porte St. Denis, very ingeniously arranged and silvered. The Jury award the Prize Medal to this exhibitor.

P. Poussielgue-Rusand, 34 Rue Cassette, Paris. (1405 France, p. 1243.) By devoting himself exclusively to the manufacture of church-plate, M. Poussielgue-Rusand has become a master of this particular branch of art. He has availed himself of the best ancient and modern models: his large enamelled shrine, after designs of the Abbé Martin, has a very beautiful effect, with the exception of the small engraved medallions: he exhibits also a bronze ewer gilt and enamelled, and silvered croziers richly ornamented with carving and enamels. The Jury award him the Prize Medal.

P. J. Lahoche, 162 Palais National, Paris. (1287 France, p. 1238.) Among the articles exhibited by M. Lahoche, the Jury have remarked a dark-blue porcelain clock, with mountings and Cupids in gilt bronze in the Louis XVI. style: a centre-piece for the table: a large oval basket of porcelain, of a light-blue ground, supported by Cupids with tails of fishes, and garlands having branches to hold candles; also the two candelabra vases which accompany it; finally, two dark-blue porcelain vases, with a very beautiful mounting in gilt bronze forming a garland. The Jury award this exhibitor the Prize Medal.

L. D. J. Audot, 81 Rue Richelieu, Paris. (11 France, p. 1170.) The beautiful fittings for the dressing-case of the Princess Wolkonski, manufactured by M. Audot, are of engraved silver, and of very good workmanship. The same exhibitor shows a very beautiful vase, with triple spout of reticulated silver highly finished of an interlaced form, the spout and handles gilt, with flowers and foliage in relief, and gilt in three colours. The fittings of another dressing-case are entirely of waved silver, inlaid with enamel and damascened, having a very good effect. These articles are deserving of the Prize Medal, which is awarded to M. Audot.

C. S. Matifat, 9 Rue de la Perle, Paris. (923 France, p. 1224.) As a manufacturer of gilt bronzes, M. Matifat has sought novel, varied, and elegant forms, and has been as careful in the execution as in the choice of his models. The Jury have remarked with pleasure the beautiful mounting of a large mosaic table: this mounting is entirely in gilt bronze, with heads of chimeras and lions' feet, of a solid design and very well chased. The clock, with a group of a female satyr and her child after Clodion, and the cup of old Sèvres, with modern painting and beautiful mounting of bronze gilt, are objects particularized as deserving of the Prize Medal. (Awarded a Council Medal by Jury of Class XXII.)

A. Thoumin, 44 Boulevard Beaumarchais, Paris. (696 France, p. 1212.) The Jury award the Prize Medal to M. Thoumin for his stamped brass furniture ornaments. The rough patterns of the articles exhibited are placed in juxtaposition with the finished samples, in order that the precision of the stamping may be appreciated. The finished ornaments are lackered in a colour much resembling gold.

A. R. Payen, jun., 18 Boulevard Saint Denis, Paris. (1674 France, p. 1257.) The jewellery is intended for exportation, and composed with much taste. This exhibitor makes filigree work after the manner of the Indians, and employs to advantage numerous real pearls of small size. The Jury award a Prize Medal to the intelligent workmanship of M. Payen.

J. Aubanel, 43 Rue de Trévise, Paris. (1055 France, p. 1229.) The articles exhibited by M. Aubanel consist of a rich chimney-piece in the Louis XIV. style, in gilt bronze. The two ends are occupied with vases filled with fruit; a light and gracefully-outlined arcade is placed in the middle, and surmounts an oblong vase, whilst it supports another in the shape of a church lamp, from which issues a girandole for seventeen candles. All the vases are of "griotte" marble. The Jury, seeing much merit in this work, award M. Aubanel the Prize Medal.

Levy Frères et Co., 76 Rue des Fossés du Temple, Paris. (595 France, p. 1206.) The workmanship of these exhibitors, without making pretensions to an elevated is far above an ordinary character. They produce in their own manufactory all their gilt bronzes, which they use for the decoration of porcelain mounted by them with much propriety and richness. Turquoise-blue porcelain of subjects in the style of Watteau is exhibited; and the judicious manner in which it is mounted in highly-ornamented gilt bronze, deserves the Prize Medal awarded by the Jury.

A. Weygand, 108 Rue Vieille du Temple, Paris. (740 France, p. 1215.) The blue porcelain vases, mounted with gilt bronze, representing Syrens, and the clock representing Agriculture, in gilt bronze and ivory, exhibited by M. Weygand, render him deserving of the Prize Medal. The work of these articles is generally in good taste: nevertheless the architecture of the pedestal of sea-green on which rests the statue of Agriculture, in itself presenting a beautiful combination of gold and ivory, is not satisfactory. The remainder of this collection contains some pretty figures in bronze, which the Jury regret it is not within their province to notice.

A. Caron, Passage de l'Opéra, Paris (1133 France, p. 1232), gunsmith, exhibits pistols very richly silvered, gilt, and damascened. The Jury award M. Caron the Prize Medal for this portion of his collection.

Moutier le Page, 11 Rue Richelieu, Paris. (1364 France, p. 1241.) The Jury award a Prize Medal to M. Moutier le Page for a hunting-knife, the hilt of which is ornamented with a pommel representing an heraldic shield emblazoned with a lion in red enamel, accompanied by savages in coloured gold, terminating in foliage of another kind of gold, and armed with golden clubs with silver points; the shield is surmounted by a steel helmet with a rich wreath and crest. This work is executed in gold of various colours, inlaid to a great depth on a steel core, and is a specimen of the application of jewellers' work to side-arms.

F. Prélat, 41 Rue de la Ferme des Mathurins, Paris. (1681 France, p. 1257.) The arms exhibited, particularly the pistols, are embellished with gold damascening, and gilt relievo ornaments. The quality of his work entitles this exhibitor to a Prize Medal.

L. A. Bruneau, 40 Rue de Montmorency, Paris (1119 France, p. 1232), manufactures a variety of articles, such as flat purses, office-articles, boxes inlaid with enamel, pocket-companions, scent-bottles, cigar-cases, with representations of various subjects, cast, chased, and in *repoussé* work, or produced by the electro process. The execution is in keeping with all the objects, and M. Bruneau carries out with intelligence this eminently Parisian branch of commercial industry. The Jury award him a Prize Medal.

— Lefaucheux, 37 Rue Vivienne, Paris. (1308 France, p. 1239.) The Jury award a Prize Medal for the beautiful gold mounting of a carbine; for a double-screw plate for a gun, ornamented with dogs, inlaid and sculptured in gold, after models by M. Lechesne; and for the fine galvanic gilding of his weapons.

— Desfontaines, of the house of Leroy et Fils, Palais National, Paris. (1186 France, p. 1234.) M. Desfontaines exhibits a clock and a set of ornaments for the chimney-piece, which present a novelty in the material employed for the sculptures. The bodies of the clock, and of the candelabra vases which accompany it, are of dark-blue porcelain: all the ornaments and fittings are executed in cast-iron, polished and damascened in gold. The clock is ornamented with a composition representing five knights struggling for the *oriflamme*, one of whom is unhorsed,—a very animated scene, and executed with talent. The candelabra vases are surmounted by a figure of St. Michael in armour, holding in his hand a drawn sword: on the handles are two knights combating with dragons; and the feet are formed of three lions, with bats' wings: this work, taken as a whole, the effect of which is highly satisfactory, must have presented great difficulties of execution, which M. Desfontaines has surmounted in a happy manner, while the judicious employment of the gold relieves the harsh colour of the cast-iron. The Jury award the Prize Medal.

The Jury of Class XXIII. make Honourable Mention of the following Exhibitors, their several claims to which are indicated after their names:—

Lister and Sons, Newcastle-upon-Tyne. (27, p. 676.)

Silver plate for tea and coffee-service: a brooch in blue enamel with fleur-de-lis.

Reid and Sons, Newcastle-upon-Tyne. (3, p. 673.) Silver plate for table-service, and candelabra.

M. McGregor, Perth. (46, p. 680.) A ram's head richly ornamented.

Rettie and Sons, Aberdeen. (24, p. 675.) Bracelets of Aberdeen and Peterhead granites: Scotch jewellery.

Marshall and Sons, Edinburgh. (23, p. 675.) Cup, chatelaine, and bracelets in agate.

Cartwright and Hirons, Birmingham. (30, p. 676.) Silver plate for the table.

E. and J. Seymour, 40 Gerrard Street, Soho, London. (72, p. 682.) Portraits upon enamel of the Queen and Prince Albert.

Henrys and Co., 2 Budge Row, London. (131, p. 694.) Imitations of diamonds, pearls, and precious stones.

E. Matthews, 46 Berwick Street, Soho, London. (95, p. 686.) The Royal Arms of England engraved upon brass on a background of tin, in imitation of enamel.

E. Nash, 30 Coppice Row, Clerkenwell, London. (86, p. 683.) Snuff-boxes in dark tortoiseshell, inlaid with gold "de burgos" and "pique."

W. Mott, 36 Cheapside, London. (116, p. 693.) Pencil-cases and pen-holders in various styles.

J. Mayer, 68 Lord Street, Liverpool. (14, pp. 674-75.) Blue enamelled gold brooch in the form of a knot of ribbon: a necklace in gold, formed of a chain-work of scales, with medallion with three emeralds and two brilliants.

S. Wertheimer, 35 Greek Street, Soho, London. (Class XXVI., 177, pp. 746-47.) A bronze casket, gilt, pierced, and stamped: an inkstand ornamented with slabs of painted china and with gilt mountings.

Smith, Nicholson, and Co., Duke Street, Lincoln's Inn Fields, London. (110, p. 691.) Silver flower-stand.

R. Attenborough, 19 Piccadilly, London. (113, pp. 692-93.) A plain tea-set gilt in the inside: a set of spoons and forks in the style called the Paxton pattern: bracelets in the form of a cross; one of them in brilliants upon gold and dark-blue enamel, the other in rubies upon diamonds and turquoise-blue enamel.

W. Baird, 72 Argyle Street, Glasgow. (26, p. 676.) Ram's head richly mounted, the ornaments being silver thistles.

H. Wilkinson and Co., Sheffield. (44, p. 680.) Large pieces of silver plate and table ornaments.

Widdowson and Veale, 73 Strand, London. (100, p. 690.) Rings mounted with fine stones: a bandeau of diamonds with an emerald in the centre: a green and red enamelled curb-chain necklace with pendants.

G. Angell, 51 Compton-street, Clerkenwell, London. (103, p. 690.) Vases in the Etruscan style, of various shapes.

G. R. Collis, Church Street, Birmingham. (34, p. 677.) Large silver waiters: tea-service gilt and burnished in the inside and engraved on the sides: a large chocolate-pot with outline ornaments.

F. Allen, Birmingham. (Class XXII., 293, p. 627.) Vases of red glass surrounded by filigree-work: bouquet of the same description of workmanship.

H. Buss, 13 Great Newport Street, Leicester Square, London. (79, p. 682.) A shield in enamel, representing the heraldic devices of the nations whose works are shown in the Exhibition.

Martin, Baskett, and Martin, Cheltenham. (2, p. 673.) A chatelaine in gold and turquoise-blue enamel: a watch of turquoise-blue enamel and brilliants, with a chain of gold and enamel of the same colour.

G. and S. Waterhouse, 25 Dame Street, Dublin. (20, p. 675.) Brooches made from materials of Irish produce, and copied from the antiques of that country.

J. and F. Biden, 37 Cheapside, London. (51, pp. 680-81.) The engraving armorial bearings upon stones, for private and official seals.

C. Goodwin. (64, p. 681.) Bloodstone cup.

Phillips Brothers, 31 Cockspur Street, London. (87, p. 684.) Statuettes in oxidised silver: pins and fancy jewellery in gold and enamel.

G. W. Adams, Hosier Lane, London. (88, pp. 684-85.) Knives, forks, and spoons, of the pattern called Tudor.

Marsaux and Legrand, 14 Rue de la Perle, Paris. (332, p. 1193.) Stamped yellow copper for furniture decoration. (Awarded a Prize Medal by Jury of Class XXII.)

F. Laurent, 5 Rue Chapon, Paris. (564, p. 1205.) Fittings for dressing-cases in waved silver. (Awarded a Prize Medal by Jury of Class XXIX.)

L. Rouvenat, 62 Rue Hauteville, Paris. (1460, p. 1245.) Patterns of sword-hilts and mountings.

A F. Pichard, 26 Rue des Blancs Manteaux, Paris. (1388 France, p. 1242.) Imitation of gold and precious stones: brooches, bracelets, and flowers, made in imitation-diamonds with enamelled ribbon.

E. Maillot, 28 Rue Grenier Saint Lazare, Paris. (597 France, p. 1206.) Mountings for smelling-bottles.

J. B. Marchant, 57 Rue Richelieu, Paris. (607 France, p. 1207.) Chimney-ornaments in gilt and silvered bronze: military figures. (Awarded a Prize Medal by Jury of Class XXII.)

B. Houllier, 36 Rue de Cléry, Paris. (1628 France, p. 1255.) Damascene pistols inlaid with gold of various colours.

J. H. Cornillon, 36 Rue du Temple, Paris. (95 France, p. 1166.) Scent-bottles for the toilette-table coated with copper by the electro process, and afterwards carved, engraved, and gilt.

Desjardins-Lieux, 4 Passage St. Avoye, Paris. (1588 France, p. 1253.) Statuettes, bas-reliefs, and medals, in stamped silver and bronze.

Detouche and Houdin, 158 and 160 Rue St. Martin, Paris. (1589 France, p. 1253.) Mountings of a large clock in gilt bronze, in the style of Louis XVI.

F. Kirstein, Strasbourg. (281 France, p. 1190.) Deer in a forest, in *repoussé* silver.

Jünger Jacob, widow of, Hanau. (409 Prussia, p. 1073.) Samples of enamels.

M. Goldschmidt and Son, Frankfort-on-the-Maine. (20, 5 Zollv., p. 1122.) Set of jewels in gold, green enamel, and brilliants.

B. Schreger, Darmstadt. (51, Grand Duchy of Hesse.) Jewellery in oxidised silver.

G. I. Hoffmann, Dantzig. (440 Prussia, p. 1075.) Yellow amber necklaces.

L. Bolzau, Lemgo, Principality of Lippe. Mountings for meerschaum pipes.

G. E. Jantzen, Stolp. (205 Prussia, p. 1059.) Necklace, brooches, and articles for dressing-cases, in lemon-coloured amber.

L. Geismar and Co., Wiesbaden. (13 Nassau, p. 1132.) Brooches and lids for boxes, carved in ivory, with subjects of the chase. (Awarded a Prize Medal by Jury of Class XXVIII.)

William Bergmann, Warmbrunn, near Hirschberg, Silesia. (207 Prussia, p. 1059.) Brown rock-crystals cut.

C. Weber, Mannheim. (325 Prussia, p. 1069.) A ring of Rhine pebble.

S. Mercier, Geneva. (96 Switzerland, p. 1273.) Enamelled watch-cases. (Awarded a Prize Medal in Class Xb.)

J. F. Bautte and Co., Geneva. (236 Switzerland, p. 1281.) Paper-weight of enamelled gold, with mechanical singing-bird.

J. Patton, Chauxdefonds, Neuchâtel. (44 Switzerland, p. 1269.) Plate of gold engraved with inscriptions in various characters.

H. Grohmann, Prague. (576 Austria, p. 1036.) Bohemian garnets set in buttons; buckles, necklaces, smelling-bottles, and bracelets.

A. Portelli, Valletta, Malta. (23 Malta, p. 944.) Filigree-work.

E. Critien, Valletta, Malta. (24 Malta, pp. 944-45.) Filigree-work.

S. Falson, Valletta, Malta. (25 Malta, p. 945.) Filigree-work.

B. G. Mamede, Portugal. (1022 Portugal, pp. 1316-17.) Set of amethysts in gold filigree-work, with earrings in the form of parasols placed one above another.

A. de Franca, Portugal. (1022a to 1022c Portugal, p. 1317. Snuff-box of silver, waved and engraved.

Paris, November 1851.

D'ALBERT DE LUYNES, Reporter.

CLASS XXIV.

REPORT ON GLASS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

Lord DE MAULEY, F.R.S., *Chairman and Reporter*, 21 St. James's Place.
E. H. BALDOCK, M.P., *Deputy Chairman*, 5 Hyde Park Place.
R. L. CHANCE, Glass Works, Birmingham; Glass Manufacturer.
L. C. DUNCAN, United States; Barrister.
*JULES FRISON, Belgium; Glass Manufacturer, Member of Chamber of Commerce at Charleroix.
ROBERT ORRARD, 2 Crescent, Blackfriars; Merchant.
EUGENE PELIGOT, France; Professor at Museum of Arts and Sciences; Member of the Central Jury.
Dr. SCHUELER, Zollverein; Mining Councillor.

Associates.

GEO. BONTEMPS, at Messrs. Chance and Co.'s, Birmingham; Glass Manufacturer.
Sir DAVID BREWSTER, Principal of the University, St. Andrews. Juror in Class X.
JOSEPH CHATER, 24 St. Dunstan's Hill, Tower Street; Window Glass Dealer.
ALFRED B. DANIELL, 18 Wigmore Street; Flint Glass Dealer.
W. MORTLOCK, 18 Regent Street; Flint Glass Dealer.
PHILIP PALMER, 118 St. Martin's Lane; Window Glass Dealer.
JAMES POWELL, 16 Temple Street, Whitefriars; Flint Glass Manufacturer.
ANDREW ROSS, 2 Featherstone Buildings, Holborn; Optician.
WM. SWINBURNE, 93 Upper Thames Street; Plate and Crown Glass Manufacturer.
CHAS. WINSTON, 3 Harcourt Buildings, Temple; Barrister.
THOMAS WOOD, 19 Greek Street, Soho; Plate Glass Silverer.
ERNEST ZUCCANI, Brick Lane, Spitalfields; Looking Glass Manufacturer.

* Professor JULES CHANDELON, Proxy for M. Frisen.

THE limits to which the Reports of the Juries must necessarily be confined will admit of a very brief and cursory sketch only of the rise and progress of this manufacture.

Its origin is uncertain, and has been ascribed by some of the writers of antiquity to accident. Josephus claims the discovery for the Israelites; Pliny assigns it to the Phœnicians, and states that the first glass-houses were erected in Tyre, where the only staple of the manufacture existed for many ages. Herodotus and Theophrastus likewise confirm the fact of the use of glass having been known in the earliest periods of civilization, and of the establishment of works for its fabrication in Egypt and Phœnicia, and even in India, where rock crystal was employed in its composition. It is mentioned in the book of Job, "Hast thou with him spread out the sky, which is strong, and as a molten looking-glass?" But possibly this expression may have been intended, in the original Hebrew, to refer to the metallic speculum.

The Egyptian philosophers had made chemistry their study, and attained to a very high degree of proficiency in that science. They involved it in the same mystery as they did their religious rites, and claimed for it from the people the same respect as for an institution of divine origin; and it is not surprising that they should have discovered in the prosecution of their researches, the simple process of vitrification, resulting from the action of intense heat upon siliceous particles, combined with alkaline salts; and that they should at once have perceived the facility of working the malleable substance thus produced, which possessed the quality of becoming hard and transparent as it gradually cooled.

This fact once established, their artistic skill, with the aid of science, could not fail of advancing another step, and of availing itself of the means of conveying form and colour to the shape, and of dealing with it for purposes of ornament and utility; as we see exhibited in the few beautiful remnants which have been brought to light in the excavations of modern times.

The process of manufacture, detailed by Pliny in the curious and interesting chapter of his "Natural History," (lib. 36, cap. 25,) appears to have been very much the same as that practised at the present time; and Sir Gardner Wilkinson (vol. iii., page 89), gives the representation of two glass-blowers inflating a piece of molten metal, by means of hollow tubes; taking from a painting of Beni Hossan, executed during the reign of that monarch, who lived about 3,500 years ago, and adds, "That glass vases, if we may trust to the representations in the Theban paintings, are frequently shown to have been used for holding wine, as early as the Exodus, about 1,490 years before the Christian era." The remains of Alexander the Great are said by Suetonius and Strabo to have been delivered to Augustus, when he was in Egypt, in a glass case, in which Seleucus had deposited them after removing them from a golden urn.

This substance is supposed to have been used by Archimedes for scientific purposes, and an orb of glass is mentioned, as having been constructed by him, which gave rise to the epigram put into the mouth of Jupiter by Claudian—

> Jupiter in parvo cum cerneret æthera vitro,
> Risit, et ad superos talia dicta dedit.
> Huccine mortalis progressa potentia curæ;
> Jam meus in fragili luditur orbe labor!
> Jura poli, rerumque fidem, legesque virorum,
> Ecce Syracusius transtulit arte Senex!

There is in the British Museum a perfect and beautiful goblet, excavated by Captain Layard from among the ruins of Nineveh. It has a name (probably that of the contemporary sovereign, or of the maker) engraved upon it; and from the characters employed, and the locality in which it was found, it is believed to be of a date not less recent than seven centuries before the Christian era, and is probably the most ancient piece of manufactured glass in existence. The Barberini, commonly known as the Portland Vase, likewise in the British Museum, and broken a few years ago by a fool, or a madman, shows the perfection to which the art was carried at a somewhat later period.

The commercial intercourse of the Phœnicians and Egyptians with the islands of the Mediterranean, and with Etruria, extended to them, and even to more remote regions, the use of this material. But it was not till the reduction of Egypt imparted to the Romans a more intimate knowledge of the arts practised in the conquered country, that the use of glass became general in Italy, and formed a very important article of commerce.

In the reign of Tiberius, works for the manufacture of glass were first established in the neighbourhood of Rome, and many instances are given by the writers of the day of the estimation in which it was held, and of the enormous sums occasionally paid for vases, or goblets of that substance, which were preferred by many to those made of the precious metals. It was employed by them not merely as an article of luxury in their feasts, or as an ornament in their palaces; but it served to decorate their altars, and for a pious offering in the tombs of the dead. Many fragments have been found in the catacombs, showing it to have been used likewise by the early Christians in their places of worship.

How far glass entered into the common purposes of domestic economy does not clearly appear; but it has been described as having been employed in the construction of hollow columns in the theatres, in which lamps were placed for the purpose of illumination; it was likewise used for incrustation of the walls of apartments, instead of marble; and to this use the expression "vitreæ cameræ," employed by Pliny, has been thought to apply, whilst some commentators have considered that expression as referring to windows. But there is no positive authority for the use of glazed windows earlier than the close of the third century, when they are alluded to by Lactantius, who compares the researches of the mind with the operations of the eye, regarding external objects "per fenestras lucenti vitro, aut lapide speculari obductas." St. Jerome also mentions windows, formed of melted glass, cast into plates (A.D. 422).

A sheet of glass is said to have been found a few years ago in a window-frame at Pompeii, but the fact does not appear to be very well authenticated, and at all events it can only be one of very rare occurrence. After the removal of the seat of empire to Byzantium, the arts suffered amidst the disturbances and confusion which prevailed in Italy during the decline of the Western Empire. Constantine had assembled around him all that could tend to the cultivation of art, and the embellishment of his new city, and there still remain in the cabinets of our days some few specimens, showing the perfection to which the manufacture of glass was carried in his time, and that of his immediate successors.

Venice, according to her early writers, had been in possession of the art of glass-making almost as early as the foundation of the city itself; but the capture of Constantinople (1204), in which she took so great a part, and the extension of commerce which this event afforded her, induced her wealthy merchants to avail themselves of their increased relations with the East for the improvement of their domestic manufactures.

As early as the beginning of the 13th century, glass had been a subject of special attention to the Venetian government, and was regarded by them with so much care, as to have been, according to Carlo Marino, "in ogni tempo considerata dal governo, qual pupilla degli occhi suoi." The trade and manufacture of this article increased so rapidly as to require a large number of additional buildings for carrying it on, and great uneasiness was excited among the inhabitants, lest fire might accidentally occur among them. In 1291 they were in consequence removed from the city, and the island of Murano was assigned by the government for their reception. Considerable privileges were, at different times, accorded to the merchants of Murano, with the view of adding importance to their operations. A separate jurisdiction, independent of all the authorities of Venice, excepting the supreme council, was granted to them; and a *libro d'oro*, in which the most eminent members of their guild, or fraternity, were registered, placed them in a position equivalent to that of the nobles in a monarchical state. But, on the other hand, they were subject to very stringent regulations. They were prohibited, under severe penalties, extending to their families, and even to their relations, and involving the loss of life and property, from conveying to any foreign country the secrets of the manufacture, or the materials employed; or even from affording their own individual services, by which the competition of foreigners with the trade of Venice might be promoted. An immense trade in beads, imitations of pearls and of precious stones, was carried on with the coasts of Asia and of Africa, and extended to India and to China; and continues by means of the commercial intercourse of England with these countries to the present day.

The revival of art in Italy had a beneficial effect on the manufactures of Venice, and improved the design and the colours of her produce. Her mirrors, her table-glass of variegated colours and spiral stems, her bottles and cups, obtained a very high reputation, and became the source from which the wants of Europe, Africa, and Asia continued for a time to be supplied.

But, in the 15th and 16th centuries, events occurred which greatly affected the prosperity of Venice. The passage to India and to China, round the Cape of Good Hope, and the discovery of America, changed the whole system of European commerce, and threw open to Portugal and to other States the advantages which Venice had almost exclusively enjoyed. England and Holland had forced their way into the Levant trade, up to that period monopolised by the Venetians and Genoese. The policy of Soliman, who, after the capture of Constantinople (1453), endeavoured to turn the commerce of the East into channels which he could control, or from which he could derive advantage; and the loss of Candia and of Cyprus, operated still further to the disadvantage of Venice. The mystery in which she involved all her transactions, and the severity of her fiscal arrangements, by which she endeavoured to preserve her monopoly, impeded her own progress, whilst her exclusive system excited a spirit of competition among her neighbours, which rendered them successful rivals; and her own commerce and manufactures, assailed and undermined in so many different quarters, were rapidly giving way.

Her trade in glass suffered with the rest; and Bohemia, Germany, France, the Netherlands, and England, derived advantage by the dissolution of the Venetian monopoly, by the improvement of their established manufactures, or by the introduction of a new process into their respective States; where, to this day, the works of the artists of Venice are still adopted as models of great beauty and skill, inferior only to the still more perfect productions of ancient Greece and Rome.

Bohemia was the first to emancipate herself from a state of commercial dependence upon Venice, and to resort to her own resources for her supply. Her forests afforded fuel and potash in abundance; silex and lime of excellent quality were to be found in the immediate neighbourhood of her existing works, and probably led, in the first instance, to the introduction of an improved system into that country; giving the manufacture an impulse which, combined with skilful manipulation, caused it to make rapid progress in the peculiar qualities requisite in the art.

The Bohemian proprietors having no other means of obtaining a return for those resources, which abounded on their estates, were induced to support the manufacture by their own exertions, and even to embark in the trade themselves. They have thus been enabled to bring into the market a beautiful article of commerce, and to compete successfully with countries possessing larger capitals, but where a higher price is paid for labour, and where many of the substances used in the manufacture require to be imported. The Venetian origin of their craft shows itself to this day in the reticulated pattern, the Eastern forms, the taper stem, and the variety of colours. Their colours, and engraving, and imitations of precious stones are likewise very beautiful; but at the best they are but an imitation of Venetian art.

Bohemian glass is a silicate of potash and lime, and has no lead in it. The manufacturers of that country make use of the same materials in the construction of the metal, whether employed for window-glass or mirrors; with this exception, however, that for the last 25 years they have been using sulphate of soda, instead of potash, for making common window-glass. The same combination of materials prevails generally throughout Germany.

The manufacture of glass had probably been introduced into France at the same date as into Germany, and had been practised for common purposes from the earliest centuries of our era. Both countries derived their knowledge of it from the Romans; or probably from their commercial intercourse with the East, improved by the Romans, and still farther advanced in quality and artistic ornamentation, adopted from the Venetians. But it was not till a later period that France sought to increase the supply of her own demands, by paying greater attention to her manufactures at home.

As early as the fourteenth century, her government, with the view of inducing persons of education and capital to enter into the business, had declared that occupation to be in nowise incompatible with the dignity of the aristocracy, and decreed that none but gentlemen should venture to engage in any of its branches; and, as late as the latter part of the seventeenth century, the glass-blower might be seen laying aside his cocked hat, dress-coat, and sword, to prepare for the performance of his daily work. Other important privileges were granted to the manufacturers, and confirmed by a Royal Charter of Incorporation. But as education and capital became more generally diffused, these exclusive privileges were found to be injurious to the prosecution of trade, and have from time to time been modified; they still, however, remain in sufficient force to have an injurious effect upon the operations of the manufacturer and the merchant, and the convenience of the public. Privileges of this nature were no doubt intended for the promotion of trade, by holding out advantages to individuals disposed to apply their capital and industry in the pursuit. But the import duties, which afforded protection to the speculator, were likewise resorted to by the government, in order to assist the revenues of their States; and whether a sort of patent right were conceded to the speculators, or import duties were imposed for the purpose of checking foreign competition, the result was the same,—injury to the manufacturer, and inconvenience to the public. The fiscal regulations affecting glass in the reigns of James and Charles were of this character; and the excise and customs' duties in England, imposed at a later period, proved still more objectionable.

The first tax on glass was imposed 6 and 7 William and Mary, subjecting all glass wares manufactured in England, or imported from foreign ports, to a duty therein prescribed. It was shortly afterwards reduced to one-half; and in 10 and 11 William III. "it was totally repealed, being found to be vexatious, and troublesome in the levying and collecting, and of small advantage to the Crown, and, if continued, it would lessen the duty on coals employed in the manufacture, throw great numbers of poor out of work, and endanger the loss of a manufacture so beneficial to the kingdom."—*Parliamentary Reports*, 1835. In the latter part of the reign of George II. an attempt was made to renew the tax in a somewhat different form, but it was again found necessary to modify it. Several Acts were passed in the reign of George III., which not only added very considerably to the duties weighing upon the home manufacture, but likewise established regulations relating to the process of fabrication, the thickness and weight of the articles manufactured, and the powers and duties of the officers employed, which, in addition to the pressure of the tax, were particularly disadvantageous in a business "which necessarily depends for its success on the application of scientific principles to the various combinations of the materials, which are used, either as fluxes, or to form the basis of the product; and especially to the due regulation of heat, both as to its intensity and duration." A uniform system of regulation, prescribed by Act of Parliament, and executed by officers, who, however well meaning, were generally ignorant of the details of the business, could not fail of being vexatious, and of operating to the detriment of the manufacturer.

The 6 George IV. extended the duty to Ireland, the immediate consequence of which was a great and general depression of the trade. The primary intention of the excise laws was to secure the due payment of the tax, and to establish checks both on the manufacturer and on the officers employed in levying the tax; but they likewise assisted one branch of the manufacture at the expense of another. For instance, a severe restriction was imposed on the bottle and crown-glass trade; the object of which restriction was to promote the use of flint-glass, which is prepared from much more costly materials, and was charged with a rate of duty much higher than that on bottle glass. The repeal of the excise laws removed the restriction, and was consequently more advantageous to the manufacturer of bottle and crown glass, than to the persons engaged in the manufacture of flint; as the former were thereby enabled to supply a much cheaper article than flint glass, for all those purposes in England to which this material is adapted, as is the case in those countries where excise regulations do not exist. The gobletterie on the Continent (including phials and small glasses) is usually made of crown-glass, and is much cheaper than in England, where the pressure of the tax impeded the manufacture; so much so, that in many instances in England bottle and crown glass were manufactured of such good quality, as to lead to the strong suspicion that their improvement must have been effected by the use of materials not authorized by law, and consequently not consistent with the protection afforded by that law to the flint-glass trade. But there were other provisions of the statute equally injurious, and which led to evasions in the highest degree disadvantageous to the legal trader, as well as to the revenue.

The most considerable advance in duty took place in 1812, and the immediate effect on consumption was as follows:—The annual average quantity of glass of all kinds, made for home use during the three years ending in 1812, was 413,414 cwt.; the average of the three following years ending in 1815, was 264,931 cwt., showing a decrease of about 35 per cent. in the quantity made. In the quantities retained for home use in 1793, when taxation was comparatively low, and in 1829, there was a decrease of 9,626 cwt., notwithstanding the great increase of population, and the advance of civilization made during the interval by all classes.

So much has been written on the subject of glass, that it would be merely a repetition of the able and interesting information given in the different Encyclopædias, and in the many treatises on the history and manufacture of glass, if in our Report we attempted to do more than briefly allude to the details of the manufacture. But it is important to bear in mind that the basis of all glass, at all times and in all countries, is the same—silex and alkali, two apparently opaque bodies, which by their fusion produce a transparent result.* The alkali acts as a flux, and facilitates the vitrification of the earthy particles, which separately are unvitrifiable; and gives to them a pliability, when hot, which admits of their being blown, wrought, extended, and even hammered. It is remarkable that the glass found by Mr. Layard at Nineveh, now in the British Museum, bears the marks of having been turned, a process seldom attempted by the modern artists, though the application of the grinding tool, fixed on a lathe, approaches to the practice.

To the silex and alkali other substances are added, for the purpose of facilitating the flux and of purifying the metal, and imparting to it some peculiar quality or colour. Metallic oxides are employed for this purpose. The oxide of lead, in the form of minium, is principally used in flint-glass, and increases its brilliancy, the purity of its colour, and the power of its refraction. Manganese, formerly known as glass-makers' soap, is also in general use for the purpose of clearing the glass of all colouring matter. Its effect may probably be ascribed to the facility with which it gives up its oxygen, which combines with the colouring principles and destroys them. But very great care must be taken lest the remedy, applied for the removal of one description of defect, should give rise to others of an opposite character. The presence of too much alkali attracts humidity, and (to use the glass-makers' phrase) disposes it to sweat. It also diminishes the refractive power of the glass, and when used in the state of undecomposed sulphate of soda, or potash, renders it opalescent. Lead in excess will produce equally bad effects: it will soften the substance of the glass, affect its clearness, and, in course of time, render the surface liable to be altered and decomposed. The importance of lead in this manufacture, whether in the form of litharge or of minium, which is obtained by oxidizing litharge, is so well understood in England, that very great attention is paid to its preparation, as well as to the quality of the lead: it is made an object of exclusive manufacture, and is one cause of the excellence of British flint-glass.

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* Where sand is used, it is found, on examination with a microscope, to consist chiefly of small rough, rock crystals, which, by the action of alkali and fire, are aggregated and purified.

Borax, white arsenic, and nitre, are also useful, and powerful agents when well applied; but danger may arise from the employment of arsenic in vessels intended for domestic use. Borax, or borate of soda, is too expensive to admit of its being employed for common purposes. It is, therefore, far from being generally adopted, and is applied rarely even to objects of great importance. It was formerly imported from India, being a product of Thibet, but in a very impure condition; and a better sort in the form of boracic acid is now supplied from the works which M. de Larderel has established at Monte Cerboli, near Volterra, in the Tuscan Maremme. Having ascertained the presence of large quantities of boracic acid in the district, he obtained a grant of land for a term of years from the Grand Duke, and immediately commenced operations. He began by diverting a stream to the spot where the boracic acid was found to abound; and after the water had become impregnated with the acid, it was allowed to flow on through pipes to large pans, for the purpose of evaporation. Volcanic heat likewise prevails in the same district, and in order to avoid the expense of fuel, which M. Larderel found extremely high when he first undertook the works, he has availed himself of this volcanic agency, and conveyed the heat in tubes, so as to make it pass under the pans, by which means the evaporating process is effected, and the boracic acid remains in the pans.

Notwithstanding the facility afforded by this natural agent, the manufacturers complain of the high price of this substance, about 5*l*. 10*s*. the metrical quintal (205 English lbs.). The price is said to be regulated by a contract, made with some merchant at Leghorn; but it has the effect of excluding the material from the manufacture of glass for domestic purposes; and it is likewise to be observed that the Tuscan boracic acid, even at this price, contains nearly one-half its weight of water of crystallization; so that the glass manufacturer has to pay at the present day nearly 1*s*. per pound for the material in its available form as a flux. There are, also, other objections to its employment; for it is so extremely pungent that, unless applied with great caution, it corrodes the pots, introduces alumine into the fused metal, or passes away through the pores of the vessel.

It is said that this material has been found in abundance on the western coast of America, in combination with lime, as borate of lime; which, if correct, will be of essential service in many branches of manufacture. It is described, for the first time, by the American mineralogist, Hayes, and has been called Hayessine, from its discoverer. It is met with in the Peruvian province of Tarapaca, not far from the port of Iquique, in the same locality where the nitrate of soda, now so extensively exported to England, has been found. The borate of lime contains nearly 45 per cent. of boracic acid, combined with 19 per cent. of lime, and 35 per cent. of water, substances which cannot deteriorate its quality as a flux; whilst its moderate price, white colour, and absence of any metallic oxide, render it well suited to the use of the glass crucible.

The first chemists in England, France, and Germany have directed their attention to the fabrication of glass. Experiments have been tried by practical working men, with great liberality and intelligence; but there are certain principles dependent upon science, according to which all operations connected with the art must be directed. It is to the accuracy and judgment exercised in adhering to these principles, in providing for the selection and application of the component substances, in determining their proportions, and securing their purity and quality, in the working of the metal, the construction of the furnaces and the pots, in the management of the fires, and the annealing process, that we must look for the production of a good composition, and for improvement in the art of glass-making.

The silex mostly used in England is sea-sand, consisting chiefly of quartz. The finest qualities are obtained from Alum Bay, in the Isle of Wight, and from near Lynn, on the coast of Norfolk. Black flint, when raised to a red heat, and plunged in cold water, is frequently used, and probably gave the name to the species of glass, flint-glass, or crystal, to which it is most commonly applied.

The alkali used in this manufacture is either soda or potash, which is preferred for the finest works in the condition of the carbonate, and is then called carbonate of potash, or pearl-ash, from which the carbonic acid is expelled by the heat of the process in fusing. Soda is used as dry carbonate of soda, when a more than ordinary degree of whiteness is required, as in plate-glass. It is also used in this state in coloured glass. In window-glass (crown and sheet) soda is more generally used as a sulphate of soda.

Colour is imparted to glass by the application of the metallic oxides, and when it pervades the whole mass is termed pot-metal, as distinguished from that to which the colour is applied in the form of enamel.—(See Coloured Glass.)

Cobalt produces blue.

Manganese produces violet.

Antimony produces yellow.

Precipitate of cassius, or gold, produces pink.

Uranium produces opaline-greenish colour.

Chromium produces green.

Copper produces ruby, or greenish blue, according to its degree of oxidation.

Copper with iron produces ruby, or green, according to the degree of oxidation of the copper.

Silver produces a pure and beautiful yellow, but only by staining the surface at the fire of a muffle.

These colours, however, will be modified, or even completely altered, by different combinations of the metals, the degree of their oxidation, the greater or less degree of heat employed, the addition of vegetable carbonaceous matter, and other circumstances.

The manufacture of glass has been classed by the Commissioners under the following heads:—

A. Window-glass, including—
    1. Crown-glass.
    2. Sheet.
    3. Brown plate, silvered or unsilvered.
    4. Coloured sheet, pot-metal, or flashed.

B. Painted and other kinds of ornamental window-glass.

C. Cast plate-glass.
    Rough plate.
    Pressed plate.
    Rolled plate.

D. Bottle-glass, including—
    Ordinary bottles.
    Moulded bottles.
    Medicinal bottles.
    Water-pipes and tubing.

E. Glass for chemical and philosophical purposes.
    Matrass-retorts, &c., &c.
    Water-pipes and tubing.

F. Flint-glass, or crystal, with or without lead; white, coloured, ornamented, for table-vases, &c., &c.—
    1. Blown.
    2. Moulded and pressed.
    3. Cut and engraved.
    4. Reticulated and spun with a variety of colours; incrusted, flashed, enamelled of all colours,

opalescent, imitation of alabaster, gilt, platinised, silvered.
5. Glass mosaic, millefiori, Aventurine and Venetian glass weights.
6. Beads, imitation of pearls, &c.
7. Chandeliers, candlesticks, apparatus for lamps.

G. Optical glass, flint and crown.
   1. Rough discs of flint and crown, to make lenses for telescopes, microscopes, daguerreotype and calotype apparatus, &c.
   2. Flint and crown, blown, or cast in plates for the optician.
   3. Thin glass for microscopes.
   4. Refractive apparatus, prismatic lenses for lighthouses.—(See also Class J.)

Section A.—*Window Glass, &c.*

It has been observed before, that some degree of uncertainty prevails respecting the period when this description of glass came into general use. It was at first regarded as an article of luxury and splendour, and appears to have been introduced into the churches of France about the sixth century. Fortunatus of Poitiers, who was contemporary with Gregory of Tours, mentions it in his Latin poems, as doing honour to the bishops of his day, by whose care the churches had been thus supplied with light, and embellished.

According to Bede, artificers skilled in making glass were invited into England by Abbot Benedict, in the seventh century; and the churches and monasteries of Wearmouth and Yarrow were glazed and adorned by his care. Wilfrid, Bishop of Worcester, about the same time, took similar steps for substituting glass in lieu of the heavy hutters which were then in use; and great astonishment was excited, and supernatural agency suspected, when the moon and stars were seen through a material which excluded the inclemency of the weather. York Cathedral was glazed about the same time; and in the eleventh and twelfth centuries, when a great stimulus was given to the erection of religious edifices, glass was generally employed in the windows.

It appears to have been used but very sparingly in domestic architecture till a much later period, when it came to be gradually adopted in the residences of the wealthy. As late as the middle of the sixteenth century, it was recommended, in a survey of the Duke of Northumberland's estates, that the glass of the windows should be taken down and laid by in safety, during the absence of the Duke and his family, and be replaced on their return, which would be attended with smaller cost than the repair rendered necessary by damage from weather or decay. In Ray's Itinerary, it is mentioned that in Scotland, even in 1661, the windows of ordinary houses were not glazed, and only those of the principal chambers of the King's palaces had glass; the lower ones being supplied with shutters, to admit light and air at pleasure.

The use of the diamond in glass-cutting, which only dates from the sixteenth century, greatly facilitated the manufacture.

There are two methods of making this description of glass:—

1. By the cylindrical process (sheet-glass).
2. By the effect of centrifugal force (crown-glass).

In the first, as soon as the fused metal is in a condition for working, a sufficient quantity is collected at the extremity of a pipe, and then lengthened by swinging, and blown at the same time, till it acquires the form of a hollow globe, or cylinder, open at one end, and adhering to the mouth of the tube at the other. The cylinder is then detached from the tube, the neck being cut off with a thread of hot glass, and one side of the cylinder is opened with a heated iron or diamond; after which, it is taken to the flattening kiln, in which it is heated to softness, and rubbed down, either upon a stone or upon a sheet of glass, called a lagre, by means of a block of wood, called a polissoir. The sheet, thus obtained, is then placed in an annealing kiln, and left there to cool gradually.

By the second operation, the glass collected at the end of the tube is made to assume the form of a flask, or rounded lump; and then, by a rapid rotary motion, the centrifugal force causes it to acquire the shape of a large circular sheet, about 50 inches in diameter. The thickness of this glass is nearly equal throughout, except at the knot or bullion, formed at the centre, where the rod or tube was attached to the metal.

The cylindrical process is the only one referred to by the monk Theophilus, as being in use in his time, whose work, entitled "Diversorum Artium Scedula," was written about the end of the twelfth or early in the thirteenth century.

This method was principally employed by the Venetians, and was found to possess the advantage of insuring uniformity of colour in coloured glasses, arising from the greater equality of their thickness. But as the demand for coloured glass diminished, the employment of the cylinders was entirely superseded in France, England, and the north of Germany, by that made on the rotary principle. It continued, however, to prevail in Bohemia, into which country it had been introduced from Venice, and was carried to so great a degree of perfection that when a glass of large dimensions and good colour was required in France, it was imported from Bohemia. In fact, the circular plates formed by the second process rarely exceeded 30 inches in diameter, and were of such unequal thickness that a square, exceeding 16 inches by 12, could not be cut from them.

This state of the manufacture continued till the beginning of the eighteenth century, when a French officer, struck with the superiority of the Bohemian glass, formed the project of introducing this method of fabrication into France. M. Drolenvaux formed a company for this purpose, brought workmen from Bohemia, and established a manufactory at Lettenbach, on the borders of Lorraine and Alsace, in 1730. They carried on their works with so much success, that being unable to purchase the land, which belonged to the monastery of St. Querin, they took it on lease for 100 years, and it was designated as the Manufactory of St. Querin. From this commencement have sprung all the factories, working glass on the cylindrical principle, in the Lyonnais, in the north of France, in Belgium, and latterly in England.

The first workmen, brought over from Bohemia, had been induced to leave their country by the offer of high wages, and fearing a diminution of the advantages which they enjoyed, in the event of competition, they entered into a combination for confining the business exclusively to their own families. They constantly refused to allow strangers to be taken into the establishment in which they worked, or even to give them instruction; and if a master attempted to break through this regulation, the whole establishment would throw up their engagements, and leave him unprovided with workmen competent to carry on the business. They thus transmitted their occupation from father to son; and the names of Schmidt, Zeller, Theber, Walker, Stenger, Huy, Mayer, &c., employed in the manufactories of France, even at the present day, testify their German origin. A similar practice prevailed to a certain degree in England, where the glass-maker's trade is likewise a very exclusive one; and the benefit societies, of which the workmen frequently are members, render it exceedingly difficult for the masters, even if willing, to depart from ancient practice, and attempt amendments, which are looked upon by the workmen as prejudicial innovations. Another evil of a very serious nature has also arisen from this system of exclusion, which has been more particularly felt since the alteration of the excise and customs' duties. This measure, and the consequent reduction in the price of glass, have caused a great increase in the demand; and the supply of workmen in this country, properly educated and trained for the nice and difficult process required of them, is so limited, that the manufacturers have found themselves unable to execute the orders, from want of hands competent to carry them into execution. Consequently, they have been obliged to resort to the Continent, and to bring over workmen to assist in the works, which can only be accomplished by means of increased expense in wages.

The great advantage of sheet-glass, obtained by the cylindrical process, is that of affording plates of larger dimensions, and of avoiding the waste arising from the circular form of the crown tables, and from the knob, or bull's-eye, in the middle, where the metal was attached to the tube. But the surface is much less brilliant than that of crown-glass, and is more wavy and undulated.

The manufactories of glass in plates, in France, Belgium, and the north of Holland, where the style of building required panes of large size, were in consequence gradually abandoned; and towards the close of the last century, a manufactory of that description near Abbeville, in Normandy, one in Hanover, and two others near Aschaffenburgh and Bamberg, were the last in which this process in the construction of window-glass was used.

Crown-Glass.

In England, on the contrary, the manufacture of glass on tables, under the name of crown-glass, had attained to so great perfection in the quality of the metal, workmanship, size, and exterior appearance, that this glass was generally adopted in glazing windows of houses of superior description; whilst the material known as spread-glass, or broad-glass, formerly manufactured in England on the cylindrical principle, was of inferior quality, and reserved for the poorer description of habitations. It is true, however, that the English spread-glass was not by any means so good as the German glass made upon that principle. The surface was uneven, very rough, and defective in brilliancy, which rendered it less well adapted than crown-glass to the purposes to which the latter was applied in this country.

This served to prejudice the public against all glass made upon the cylindrical principle; and it was not until the year 1832 that the manufacture of cylinder or sheet glass was introduced into this country upon the principle generally adopted upon the Continent.

It was then introduced by Messrs. Chance and Hartley, of Smethwick, near Birmingham, whose attention was specially called to the advantages attending this mode of manufacture by a visit paid in the year 1830 to the manufactory of M. Bontemps, of Choisy-le-Roi, near Paris. They were struck with the saving effected by the rectangular shape of the sheets of glass obtained by this process, and especially by the absence of the bull's-eye or knot in the centre, which rendered it impracticable to obtain, out of the tables of crown-glass, panes of greater superficial measurement than about one-third of that of the tables themselves; whereas, in sheet-glass, the panes could be obtained of the full size of the sheets blown, and the only limit to their dimensions was the strength of the workman; much greater facility being, moreover, afforded for accommodating the dimensions of the sheets to those of the frames required. Considering these advantages more than sufficient to counterbalance the disadvantage under which sheet-glass laboured in respect of evenness and brilliancy of surface, and taking into account the facility afforded by this process of manufacture for making glass shades (for covering clocks and other ornaments), which had hitherto been almost entirely imported from the Continent, and having secured the valuable co-operation of M. Bontemps, these gentlemen determined to commence the manufacture of sheet-glass, and started their first furnace in the autumn of 1832. They had, however, many difficulties to contend with, which it required all their energy and practical and commercial experience to overcome. The partnership was dissolved in 1836, and the following year Mr. Hartley established a manufactory for crown-glass at Sunderland. Not the least of these difficulties was the excise duty upon window-glass, which was at that time very heavy (amounting to at least 300 per cent. upon the cost of the glass itself), and being levied upon all the glass manufactured, whether good or bad, much enhanced the cost of experiments; and had it not fortunately happened that some advantage was allowed, in the shape of drawback, upon that portion of the glass which was exported, this obstacle might have proved insurmountable.

The waviness of the surface of this glass proved, as was anticipated, a great obstacle to its introduction for general glazing purposes, excepting in such cases as those in which surface was of no moment, and strength the chief quality requisite; and it was not until the year 1838, when Messrs. Chance, Brothers, and Co. introduced a thicker description of sheet-glass, which was at the same time of a better surface, that its use can fairly be said to have become general. Since that time further improvements have been made, and the manufacture has gradually been adopted by other crown-glass manufacturers; and since the removal of the excise duty it has extended to such a degree that at the present time the weight of sheet-glass annually made is probably nearly equal to that of crown-glass, and it appears to be continually increasing. It is with this that the Crystal Palace was glazed at a very short notice.

The manufacture of broad or spread-glass was continued for many years after the introduction of sheet-glass, with which it was able to compete, in consequence of a difference in the rate of excise duty which was levied upon it; but this difference having been done away with in the year 1845, and the duty equalized with that upon sheet-glass, it could no longer sustain the competition, by reason of its inferior quality; and the manufacture was shortly after abandoned.

It was not so with the manufacture of glass shades, which, as before mentioned, was introduced at the same time, and by the same firm, as that of sheet-glass, and which has kept pace with it, and increased to a very great extent; and it has likewise undergone much improvement in the quality. The shapes have been adapted to the taste of the English; and shades are now produced of a larger size than were ever made on the Continent, to the almost entire exclusion of those of foreign manufacture, with which this market was supplied until the year 1832.

In the year 1840 a new variety of window-glass was introduced by Messrs. Chance, under the name of patent plate, which they obtained from sheet-glass by a new process of grinding and polishing. Many attempts had previously been made, both in this country and abroad, to attain this object; and small glasses for silvering purposes had long been manufactured in France and Germany by this means; but the great loss in thickness attending the process of grinding, hitherto adopted in those countries, which made it necessary to make use of sheet-glass of great thickness, and which, therefore, was necessarily limited in size, had hitherto proved an insurmountable obstacle to the production of any but thin and small plates, which were not suitable for glazing, and other purposes for which size and substance were requisite. By the invention of Mr. James Chance this obstacle was overcome; and it became practicable to manufacture plates of several degrees of thickness, and of sizes containing from 8 to 12 superficial feet. The surface of the glass obtained by this process, though not perfectly true, was very nearly so; and in brilliancy it was unsurpassed even by cast plate. This glass, consequently, soon became a formidable rival to crown, sheet, and cast plate, for glazing and for many other purposes; and since the removal of the excise duty, in 1845, the manufacture has greatly extended.

This improved process has, within the last few years, been introduced into France by Messrs. Patoux and Co., of Aniche; and has been successfully established, though upon a comparatively limited scale.

In Germany, the fabrication of blown glass, which was derived from Venice, has never been departed from, nor replaced by the use of cast plate. They are not, however, restricted to the production of the small glasses known in the trade as the Nuremberg glasses, and they have reached the dimensions of 84 by 42 inches, some of which are shown in the Exhibition; but there is reason to believe that blown glasses of such large dimensions are both more difficult of manufacture and more costly than when cast. A large capital, however, is required for the latter process. The Belgian window-glass has made very considerable progress, and enjoys a high reputation. A large quantity is made annually for exportation. M. Frison, of Dampresny, serving on this Jury, and Messrs. Bennert and Bivors, are carrying on business at their respective manufactories on an extensive scale, and the quality of their products is highly appreciated.

Section B.

Painted and other kinds of ornamented window-glass have been assigned to this Section, but will be reported on elsewhere.

Section C.—*Cast Plate, Rough Plate, Pressed Plate, Rolled, &c.*

Notwithstanding the encouragement afforded to the manufacturers of glass of these descriptions in France, their progress does not seem to have been very rapid, until the ministry of Colbert, when some French artists who had been employed at Murano, and become thoroughly cognizant of the method of making blown plate-glass adopted in the Venetian manufactories, conceived the project of introducing the art into their own country.

They were taken up and warmly supported by Colbert during his ministry, and established works at Tourlaville, near Cherbourg, in 1688, in a situation resembling that of Murano, as nearly as possible, which they imagined to be calculated to promote the success of the enterprise.

We owe to Abraham Thèvart, a working manufacturer, the process of casting the metal, fused in the glass pots, which has effected so great an improvement in this branch of the manufacture: he at once perceived the advantage to be derived from it in producing glasses of larger dimensions and better construction. He made his proposals to the government, and, obtaining a patent, established his works in the Faubourg St. Antoine, at Paris, but shortly afterwards removed to St. Gobain, in Picardy. There he and his associates had to contend with much opposition on the part of the old company of Tourlaville; but in 1695 they endeavoured to reconcile their differences by uniting under a common charter of incorporation. This step, however, did not produce the desired effect, and the company were reduced to the greatest distress, when a new association was formed, under the management of Antoine D'Agincourt, who laid the foundation of the magnificent establishment now existing there.

The company of St. Querin, which had been the first to make sheet-glass on the cylindrical principal in France, was not backward in adopting the great improvement in the manufacture suggested by Thèvart; and combined the process of casting with their other works. Their lease from the monks of St. Querin expired in 1840, but long previous to that period they had taken the precaution of protecting themselves against the evils which might arise from the competition of a rival company at the expiration of their lease, and had formed another establishment at Cirey, in the neighbourhood of St. Querin, which, after the lapse of the term, merged in their more recent establishment at Cirey.

The two great manufactories of St. Gobain and Cirey, for a time, continued in opposition to one another; but a new enterprise entering the lists against them, the two long-established companies, without actually forming a partnership, entered into an agreement for their mutual advantage, and used a common depôt for the sale of their produce, and for regulating the price in the different markets.

Another company established works at Montluçon about three years ago, and has sent some of their glass to the Exhibition. Their recent establishment does not afford them a large stock from which to select the best produce, but the colour of their glass is good; and if they can sustain the difficulties of a commencement, there is every reason to hope that, with time and encouragement, they will not fall short of the high reputation which so deservedly attaches to this branch of manufacture in France.

The manufacturers of St. Gobain and Cirey have sent to the exhibition three glasses of large dimensions (one of which is silvered, the others not so), pure in colour, excellent in structure, finish, and polish, and free from the globules and other defects which are so frequently met with in glass. In short, the produce of these manufactories, now exhibited, approaches as near to perfection in this branch of the manufacture as it can attain. They did not, however, reach their destination until the time had elapsed which had been finally fixed by the Commissioners for the admission of objects claiming to compete for the Medals; and on learning that an uneasy feeling prevailed on the subject among those exhibitors who had sent in their glasses two months earlier, in accordance with the original directions of the Commissioners, and who contended that it would not be just that the French glasses, selected from a large store after the Directors had had the opportunity of examining those which had been so long in the Exhibition, should be placed on the same footing, the St. Gobain and Cirey exhibitors, with a moderation which did them honour, consented to withdraw from competition, and merely to exhibit their productions, without claiming the reward.

In England, plate-glass, for mirrors and coach windows, had been introduced for the first time by the second Duke of Buckingham, who brought over workmen from Venice, and established a manufactory at Lambeth, where the works were carried on with success. The great improvement which had taken place in the process in France, and more particularly the important inventions of Thèvart, found their way to England; and the first manufactory for cast plate was established in 1773, at Ravenhead, near Prescot, in Lancashire, by a society of gentlemen, to whom a charter was granted, under the name of "The British Plate Glass Company," under which title they still enjoy a high reputation, though their firm, their capital, and their privileges, have undergone considerable alterations. When this company was first established, the only cast-plate manufactory was that in France, supported by the government; and all the processes of grinding and polishing were done by hand labour. In 1788 this company ordered of Messrs. Bolton and Watt, of Birmingham, a steam-engine, which is believed to have been the second ever erected; and in the following year they commenced the machinery for grinding and polishing. They were thus the first to introduce machinery for bringing their work to perfection, and the example was followed by all the other companies. It is remarkable that though many attempts have been made to improve the machinery, it remains, in all the manufactories, without any alteration of its principle. The glass produced by this company is tinged with a slightly-blue colour, which they attribute to the fact of their avoiding the use of the metallic oxides in their metal; and consider that this practice gives hardness, brilliancy, and transparency to their glass, and admits of a finer polish; and they assert that their glass is not liable to the change of colour which occurs when arsenic, lead, or manganese are employed. The glass which is exhibited by this company is placed in the Nave.

The establishment at South Shields, founded by the Cooksons, in 1728, likewise added the process of casting to their existing works. A very considerable business is now carried on there by their successors, the Messrs. Swinburne, who have supplied several large glasses for the decoration of the Building, and point out one in the furniture department, marked in the Catalogue No. 4, as a specimen of their manufacture. They have likewise exhibited a dome of opaque white glass, large tablets of glass, coloured in imitation of marble, and a great variety of other objects composed of plate glass.

The rough plate glass of Messrs. Hartley, of Sunderland, likewise belongs to this section. A great variety of articles are manufactured by them; but it is this useful product that they particularly specify as the object contributed by them to the Exhibition.

The Thames Plate Glass Company was established in 1835-6 at Blackwall, and have exhibited two glasses of very large dimensions.

Two others in Lancashire, and that at Smethwick, near Birmingham, have all been brought into existence within the last half-century, and considerably increased since the repeal of the excise laws. Their joint produce now exceeds two millions of square feet annually, which are used, first, in the shape of rough plates, for glazing, for roofing-in the railway stations, skylights, and other similar purposes; secondly, as polished glass, for shop windows, and large plates, for the windows of houses.

The process of casting is much the same as that employed by Thèvart; but where manual labour was formerly used in the grinding and polishing, the use of machinery now assists the operation, and has led to a diminution in the cost of production, and consequently to increased consumption.

SECTION D.—*Bottle-Glass, Water Pipes, and Tubing.*

The manufacture of bottles is of very considerable importance, from the amount and value of its produce. In France alone, the trade is estimated at above 60 millions of bottles annually; and their value at more than half a million sterling. The earliest and one of the most important manufactories of this species of glass was established in 1294, at Quinquengrone, in Normandy.

The bottles used for the effervescing wines, and for containing certain acids, require very great care in their fabrication. In the former, it is necessary that the component parts should be thoroughly mixed, when the mass is in a state of fusion; and that the glass should be of equal thickness throughout, that in every part the bottle may be equally strong, and able to resist the pressure of the fixed air confined within.

The loss of bottles by bursting, in the champagne trade, is stated to amount to from 20 to 30 per cent.; and a machine has been invented for testing their strength, which ought to be equal to bear the pressure of from 25 to 35 atmospheres. The price of bottles for this purpose is generally nearly double that for ordinary purposes.

In bottles intended to contain acids, care should be taken to combine chemically the alkali and the lime, so as not to incur the risk of their being acted upon by the acid, and subjected to decomposition.

SECTION E.—*Glass for Chemical and Philosophical Purposes.*

The glass to which this section refers requires peculiar qualities, according to the purpose to which it is to be applied. Hardness, evaporation of the salts by a long-continued exposure to heat, but which cannot be effected without deteriorating the colour, are the most essential qualities for glass of this description; and will bring it under the heads, partly of bottle-glass, and partly of flint-glass.

Several other products, useful in the dairy, the farm, the garden, &c., may be referred to this section.

SECTION F.—*Flint-Glass, or Crystal, with or without Lead.*

The glass comprised in this section is derived from the remotest antiquity. Among the excavations which have been made in Egypt, Greece, Italy, &c., are found fragments of blown-glass, moulded, pressed, cut, engraved, mosaic, reticulated, &c., and adorned with cameos of the finest workmanship. Venice and Bohemia followed in the same branch, and were only surpassed by the substitution of a metallic oxide in the manufacture, and the production of a silicate of lead and potash, in lieu of the silicate of potash and lime to which they still adhere.

The first manufactory of flint-glass in England was established in the Savoy House, in the Strand, in 1552, and another in Crutched-Friars; but it was not till long afterwards that the great improvements which have brought it to its present state of perfection, by the use of minium, or oxide of lead, and closed pots in the furnace, were introduced.

In 1635, Sir Robert Mansell obtained a patent for making glass of this description, in consideration of his undertaking to employ pit-coal, instead of wood, in his furnaces. He was also granted, on the same grounds, the exclusive right of importing drinking-glasses of fine quality from Venice, which were not made in England till half a century later.

The use of coal was soon found to affect the colour of the metal; closed pots were then used for the purpose of obviating the evil, but from their use arose another objection. The fusion did not take place in the closed pots so rapidly as when the metal was more immediately exposed to the action of the fire. A larger supply of alkali was required to assist the fusion, and the colour was still affected. This led to the adoption of a metallic flux, and the oxide of lead was applied in as large quantities as the fusion would bear without an alteration of colour. This new process not only remedied the evil, but has been found to produce glass of the purest colour, most brilliant effect, and most perfect in quality of any yet made.

This method of fabrication was not so much required on the Continent as in England, wood being principally used as fuel in the furnaces. It was not till 1784 that the metallic oxide was introduced in a small factory at St. Cloud. It was afterwards removed to Mont Cenis, near Autun, which possessed the advantage of coal in the neighbourhood, and was known as the glass-works of the Queen, and continued its works till 1827.

Another manufactory of crystal, or silicate of lead, using wood fuel and open pots, was established in 1790, at St. Louis (Moselle). It has continued to carry on a very extensive business during the last thirty years, and only yields in importance to the glass-works of Bacarat, which were purchased in 1816 by M. D'Artigues, whose works at Vonesch, near Namur, had become, by the Treaty of 1815, a part of the Belgian territory, and who preferred to carry on his business in his own country.

The coloured glasses of Bohemia, of which Count Harrach, Count Schaffgotsch, and others, have exhibited very beautiful specimens, and their imitations in Germany, France, and England, are comprised in this section; and likewise the *mille fiori* style of work, adopted for making presse-papiers and other ornaments, and sold by hundreds of thousands, which, by the extent of the trade, have become a very important branch of manufacture.

The description of glass referred to in this section sustains the high reputation which it has earned, and is ably supported in the Exhibition by the products exhibited by the Oslers, the Pellatts, the Powells, the Richardsons, and many other exhibitors. The American glass likewise is comprised in this section. It is a silicate of protoxide of lead, and is remarkable for the purity of its colour.

SECTION G.—*Optical Glass, Flint or Crown.*

The properties which are usually considered as constituting excellence in glass for ordinary purposes may easily be attained; but in glasses intended for optical instruments, and to be employed in the examination of objects so remote or so minute as to require the most undeviating accuracy, the difficulty of obtaining the metal sufficiently free from the defects to which glass is incident, had hitherto baffled every attempt to produce a lens, except of very small dimensions.

Purity, unchangeableness of colour, transparency, and a certain degree of refractive power may be obtained; but perfect uniformity in the structure of the glass, so as to render its composition absolutely homogeneous in all its parts, is not so easy to be accomplished; and it is precisely this quality which is the most indispensable in the manufacture of optical glass.

The great difficulty seems to occur in the difference of the specific gravity of the several constituents of the metal: some melt at a lower temperature, and sinking through the mixture, leave a streak or trail in descending; some evaporate or decompose in a heat required for the fusion of others; and different substances cool at different temperatures. Hence arise discoloration, sweating, threads, globules, striæ, irregular crystallization, which cause irregular refraction by the interruption of the rays of light, and their deflection from the course which they ought to pursue.

The discovery of the achromatic telescope has been of the utmost importance in the science of astronomy. The first idea is due to Galileo; but Euler, in recent times, applying his mind to the investigation of the cause of frequent failure in the construction of the telescope, adverted to the perfection of the arrangement of the crystalline humours of the eye, bestowed by the bounty of Providence on man, which are so disposed as to provide for the variation in the different rays of light, and draw them to one focus; and he imagined that glasses of different media might, on the same principle, be so adapted to one another as to correct and regulate the dispersive powers of the different rays. But the experiment tried on his principle did not meet with the success which he had expected.

In 1753, John Dollond directed his attention to the same object; and, aided by the co-operation of Euler, and of Klingenstierna the Swedish mathematician, he succeeded, after a long series of experiments, in discovering the due proportions of the curvatures of the two lenses, of which the object-glass of the achromatic telescope is composed; the one being flint-glass (silicate of white lead and potash), the other, crown or plate (silicate of soda and lime), which, having different refractive and dispersive powers, may be so arranged, that while, by the combination of the two, the rays are brought to a focus, the greater dispersion of the flint lens may be corrected by the less dispersive power of the plate; the one being negative, the other positive. "The refractive power of the glass bends the rays of light falling upon, or rather entering its surface, according to a certain law, in which it proceeds through the medium, while the glass is of the same kind. The same occurs again when the ray, having passed through the lens, arrives at the other surface and passes into air, the ratio here being the inverse of the former."—*Encyc. Met.*

Hence arises the importance of avoiding any variation in the media of which the glass is composed; as the slightest difference would act as a disturbing cause to the progress of the ray of light in its due course, derange the refraction, and distort the object.

After this principle was attained, Dollond and the French and German opticians experienced extreme difficulty in procuring glass adapted to their purpose. The Academy of Sciences, at Paris, offered prizes in vain for this object. The celebrated chemists, Macquer Roux, of St. Gobain, and Auut, of Langres, devoted their attention to it in vain; and even when procured, 3 to 3½ inches in diameter was the largest size they could obtain.

M. d'Artigues, one of the first manufacturers of crystal (flint-glass) in France, and who to his high reputation for practical skill added that of scientific knowledge, equally failed, or produced insufficient results; and it remained for a man in no degree conversant with science, not a glassmaker by trade, nor distinguished by education, but endowed with extraordinary energy, spirit of inquiry, and perseverance, to have the honour of arriving at the solution of the difficulty.

Guinand des Brenets, near Neufchatel, a workman in the clock and watch trade, who had been accustomed to the fusing of metals in the prosecution of his business, observing that in the ordinary process the waving and the threads, which are frequently to be seen in glass, were removed by stirring and thoroughly mixing the metal by means of an iron bar, applied the same process to flint-glass, and combining it with close attention to the structure, after many attempts made during his leisure hours, succeeded in producing flint-glass perfectly free from striæ.

M. Utzschneider, of Munich, hearing the result of his experiments, on making further inquiry, proposed to him to join him and M. Frauenhoffer in their establishment at Munich: he accepted the offer; and one of the largest glasses resulting from their experiments, the diameter of which is 9 inches, is now in the Observatory at Dorpat.

Guinand returned to his own country, but not being a glass-maker by profession, he prosecuted his researches only at intervals. He had discovered the principle; he had earned a well-merited reputation in the world of science, and promoted the researches of others; but the results of his experiments had not attained to certainty in practice, and he had not overcome the difficulties in the fabrication of crown-glass, which requires the same perfection, and the same dimensions as the corresponding flint.

In the latter years of his life, Guinand entered into communication with the Astronomical Society of London, and sent over some discs of flint-glass, of which Messrs. Dollond, Herschel, and Pearson made a favourable report. The largest of these glasses was 6 inches in diameter; and it is remarkable, that in England, which had supplied the Continent with flint-glass, a disc of 6 inches should have been regarded as a rarity.

Soon after, a Commission, composed of Messrs. Herschel, Faraday, Dollond, and Roget, was instructed to pursue the inquiry as to the manufacture of flint-glass. Mr. Faraday took the lead, both in his own laboratory and at the glass-works of Messrs. Pellatt, and could not fail of arriving at important conclusions. He changed the principle of fabrication, and produced a borate of lead of remarkable purity. The Lords of the Treasury had found it advisable to make a relaxation of the Excise laws in favour of the Royal Society, or persons acting for scientific purposes under that body. But, notwithstanding this regulation, the interference of the officers, and the delay in obtaining the necessary licence, proved so onerous and inconvenient, as completely to shackle their proceedings, and preclude all attempt to improve by means of experiment: and the question as to the fabrication of flint-glass being actively pursued in France and Switzerland, the Commission ceased from its labours.

Shortly afterwards M. Guinand died, without leaving any information as to his process. But in Bavaria, the works in which he had taken part had been continued according to his system; and his wife and two sons had witnessed his experiments, and were desirous of availing themselves of their father's invention for their own advantage.

M. Bontemps, who had devoted much attention to the manufacture of glass generally, and particularly of such as is required for optical purposes, was introduced by M. Lerebours, of Paris, to one of the sons of Guinand, who was endeavouring to sell his father's secret in England, or in France. He formed an association with him, but did not succeed in arriving at any good result. The treaty was broken; but M. Bontemps, satisfied of the correctness of the principle if properly applied, continued the experiments at his works without excluding Guinand; and in 1828 they succeeded in producing good flint-glass, and discs of from 12 to 14 inches, and a large quantity of smaller sizes. From that time the manufacture may be considered to have been established on a regular system.

The widow of Guinand and her other son set up works in Switzerland upon the father's principles, and were succeeded by M. Daguet, of Soleure, who has sent to the Exhibition some of his products of moderate size, and pure in colour (14-6 *et infra*); but they prove the difficulty of producing large discs, and confirm the belief that there are even more impediments in fabricating crown-glass of large size, than in making good crystal. In order to render it free from impurity, it becomes more difficult of manufacture, more liable to tension, and to accidents. It requires a higher temperature. By increasing the facility of fusion, the disposition to attract humidity, or to sweat, is increased. In rendering it too hard, the risk of crystallization, and imperfect vitrification in cooling, is incurred.

The insecurity in which political events in France involved the persons engaged in industrial pursuits was experienced by M. Bontemps: he contended against it, however, till the year 1848; when, after attaining to a high degree of eminence, and receiving the decorations which are awarded in that country to distinguished merit, he was induced to retire from the difficulties and dissensions which prevailed around him, and to accept the invitation of Messrs. Chance, Brothers, and Co., to unite with them in the attempt to improve the quality, and extend the utility of this important branch of manufacture. They have succeeded in producing discs of extraordinary dimensions in flint of 29 inches in diameter, weighing 2 cwt., and of crown-glass up to 20 inches. These discs appear to be pure in colour, good in structure, and exempt from those defects which tend to polarization of light, &c., and were considered by the Jury of Class X., Sir David Brewster, Sir John Herschel, Lord Wrottesley, and others, to be so important, that they invited Messrs. Chance to submit their disc of flint to the operation of grinding, finishing, and other processes, necessary in order to ascertain the uniformity of its density throughout.*

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* Since the above was written this remarkable disc has been subjected to the tests required in order to prove its

Mr. Ross, the celebrated optician of London, was the first to call attention to a defect, which may be detected by polarization of light; and there is no doubt but that many failures, which had occurred previously, were to be attributed to the absence of this searching test. A glass, exceeding only the small diameter of 6 inches, undergoes the annealing process with difficulty, and is liable to cool at the surface more rapidly, than in the interior; and this tendency increases with the size, which renders the production of a disc of 29 inches a very remarkable work.

In this section are comprised the optical glasses of M. Maës, of Clichy, which have been distinguished by the award of a Council Medal (see p. 532), and likewise the annular lenses and cylindric refractors, which are applied in the construction of lighthouses, according to the principle introduced by Augustin Fresnel. Buffon in the last century, and Sir David Brewster in our own times, had recognized the advantage resulting from the arrangement of lenses in separate pieces, having a common focus. Fresnel, without being aware of the exertions made by Sir David on the subject, submitted, in 1822, to the French Commission on Lighthouses, a plan for substituting, along the coast, lights on this principle, and introducing the refracting apparatus instead of the metallic reflectors then in use.

In 1834, Mr. Alan Stevenson was sent to France to compare the lenticular apparatus with the paraboloidal mirrors in use in our lighthouses, and to report on the comparative merits of the dioptric and catoptric systems. The result has been the gradual introduction of lights on Fresnel's principle into our lighthouses, under the direction of the Commissioners of Northern Lights, and Mr. Stevenson's superintendence. The Commissioners have exhibited in the North-western Gallery some small lights (we presume) as models of those in course of adoption.

Two sets of lights have likewise been constructed on a larger scale, of which one is exhibited by Messrs. Chance, another by Mr. Wilkins, of London. The latter is an apparatus containing the fixed light, varied with flashes, invented by Fresnel. The glass of which it is constructed was made at St. Gobain, and wrought in Paris by M. Letourneau. It is white, and appears to be of good quality; and if it is found not to be liable to humidity, the colour is certainly much in its favour.

The apparatus contributed to the Exhibition by Messrs. Chance was constructed at their manufactory, under the superintendence of M. Tabouret, formerly employed in the department of the Ponts et Chaussées in France, who, after thirty years of practice under that Board, had accepted the invitation of Messrs. Chance to direct the manufacture of the dioptric lighthouse apparatus, which they were desirous of establishing at their works. They have exhibited a dioptric apparatus of the first order, with revolving lenses and catadioptric zones, constructed on the principle of Fresnel. The upper and lower parts of the apparatus consist of a series of prismatic rings, each of which reflects, at the internal surface of its base, the incident rays of light. The advantage of this mode of reflection over the ordinary system of opaque reflectors consists in its saving a considerable loss of light, and being less liable to imperfection of surface. The middle portion of the apparatus is refracting, and produces by its revolution a succession of flashes or blazes of light, which may enable the mariner to distinguish any particular lighthouse. The revolving part consists of eight annular lenses. Each of these lenses is composed of a number of concentric rings round a central lens, so as to produce all the refractive effect of a single solid lens of corresponding dimensions, but with less loss of light. A more perfect optical figure is moreover given to these compound lenses than to a single piece of glass, spherical aberration being in some measure corrected, and lenses of larger size may thus be formed than could otherwise be practicable. The glass used in the apparatus now in the course of adoption in the lighthouses on the coast of Scotland is made in France, and it has been alleged that it is liable to attract moisture or "sweat," and consequently to lose a portion of its brightness. But the French manufacturers deny the charge; and when the judgment and care manifested in the execution of these important works are taken into consideration, a strong presumption is afforded that the Commissioners and Mr. Stevenson as yet find the French glass the best adapted for the purpose. But, supposing the contrary opinion to be correct, it only opens to the British manufacturer a fair field for competition, in which we have no doubt of his being successful. Messrs. Chance have acted upon this principle: they have made a first experiment with the view of promoting this branch of the manufacture of glass in England; but in order to avoid the defect of sweating, they have, perhaps, gone into the other extreme, and though the glass of their lights is good in quality, the measures taken to expel the salts in its composition, which render it liable to this objection, have affected the colour, and given it a green tint, which is considered by competent judges to be objectionable.

The question of lighthouses does not properly come within the scope of this Jury; but having been called upon to advert to the apparatus in the Exhibition, of which the glass forms so material a part, we cannot quit the subject without briefly noticing some of the progressive improvements which have taken place in this department of the public service. The first, or most magnificent work in modern times was the Tour de Corduan, founded in 1584 on an extensive reef at the mouth of the Garonne, but not finished till 1610. Wood and afterwards coal afforded the first light. In 1780, M. Lenoir was employed to substitute paraboloidal reflectors and lamps, and in 1822 the dioptric apparatus of Fresnel was introduced.

The Eddystone, 9¼ miles from the Ram's Head, on the coast of Cornwall, was erected of timber by Winstanley in 1696–98, and washed away in 1703. It was rebuilt by Rudyard in 1706, and destroyed by fire in 1755. The present edifice was erected by Smeaton in 1757–59. Tallow candles were used in the first instance for the lights. In 1807 argand burners and paraboloidal reflectors of silvered copper were substituted.

The Bell Rock Lighthouse, commanding the line of approach to the Firths of Forth and Tay, constructed of stone by Mr. Robert Stevenson in 1807–10, is too well known, and reflects too much honour on his name, to require any further notice.

The most remarkable work on the coast of Ireland is that of Carlingford, near Cranfield Point, erected in 1830.

The Skerryvore Rocks, about twelve miles south-west of Tyree, off the coast of Argyllshire, lying in the track of the shipping of Liverpool and of the Clyde, had long been regarded with dread by the mariners frequenting those seas. The extreme difficulty of the position, exposed to the unbroken force of the Atlantic Ocean, had alone deterred the Commissioners of Northern Lights from the attempt to place a light upon this dangerous spot; but in 1834 they caused the reef to be surveyed, and in 1838, Mr. Alan Stevenson, their engineer, inheriting his father's energy and scientific skill, commenced his operations on a site from which "nothing could be seen for miles around but white foaming breakers, and nothing could be heard but howling winds and the lashing of the waves." His design was an adaptation of Smeaton's tower of the Eddystone to the peculiar situation—a circumstance with which he had to contend. He established a circular base 42 feet in diameter, rising in a solid mass of gneiss or granite, but diminishing in diameter to the height of 26 feet, and presenting an even, concave surface all around to the action of the waves. Immediately above this level the walls are 9·58 feet thick, diminishing in thickness as the tower rises to its highest elevation, where the walls are reduced to 2 feet in thickness, and the diameter to 16 feet. The tower is built of granite from the islands of Tyree and Mull, and its height from the base is 138 feet 6 inches. In the intervals left by the thickness of the walls are the stairs, a space for the necessary supply of stores, and a not uncomfortable habitation for the three attendants. The

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quality: and its merit has been so satisfactorily established as to justify the Jury of Class X. in recommending that a Council Medal be awarded to the manufacturers.

rest of the establishment, stores, &c., are kept at the depôt in the island of Tyree. The light of the Skerryvore is revolving, and is produced by the revolution of eight annular lenses around a central lamp, and belongs to the first order of dioptric lights in the system of Fresnel, and may be seen from a vessel's deck at a distance of 18 miles. An arrangement of apparatus of considerable importance has been suggested by Mr. Thomas Stevenson, whereby true lenticular action may be extended by the adoption of total reflection for that end. By this arrangement, combined with the use of spherical mirrors, he has been enabled to use all the light of a lamp, and he has therefore termed it a holophotal system. Much has been done of late by the English, the Scotch, and the Irish Boards for the improvement of the lighthouse system; but the interests of commerce and of humanity require that much more should be done,—as the funds set apart for this object will permit,—in order to afford still greater security to vessels approaching our coasts; and we trust that the British manufacturers will not be slow in availing themselves of the opportunity of supplying a material of the very best quality for this important object.

In a sketch of this nature, it is for obvious reasons extremely desirable to avoid anything like a comparison between the products of different countries or different individuals; but it manifestly comes within the scope of our duty to give a brief account of the rise and present position of the principal establishments which have contributed their productions to the Exhibition; and to take a general view of the state of the manufacture in those countries, which have, at expense and inconvenience to themselves, intrusted their property to our care, and confided in our impartiality and justice in determining to the best of our ability their respective merits.

In the progress of this undertaking, we have felt an increasing sense of the importance of the subject, and of the responsibility arising out of the task. We have felt that the contributors might reasonably desire a more detailed description of the products which they have contributed to the Exhibition, and of the art to which they have applied their intellect, their resources, and their industry. But our limits are necessarily restricted within narrow bounds, and we fear that we have already trespassed upon the Commissioners and the public, further than the object, intended in calling for Reports from the Juries, fully justifies. But we must plead in our excuse the interest and importance of the subject—an interest which we have felt growing upon us as we proceeded; and though we are aware that the subject has frequently been well and ably treated, yet we trust that in pointing out some novelties and improvements in the art, to which recent practice has given rise, we shall obtain forgiveness for exceeding in some small degree the limits assigned to us. In the remarks which we feel ourselves called upon to make, it has been our most anxious desire not to wound the feelings of any exhibitor, still less to do him an injury in his trade by any observation of ours, applying to his work. We have endeavoured to confine ourselves to general principles, not to point out defects; but to leave it to the exhibitor to judge for himself, whether our principles are correct, and whether he has acted in accordance with them; and if not, to amend his practice, and entitle himself to commendation on some future occasion.

There are, however, points at issue to which it is extremely important to call the most serious attention of the manufacturer. A difference of opinion prevails as to the actual composition of glass, and this must be regarded as a difference of principle. A practical difference prevails, particularly in cast plate-glass, as to the finishing and polishing. By finishing is meant the process of rubbing away the roughness or marks occasionally left on the surface after grinding, which will always be perceptible if they are not carefully removed before the glass is polished; and will consequently deteriorate its quality. Lastly, the question of price.

With respect to the first question—the composition of the metal—upon this must depend the merit of the glass, and consequently its value. The combination of as much brilliancy of refraction with as perfect purity of colour as can be obtained is the object desired.

By some manufacturers, purity of colour is sacrificed to brilliancy of refraction; by others, the reverse is the case. The real object, the *juste milieu*, can only be attained by a judicious selection and apportionment of the materials employed; and this can only be the result of careful experiments, and the study of the effect of various chemical combinations. The expulsion or retention of the alkalies, the metallic oxide used, the amount of heat employed, and the annealing process, are very important considerations in determining this question.

In some descriptions of glass the defect of colour is less apparent than in others. In mirrors a greenish hue, or a dull, heavy appearance in the glass, cannot fail of imparting to the object reflected a portion of its colour and tone; and in proportion to the extent of the defect, deteriorating the merit of the glass. The French and the Belgians have paid great attention to this circumstance; and judging from the specimens of the Cirey and St. Gobain glass in the Exhibition, and of the Belgian glass, which we have likewise seen in the hands of persons who had not the opportunity of exhibiting them, we should say, that if these glasses maintain their present appearance, and do not exude moisture, a very great advance has been made in the art, and a very perfect article of manufacture attained.

In England, the long-continued pressure of taxation exercised its influence over this species of glass, which, in consequence of its high price, was not in very great demand until the removal of the evil enabled the manufacturer to reduce his price, and improve the quality of his glass. Glass for glazing windows has been employed, in this country, to a far greater extent than silvered glass for mirrors; and the defect in colour is not so much perceived in the transparent glass, as in the latter. We are likewise told that, since the diminution in price, which took place on the reduction of the duties, the demand for both silvered and transparent plate-glass has increased to so great a degree, that hands cannot be found to supply the wants of the public; and that the consequence has been a less careful fabrication of the material, or rather a fabrication of an inferior article, at the lowest price possible. It has been stated, that the more perfect manufacture of the French and Belgian artists will not stand the test of time, and that deterioration will occur, both in colour and structure, by the decomposition of the alkalies used in the manufacture.

We reply, that we are informed the practice of the Cirey and St. Gobain manufacturers is, to keep a very large quantity of their glass in store, sometimes for many years together, and that they have never experienced deterioration, and consequently do not fear its occurrence through lapse of time; and that, though we may admit it may be both right and politic to supply the public with a low-priced article of inferior quality, we do not believe those manufacturers are consulting their own interest, who fabricate an important article in an inferior manner, and who exhibit products, calculated to attract the wealthy and the fastidious by the qualities of magnitude and beauty, but which, on inspection, are found liable to be charged with the defect of colour, of striæ, of globules, of undulations, &c. We believe that success in trade, as well as the honour of excelling in manufacture, requires gradations in fabrication, suitable to the means and tastes of the different classes of purchasers; but that each gradation should be as good of its kind, as the nature of its process will admit of its being made.

With respect to the third question, that of price, it is of course a most important question; and it is a most difficult one to answer. The Commissioners had the question under their consideration for a considerable time, and at last wisely determined not to meddle with it. It does not depend upon arbitrary regulation, but upon circumstances which are necessarily fluctuating. Capital, taxation, supply and demand, fashion, all more or less affect prices, and prevent them from being the real indicators of the intrinsic value of an article exposed for sale.

Having ventured to make these general observations, it only remains for us to state the principle upon which the award of Medals has been made, and the grounds upon which the Jury has decided in favour of the successful competitors. We trust that in what we have said, it will be believed that we have no other object in view than to act in accordance with our duty, and deliver our opinion faithfully, according to the best of our judgment; and in doing so, if we "just hint a fault," we do not "hesitate dislike." We are proud of our manufactures; we enter warmly into the interests of the persons engaged in their production. Perhaps we are over anxious for their success. But we see, and we see it with satisfaction, that the foreigners are making rapid advances; and are bringing their intelligence and their taste into competition with us. We see new and extensive fields, opening every day by the wisdom of Providence, for the application of our energies and our resources; and it becomes our duty, as well as our interest, not to be backward in the struggle. "Up and be doing, and God will prosper." His bounty has prospered us in a most abundant and astonishing degree; and, from the tiller of the soil, the manufacturer of her produce, to the fabricator of the most delicate work, it will be by our own fault if we cease to excel. On behalf of that art which is more particularly under our consideration, we claim the exercise of increased energy and science. It is a manufacture for which the primary constituents are easily and cheaply supplied; and it combines, in a remarkable degree, the purposes of utility, of comfort to all classes, and of decoration. It reflects the splendour of the palace, and the beauty of the toilet. It lends its aid to science, and conveys the power of vision into infinite space; and, within the last few years, has enabled the astronomer to detect, in the obscurity of their remoteness, planets on which the eye of man had never rested before; and likewise, by its aid, amid the ruins of a former creation, countless millions of animalculæ may be observed through the microscope in the oolitic formations of our globe. It imparts comfort alike to the rich and the poor, by the admission of the bright rays of the sun into their abodes, and the exclusion of the inclemency of the weather. It assists the sight of declining years, and enables the aged man to seek comfort in his Bible, and impart its Divine truths to his family. It directs the seaman in his midnight course, warning him of danger, and cheering him by the prospect of security and home.

In drawing up the foregoing Report, information has been most liberally supplied, of the advantage of which the Reporter is fully sensible, and he begs leave to return his warmest thanks to John Wood, Esq., Chairman of the Inland Revenue Board; to M. Bontemps, and to Charles Winston, Esq., for their valuable assistance and advice; to Sir David Brewster, and Mr. Ross, more particularly for that which relates to the question of the structure of glass for optical purposes; and to Messrs. Zuccani, Wood, Pellatt, and others, for the information which they have so readily given. The highly-interesting articles in Lardner's Cabinet Cyclopædia, in the Encyclopædia Britannica, and Metropolitana, and in M. Labarté's work on the collection of Debruge Dumeuil, have supplied very valuable information, and will amply repay the trouble of referring to them; and the Reporter cannot conclude without taking leave of the English and Foreign Associates in the Jury, over which he has had the honour to preside; and affording his testimony to the zeal and intelligence which they have manifested in the discharge of the duties which they have been invited to undertake; and without expressing his satisfaction in witnessing the cordiality with which Foreigners and Englishmen have acted together; and though differing in habits and opinions, and urging those opinions with acuteness and with earnestness, have gracefully conceded, where they failed in persuading the majority; and he begs them to accept his sincere thanks for their able support, and their courtesy, kindness, and indulgence to himself in the discharge of their mutual duties.

AWARD OF THE MEDALS.

The Instructions of the Executive Committee are understood by the Jury to be to this effect:—

No question of nationality is to affect the judgment of the Jury.

No comparison of the respective merits of exhibitors is to be made. In recommending for the Council Medal, and in awarding the Prize Medal at the disposal of the Juries, the merit of the article exhibited, simply, is to be regarded.

Where an exhibitor is a member of a Jury, he cannot compete for any Medal. But the Jury think themselves justified in adverting in their Report to the merits of the object which a Juror may have exhibited; and likewise in mentioning favourably those works, which are not of sufficient importance to lay claim to a Medal.

Excellence in manufacture, being, in other words, a mere difference in degree of merit between subjects included in the same Class, cannot be rewarded with a Council Medal without a deviation from the principles laid down by the Commission. Novelty of invention, or adaptation, or peculiarity in the mode of manufacture, if deemed of sufficient importance, may entitle to the reward of a Council Medal.

It is important that the exhibitors, as well as the Jury, should keep the principle involved in these Instructions clearly in view; because it cannot but appear at first sight to be an anomaly, to withhold from objects of importance or value a Council Medal, while this distinction is recommended for products, which, if not inferior in importance, beauty, or utility, are at least attended with infinitely less expense and risk in the manufacture. But the instructions of the Commissioners are so stringent on this point, as to relieve the Jury from all doubt upon the subject.

In Class XXIV. these observations apply particularly to plate-glass, and to crystal, in the fabrication of which there can be no material novelty, though beauty and merit of a high order may be obtained. But unless novelty, or extraordinary merit as works of art can be shown, these sections cannot claim the highest distinction.

In the case of Messrs. OSLER, of Birmingham, the Jury thought they were justified in recommending them for a Council Medal, in consequence of the general merit of the works exhibited by them, and a novel application of the art in the crystal fountain, placed in the centre of the Nave, which is good as a specimen of manufacture, more particularly when the magnitude of the pieces of which it is composed, and difficulty of execution, are taken into account; and though possibly the architectural design may be capable of improvement, yet there is no doubt of its being a work of great beauty, and of its adding very materially to the brilliancy and general effect, in the conspicuous part of the Building in which it is placed. But the opinion of the Jury was overruled by the Council of Chairmen, and the Council Medal withheld.

The magnitude and brilliant effect of the Building itself, which have obtained for it the denomination of the Crystal Palace, render it the first and principal object of admiration.

The material which forms so important a feature of the structure, brings it in some measure within the scope of our Jury, and we avail ourselves of the opportunity to express our high sense of the merit of Mr. PAXTON, who suggested, and of Messrs. FOX, HENDERSON, and Co., who have carried into execution a work so well adapted for the object for which it was intended; so honourable to the ability, enterprise, and industry of British artizans, and of so much brilliancy in itself; and we heartily concur in the award which has been made in favour of these gentlemen.

A Council Medal has been awarded, on the recommendation of the Jury, to M. MAËS, of Clichy, near Paris, for the reasons assigned in their Report, viz., the application of a novel chemical combination in the manufacture of lenses for optical purposes, by means of which glass, remarkable for its purity, brilliancy and beauty, has been produced, and exhibited by him. He claims the merit of novelty in the use of barytes of magnesia, and of oxide of zinc, in combination with boracic acid, which facilitates their fusion and easy vitrification. This facility is of great importance, particularly in glass intended for optical purposes; as it tends to the more perfect commingling of the substances employed in the construction of the metal; and consequently to render it more homogeneous, and free from striæ, bubbles, and other defects peculiarly injurious to glass of this description. It is true that this glass has not stood the test of time; and that the borax, required for its production, is extremely expensive, and liable to other objections;* but novelty is the principle insisted upon by the Commissioners, and the experiment, as far as it has been tried, has been eminently successful in the production of glass of remarkable brightness and purity; and the object in view being one of great importance, the Jury have viewed with satisfaction this first step made by M. Maës at considerable expense and risk to himself; and in the hope that it may lead to important results, they have thought themselves justified in recommending him to the Council for the award of a Council Medal.

M. Maës has likewise exhibited some very beautiful specimens of coloured, and other ornamental glass.

The name of **CHANCE** occurs so frequently in the preceding observations, and is so honourably connected with every branch of the manufacture, that we cannot but regret that, according to the regulations laid down by the Commissioners, their firm is precluded from entering into competition for the Medals by the fact of one of the partners having consented to act as a Member of our Jury. But though Mr. R. L. Chance is thus disqualified by his own act, he has entitled himself still more to the consideration of the Jury by the valuable assistance which his practical experience, and intimate knowledge of the details of the subjects committed to our investigation, have enabled him to afford.

When we witness the magnitude and variety of the operations undertaken by this firm, the merit of their works, the liberality, intelligence, and spirit of enterprise, which they have manifested at great cost and risk in experiments, tried for the purpose of introducing into this country branches of manufacture almost exclusively practised by continental enterprise—when we consider the advantage of inducing men, so eminent in their occupation as M. Bontemps and M. Tabouret, to settle in this country, and superintend our works—we feel that we should not act with justice by Messrs. Chance, or do our duty by the Commissioners and the public, if we did not call their attention, in a special manner, to the merits of the firm.

In addition to the improvement effected by Messrs. Chance, in crown or sheet glass, and the introduction of their patent plate in the market, they have also exhibited specimens of coloured window-glass, of painted windows, of glass shades made by the application of machinery and far exceeding the dimensions of any similar work of this description hitherto attempted, and glass for optical purposes, described in the section to which that substance is referred.

They also exhibit some extremely thin glass, 200 to 300 to the inch, for purposes connected with the use of the microscope, and for experiments relating to the polarization of light, the want of which had formerly been found to be a great disadvantage in researches of this nature. This thin glass was introduced by Messrs. Chance as far back as the year 1840; and the Jury were informed by Mr. Ross, that by its use microscopes were made of very far higher power, than could otherwise have been produced.

M. **JULES FRISON**, of Dampremsy, near Charleroi, being a member of the Jury, is likewise disqualified from entering into competition for the Medals. He is sole proprietor of the manufactory, and carries on an extensive business; the larger part of his produce being made for exportation. He has sent to the Exhibition sheet window-glass of very good quality, well blown, well flattened, with a very good surface, and free from fire-specks and scratches. He has also contributed some good glass, obscured by mechanical process; likewise some fluted glass.

SECTION B.

In the classification of objects exhibited, which has been delivered by order of the Commissioners to the Jurors for their instruction in determining the merits of the articles contained in each Class, "painted and other kinds of window glass" are referred, in Section B, to the Jury appointed to consider and report upon Class XXIV., and they proceed, accordingly, to discharge the duty assigned to them by delivering their opinion in the subjoined Report.

But the Medals having been awarded by the Jury of Class XXX. to the exhibitors of the objects referred to in this section of Class XXIV., we shall confine our Report to the statement of what we consider to be the principles of this branch of the manufacture of glass, and the use which the exhibitors appear to us to have made of it.

GLASS PAINTINGS.

Of the glass paintings, displayed in the Exhibition, there are some whose subject is a picture, a pattern, an heraldic device, or an intermixture of these three; and some of the pictures, and of the pattern glass paintings appear to have been designed and executed in a particular style of their own. The various works thus present so many different points for consideration as to render it impossible to lay down any one general rule for deciding on their pretensions; but by stating, as concisely as we can, the principles by which we have been guided in making the following observations, an opportunity is afforded of ascertaining their correctness or incorrectness; and the exhibitors may be enabled to draw their own conclusions as to the opinion which we entertain of the merits of their works.

It is hardly necessary to observe that glass painting must be judged by a different standard from that which is applied to other kinds of painting. The material employed imposes upon the artist an obedience to certain conditions in the design and execution of the work. His object should be, not to produce the best possible picture, but the best brilliant and transparent picture. Among the excellencies which are equally essential to a good glass painting, and to an oil or fresco painting, may be mentioned, a design which is pleasing in itself, and which is composed with reference to the effect sought to be produced at the distance from which it is intended to be viewed, correct drawing (which includes the course of the shadows as well as mere outlines), and harmony of colour. But such a composition must be chosen, and such a mode of colouring must be adopted, as are calculated, among other things, to display to the best advantage the brilliancy and transparency of the material, and to accord best with the mechanical construction of glass painting, which, unless it is of very moderate dimensions, must necessarily consist of several pieces of glass, connected together with lead or other metal, and supported with iron bars.

As a general rule, the best, because the most effective, composition for a glass painting (not being a mere pattern), is a single figure, or a group consisting of foreground figures, with either a landscape, an architectural, or a plain coloured back-ground; the landscape, if any, being treated as a mere accessory to the group. And the mode of execution which appears to display to the best advantage the brilliancy and transparency of the material is, where the colouring is chiefly produced by means of glass coloured in the manufacture;* where the shadows are transparent, but have hard and sharp edges; and, above all, where a large proportion of the lights are left clear and unencumbered with enamel paint.

Of the correctness of the view, so far as it relates to the sort of composition, and to the mode of colouring best suited for a glass window, we have the less doubt, since nearly all the exhibitors have acted consistently with it; but we also find that our opinion of hard-edged shadows and clear lights is opposed to the practice of nearly all the exhibitors, including those most distinguished by their works.

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* The facility with which boracic acid fuses earthy particles is so great, that if not used with much caution, it acts upon the earthen pots, and conveys alumina into the metal, when in a state of fusion.

* We are speaking of the art in its present state; if enamel painting were to be so far improved as to admit of glass being, by this means, as strongly and vividly coloured as it can be coloured in its manufacture, the objection to colouring glass with enamel colours would fail. But to such an improvement certain physical obstacles appear to be opposed.

To their authority we can only oppose that of the glass painters of the first half of the sixteenth century, when, owing to the similarity of the material, the conditions of glass painting very closely resembled the conditions of modern glass painting; and we would invite a comparison of such works as, for instance, the windows of the chapel of the Miraculous Sacrament, on the north side of the choir of St. Gudule's Cathedral, Brussels, and the two transept windows of that cathedral, with the windows of Gouda Church, Holland, and of Amsterdam Cathedral, both which are of the last half of the sixteenth century, with any of the works now exhibited; and if it appears that the Brussels and Lichfield windows are more brilliant, more glass-like, and (allowance being made for modern improvements in drawing) as pictorially effective as any of the other works to which we have referred, then we are justified in considering that the limit to which the obscuration of the glass may be carried was reached at the end of the first half of the sixteenth century, and, consequently, in regarding the works of that period as standards of true glass painting by which other glass paintings of similar nature may be judged.

The question, however, must ever be matter of opinion, and must ultimately resolve itself into a question of taste, which can only be determined by actually making the comparison suggested, and inspecting the windows themselves.

In estimating, then, the merits of a glass painting, we have to consider, first, to what extent the conditions of the art have been observed; secondly, its artistic merit as a picture or painting.

According to these principles, a work in which the composition and drawing are indifferent, but which displays vivid and powerful colouring, or is brilliant in effect, is preferable, as a glass painting, to one which is dark and dull, but in which the drawing and composition are good. Of this, we have a striking example in the ante-chapel of New College, Oxford. Sir Joshua Reynolds' window, with all its excellencies of drawing and composition, is not to be compared in effect with the rude windows of Wykeham's time that surround it. Still, though a due regard to the conditions of the art is of such preponderating weight in the merits of a glass painting, other artistic qualities, as has been said before, are not to be overlooked; consequently, of two glass paintings in which the conditions of the art have been equally observed or equally violated, that is to be preferred which displays the highest merits in composition, drawing, and other qualities of a good picture.

But besides the two points of view just mentioned, in which a glass painting is to be considered, it is necessary, in order to estimate the quality of a work professing to be executed in imitation of any ancient style, to judge of it with reference to the standard which its author has himself chosen. To condemn it, on the one hand, if it falls short of the model which it professes to follow, and fails in the effect which it professes to produce; and, on the other hand, perhaps to make some allowance for peculiarities which would be objected to as faults, if they were not excused by the necessity of adhering to some characteristic features of the adopted style.

On examining an original specimen of any ancient style of glass painting, we cannot fail to be struck with the general harmony of its features. Not only does a strict consistency exist between the character of the figures and of the ornamental details, but these agree with the nature of the design and mode of execution, which again seem to be adopted and formed with reference to the nature and quality of the material used. The changes effected in process of time in the composition and texture of the glass appear to have involved, in the opinion of the ancient artists, corresponding changes in the very conditions of glass painting.

In all the glass paintings of earlier date than the last quarter of the fourteenth century—until which period the material commonly in use was not over clear, substantial in appearance, or intense in colour—the artists seem to have relied for effect principally on the richness and depth of the colouring. In these works the means of representation may be said to have been reduced almost to the lowest degree. Even the picture glass paintings are little else than exceedingly powerful and brilliant mosaics. The figures are hardly distinguishable from each other, nor from the back-ground of the composition, otherwise than by their outlines and local colouring. The style of the painting is simple, bold, and forcible, as if the artists apprehended that softness of finish and nice gradations of light and shade would be useless and ineffective, and deemed those qualities to be alike incompatible with the simplicity of the composition, the positive character of the colouring, and the general brilliancy of the work. The drawing is effected by thick black outlines, which always strengthen, and sometimes even supply the place of broader shadows, and these shadows, when compared with those of later times, are weak, and are in great measure lost in the depth of the local colouring; which circumstance, however, renders their hardness the less perceptible.

The same style of execution is extended to patterns as well as to pictures. The design is traced on the glass with firm and strong outlines; and it is hardly necessary to remark—for this is observable in every original work,—that the harmony in form and character between the figures and the ornamental details, proclaims them to be the production of the same hand, and the conception of the same mind.

In all subsequent glass paintings, until the revival of the more ancient styles, which took place about twenty-five years ago, we may observe that in proportion as the glass became more pellucid, more flimsy in substance and appearance, and less powerful and intense in colour, a less mosaic and an increased pictorial effect was aimed at. The weakness of the individual colours was in a great measure compensated by their employment in larger masses, by judicious contrasts, and by harmonious arrangement. Their depth was increased by means of broader and more powerful shadowing, and a certain degree of richness was imparted by the more liberal use of diaper patterns and other minute embellishments. The drawing became more delicate, nicely-graduated and highly-wrought shadows were to a great extent substituted for stiff black outlines, and in many instances considerable attention was paid to perspective, and to atmospheric effects. In short, it would seem that the artists considered that the more refined nature of the material demanded as well as favoured a more refined pictorial treatment, and sought to compensate for its comparative thinness and weakness by the introduction of beauties of another description. The new system, it is true, was not fully developed until the middle of the sixteenth century; but its commencement may be easily traced as far back as the end of the fourteenth, by which time the principal change in the nature of the material had taken place.

Many persons, and among them some whose opinions are entitled to consideration, differ from the opinion that the material used previous to 1380 has not hitherto been successfully imitated; but on a point of so much importance we are bound to retain our opinion until convinced of its fallacy. That there is a visible difference in the appearance of modern glass and of that belonging to these early periods is admitted; but it is attempted to be accounted for by the supposition that it is solely due to the effect of age and exposure to the weather, and that the ancient glass, when first put up, must have appeared as weak and flimsy as our own. But as it is evident on breaking a piece of ancient glass, that the effect of antiquity is confined to its surface, the above supposition is destroyed by the observation that modern glass whose surfaces have, by artificial means, been reduced as nearly as possible to the same condition as that of the old glass, fails, nevertheless, in its resemblance to the old.

One of the most favourable examples of the closeness to which imitation of the thirteenth century glass can be carried by splashing the glass with enamel brown and other expedients, is afforded by a window recently put up in Mans Cathedral (the third clerestory window from the west on the south side of the choir). We are unable to say by whom it was painted. But although the design, owing to the breadth of its colouring, is favourable to modern glass, the deception is decidedly incomplete. Equally unsuccessful are the admirable restorations of

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the earlier thirteenth century windows in some of the apsidal chapels of Bourges Cathedral, executed, we believe, by M. Lusson. The modern glass may here be easily distinguished from the old by its want of crispness and its thinness, although it has been obscured in imitation of the effect produced by age and long exposure to the atmosphere.

We are strongly impressed with the opinion that the difference in effect between such ancient and modern glass does not depend on the state of the surface, but on the composition of the material, and this opinion has been much strengthened by the result of some chemical experiments recently made, by which the very great difference in the composition of modern glass and that of glass of the thirteenth century is clearly demonstrated.

Assuming the truth of the foregoing observations, it is obvious how important a bearing they have on modern imitations of the ancient style of glass painting. Those of the periods earlier than the last quarter of the fourth century having to be worked out in a mode of execution adapted to, and formed with reference to, a material very different from that of the present day, and therefore labouring under a disadvantage which hardly any skill or ingenuity can overcome; whilst, on the other hand, the glass of the present day resembling that of the fourteenth, or still more closely that of the sixteenth century, there is proportionably less difficulty, as far as material is concerned, in the way of the successful execution of works in the style of these periods.

The defects which appear to us to prevail the most generally are:—First, the misapplication of the materials, so that works which would have possessed merits as enamel paintings on china or any other opaque body, are, as glass paintings, weak in colour and deficient in transparency. The ill effect of thus confounding the principles of painting on an opaque surface with principles of painting upon a transparent body, like glass, are strikingly exemplified by observing, in the works of this description in the Exhibition, the difficulties the artist has had to contend with in the management of his material, notwithstanding the dexterity of his handling. The vividness of effect produced is barely superior to that of an oil painting, and in tone, transparency of shadow, and general harmony, the glass is very inferior to a painting in oil. The metallic framework which, in every well-contrived glass painting, is conducive to the good effect of the work, is here an eyesore, imparting to those outlines which it follows a harshness which does not accord with the elaborate softness which many of our modern artists have adopted in lieu of the severer style of their predecessors.

Secondly. Non-adherence to the style, which has been selected by an artist for imitation in any particular work. For instance, we have sometimes found associated together in the same glass-painting, borders in the style of the fourteenth century, canopies of the fifteenth, and figures of the sixteenth. In others, though the ornamentation is drawn and executed in the style of an early period, the figures are either wholly in the style of a later one, or else accord with the ornamentation only in the drawing or composition; the elaborate softness of their execution having been borrowed from a considerably later period. Others, in which the drawing, mode of execution, and composition of an early period are scrupulously observed, both in the figures and ornamental details, are executed in a material, which, owing to its greater pellucidness, is essentially different from that in use at the period chosen for imitation; so that sometimes the different portions of the design itself are incongruous; sometimes the design is of such a character as to be unsuitable to the nature of the material in which it is worked; and we may add that the various attempts which have been made to imitate the richness and depth of the ancient material, by coating the glass with enamel paint, have produced no other effect than that of depriving it of its brilliancy, and consequently the glass paintings, in which this expedient has been resorted to, of one of their chief and distinguishing merits.

These observations apply, in our opinion, very generally to the modern style of imitating ancient glass paintings. Improvement in the style of drawing, and many other beauties, are to be met with in the objects exhibited in Hyde Park, but these beauties are too often neutralized by the defects to which we have ventured to allude. The works are not original compositions, nor are they correct copies of the various styles which they profess to imitate.

BERTINI, of Milan. "Dante and his Thoughts."—In point of size, harmony of design, and beauty of drawing, this window is certainly entitled to claim a first-rate place; nor is there any work in the Exhibition, which, taken as a whole, is so superior to it as a glass painting as to prevent its merit as a work of art preponderating. Its defect is certainly the want of general brilliancy. Except in the Queen's glory, in the letters of the inscription over Dante's head, in the shields below, and the wreath surrounding his name (all which are true specimens of glass painting), and in the border of the windows, there are no sharp clear lights; and although pot-metal or flashed glass is used in places, as in Dante's robe, in the steps of the seat, in the sky to Domenico and Francisco, and in the robe of the figure in No. 4, it has been reduced to the same opacity as that of the enamel colouring employed in other parts of the window. The subjects taken from the infernal regions, Nos. 1, 2, 3, 4, are scarcely fitted for a glass painting, which is not suited for dark effects. The whole work is executed with so much softness, and is so highly finished, that the metallic fastenings have a harsh effect and form black lines, which do not harmonize with the delicacy of the painting; and though in general they are concealed with wonderful skill, yet they do appear in places, and rivet the attention the more the window is looked at. It may seem presumptuous thus to criticise one of the best works of the day; but the admiration which we feel for it has led us to compare it more rigidly with the windows at Brussels, and to arrive at the conclusion that it would suffer by comparison in point of general effect, though it would doubtless be superior to them in artistic refinement and drawing. Compared, however, with the more modern works it appears to advantage; for the quantity of white light introduced in the upper part of the design, in the Madonna, and in the tracery above, the angels, the crockets, and above all, in the ornamental bands or fillets which serve at once to connect together and to frame the different subjects, imparts to the window a silvery or glass-like effect, which none of the others possess, and which completely rescues the work from the imputation of being like a fresco painting. The execution of the crockets and of the foliaged ornaments round the shield is quite perfect; but perhaps the greatest display of skill is the manner in which Dante's head is made to stand free from the chair's back. The representation of one of the ladies' silk dresses and of the lining of Dante's cloak is a wonderful achievement in painted glass, and perhaps could not be accomplished in a work in which clear lights were considered indispensable.

In conclusion, we have only further to observe, that the defects which we have ventured to notice are those which prevail very generally in the works of the present day; but the beauties exhibited by M. Bertini in this production greatly preponderate, and are his own.

CAPRONNIER, J. B., Brussels.—The conditions of the art of glass painting appear to have been complied with, on the whole, in this work more fully than in any other of equal or superior size in the Exhibition; for not only is the drawing good, the composition simple and calculated for distinctness of effect at a distance, but the angular character of the draperies, and the fineness and decision of the entire execution, are admirably suited to the nature of painted glass. The style principally followed is that of the first half of the sixteenth century. The absence of clear light, and over-painting of the head of the principal figure, are to be regretted as deviations from what we consider to be a correct observance of the style adopted. Still it is impossible to refuse to this composition a first-rate place.

The above is an extract from a very able Report upon the art of glass painting, and the objects exhibited, which Mr. Charles Winston, of the Temple, has had the kindness to supply.

JURY AWARDS, CLASS XXIV.

COUNCIL MEDAL.

Nation.	No. and Page in Catalogue. No.	No. and Page in Catalogue. Page.	Name of Exhibitor.	Objects Rewarded.
France	656	1209	Maës, M.	Novelty of chemical application in the manufacture of optical and other descriptions of glass.

PRIZE MEDAL.

Nation.	No.	Page.	Name of Exhibitor.	Objects Rewarded.
France	1540	1250	Andelle, G., and Co.	French bottles.
United Kingdom	19	699	Bacchus and Sons	Cut glass, imitation of Venetian glass.
Belgium	390	1163	Bennert and Bivort	Window glass.
France	53	1173	Berlioz and Co.	Plate glass for mirrors.
Austria	600	1037	Bigaglia, P.	Venetian glass.
United Kingdom	408	700	British Plate Glass Company (Cl. XXVI.)	Plate glass for mirrors.
United States	113	1440	Brooklyn Flint Glass Company.	Flint glass.
France	39	1173	Burgun, Waller, Berger, and Co.	Watch-glasses.
United Kingdom	47	706	Coathupes and Co.	Glass pipes; curtain poles.
United Kingdom	15	699	Davis, Greathead, and Green	Cut and coloured glass, Greek and Etruscan vases.
France	1187	1234	Deviolane Brothers	French bottle glass.
France	1396	1243	De Poilly and Co.	French bottle glass.
United Kingdom	32	701	Green, J. G.	Design—form—engraving on glass.
Austria	587	1036	Harrach, F. E., Count Von	Bohemian glass.
United Kingdom	21	700	Harris, R., and Son	Cut glass, pressed, moulded, and coloured.
United Kingdom	100	708	Hartley, J., and Co.	Rolled plate glass for roofs, rough plate.
United Kingdom	18	699	Lloyd and Summerfield	Cut-glass medallions.
Austria	595	1037	Meyr's Nephews	Bohemian glass.
United Kingdom	13	699	Molineaux, Webb, and Co.	Cut glass, coloured or pressed.
United Kingdom	20	700	Osler, F., and Co.	Cut glass, various—novelty of design in fountain, candelabra, &c.
France	674	1211	Patoux, Drion, and Co.	Glass.
United Kingdom	33	701	Pellatt, Apsley, and Co.	Cut-glass crystal—imitation of Venetian glass, gems, &c.
United Kingdom	31	701	Powell and Sons	Fine crystal (purity of colour, pipes and joints).
Netherlands	99	1148	Regout, P.	Tubing and table-glass.
United Kingdom	14	699	Richardson, W. H. B. and J.	Cut crystal—coloured pipes, coloured glass.
France	1445	1245	Robichon Brothers and Co.	Crown glass.
Prussia	208	1959	Schaffgotsch, Count	Bohemian glass.
United Kingdom	4	698	Swindurne, R W., and Co.	Glass dome, plate glass.
United Kingdom	399	759	Thames Plate Glass Company (Cl. XXVI.—Main Avenue West.)	Plate glass.
France	714	1213	Van Leempoel de Colnet and Co.	Bottle glass.
United Kingdom	27	701	Varnish, E.	Silvered glass.
United Kingdom	17	699	Webb, T.	Cut glass.

HONOURABLE MENTION.

Nation.	No.	Page.	Name of Exhibitor.	Objects Rewarded.
Austria	582	1036	Abdele, F.	Looking glass.
Portugal	1023	1317	Affonso, M. J.	Cut glass.
United Kingdom	6	698	Aire and Calder Bottle Company.	Bottle glass.
Portugal	1044 to 1046	1317	Basto, Pinto, and Co.	Sketched window glass.
Belgium	387	1163	Capellemans, J. B.	Bottles.
United Kingdom	25	701	Claudet and Houghton	Glass shades (from Messrs. Chance).
United Kingdom	2	711	Copeland, W. T., Alderman, M.P. (Class XXV.)	Table glass.
France	1157	1233	Corderant, A.	Door handles, &c.
United Kingdom	37	705	Davies, G.	Imitation of marble.
Egypt	386	1411	Egypt, H. H. the Viceroy of	Rose-water bottle.
United Kingdom	40	705	Ford, D.	Vitrum marmoratum.
United Kingdom	12	698	Gatchell, G.	Glass centre-dish.
United Kingdom	41	705	Hall, J. W.	Ornamental cut-glass window.
United Kingdom	46A	706	Hancock, Rixon, and Dunt	Cut-glass chandelier.
Bavaria	60	1101	Hechinger, H.	Mirrors, &c.
Bavaria	61	1101	Heilbronn, L.	Mirrors, &c.

HONOURABLE MENTION—*continued.*

Nation.	No. and Page in Catalogue.		Name of Exhibitor.	Objects Rewarded.
	No.	Page.		
Austria	588	1037	Hegenbarth, A.	Bohemian glass.
Austria	589	1037	Hellmich, F. A.	Bohemian glass.
Austria	590	1037	Hofmann, W.	Bohemian glass.
Turkey	–	1396	Indgir-keny, Imperial Glass-house of.	Venetian glass.
United Kingdom	11	698	Jones and Sons	Coloured glass.
United Kingdom	3	698	Kidd, W.	Engraving and silvering on glass.
Austria	596	1037	König, F. P.	Centre-pieces, fruit-dishes, &c.
United Kingdom	23	701	Lockhead, J.	Glass ventilators, &c.
United Kingdom	30	701	Naylor, W.	Engraved glass, &c.—various forms and patterns.
Bavaria	62	1101	Neft, M. C.	Specimens of white crown glass.
Austria	597	1037	Pelikan, J.	Glass goblets.
United Kingdom	36	705	Perry and Co.	Cut-glass chandelier.
France	981	1236	Renard and Son	Plate glass.
Prussia	768	1092	Röhrig, C.	Glass shades, &c.
United Kingdom	1	698	Ross, O'Connor, and Carson	Watch-glasses.
Russia	293	–	Salivsky, Madame	Table glass, &c.
United Kingdom	8	698	Shephard, J.	Glass tubing.
Frankfort-on-Maine	22	1122	Vogelsang, J., and Sons	Bohemian glass.

SWITZERLAND (No. 75, p. 1271), DAGUET,[*] F., Optical Glass.

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[*] This exhibitor was awarded a Council Medal by the Jury of Class X., and his name appears in their list of awards.

DE MAULEY, REPORTER.

London, September 1851.

CLASS XXV.

REPORT ON CERAMIC MANUFACTURES.

[The Figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

Duke of ARGYLL, *Chairman and Reporter*, Stafford House, St. James's, and Roseneath.
CHARLES BARING WALL, M.P., F.R.S., *Deputy Chairman*, 44 Berkeley Square.
E. EBELMEN, France; Director of the National Manufactures, Sèvres; Member of Central Jury, &c.
GABRIEL KAMENSKY, Russia; Councillor of the Administration of Finances, and Commissioner in London.
W. MORTLOCK, 18 Regent Street, Waterloo Place; China Manufacturer.
F. ODERNHEIMER, Zollverein; Director of the Board of Trade and Commerce, Wiesbaden.
AUGUSTO PINTO BASTO, Portugal.
JOHN A. WISE, Clayton Hall, Newcastle-under-Lyne, Staffordshire.

Associates.

E. H. BALDOCK, M.P., 5 Hyde Park Place. (Juror in Class XXIV.)
THOMAS HETHRINGTON HENRY, F.R.S., 18 Lincoln's Inn Fields; Analytical Chemist.

IN framing our Report on Class XXV. we are desirous of explaining, in the first place, the view we take of the duty assigned to us, as determined by the rules of the Royal Commissioners, and by the nature of the Class itself.

In the first place, the appointment of Juries implies, of course, that they are to judge of the comparative merits of the articles submitted to their inspection. In the second place, the fact of Medals being intrusted to their award implies, farther, that it is their duty to specify those articles which, in respect of high degrees of merit, they deem most remarkable. And lastly, the injunction to accompany their judgment with a Report, implies an expectation that the Juries, besides explaining to a certain extent the grounds on which that judgment has been come to in respect of Medals, should also indicate their opinion generally, on different kinds or minor degrees of merit.

These duties, however, become somewhat complicated by a special instruction from the Royal Commissioners that the Juries are to avoid giving encouragement to the distinctions of a merely individual character, and by an explanation that the award of Medals of different orders should not imply corresponding differences of degree in merit in the "same class of subjects." We have been much impressed both with the importance of complying with this instruction of the Commissioners, and with the difficulty of reconciling it completely with the necessary exercise of our functions. We have felt that in case of the Council Medal being awarded to one or more exhibitors of ceramic manufacture, "individual distinctions" would be necessarily involved between those exhibitors, and others to whom only the Prize Medal may be given; and again, whether the Council Medal is given or not to any, the same distinctions may be felt between those exhibitors who do get the Prize Medal and those who receive none.

The withdrawal of the Council Medal from the direct award of the Juries, and the limitation of their duty to recommendations merely for that award, has divided the responsibility, but has not removed the difficulty arising out of these considerations; inasmuch as recommendations, whether acceded to or not, involve the same distinctions as an actual award.

It has therefore been a matter of anxious consideration among the Juries to come to something like a common understanding as to the grounds on which such recommendations should be made; and the Group to which we belong, accordingly laid down the following general definition of the kinds of merit which ought alone to be so distinguished:—"Important inventions and discoveries, or originality combined with excellence of design; novel application of known discoveries; great utility combined with economy and beauty; excellence of workmanship and quality."

Some of these definitions are obviously not easily applied to the kind of merit usually claimed for articles of ceramic manufacture; whilst others would require to be taken in an adapted sense. "Novelty of invention," unless displayed in entirely new compositions of the elementary earths, or in entirely new modes of dealing with them, will, in such manufacture, be generally reducible to improved methods of execution. Or if a higher sense be attached to "invention," as applied to form and high artistic merit, it will then fall under the other definition laid down, viz., "beauty and originality of design."

Understanding "invention" in the former and stricter sense, there is only one article in our Class in respect to which any important claim could be well advanced: we refer to that particular paste or body which has been variously called Parian, Carrara, or Statuary Porcelain, and which must undoubtedly be viewed as marking an important advance in the ceramic manufacture of this country. The facility and comparative cheapness with which the highest works of sculpture can be reproduced in this material—its durability and its beauty, have combined to give an important stimulus to the trade, and if well employed may much contribute to improve the public taste. It has already led to the great multiplication of copies of both antique and modern groups and statues, as well as to new designs of a similar kind.

But whilst fully acknowledging the importance to the ceramic art of this material, we do not feel called upon to found upon it any recommendation for a Council Medal. In the first place, the amount of novelty in the material is not easily defined, it being a modification of that which has long been known, and applied to the same department of art, under the name of Biscuit. However important this modification may be, it is hardly entitled to rank as an entirely new invention, especially as the improved result is attainable by several varieties of composition. This seems sufficiently established, not only by the fact that different manufacturers produce substantially the same material without identity of process, but by the further fact, that one of those who prefer a claim to the origination of parian expressly states that in his hands it has already undergone one important change.

In addition to this consideration, the Jury find that they could not recommend an award of the Council Medal for the invention of parian without deciding on the disputed claim of priority between very eminent firms, who severally advance that claim with equal confidence. We have not felt it to be our duty to come to any such decision; especially as it would appear from the statement of each party that, whichever may have actually been first in publicly producing articles in this material, both were contemporaneously working with success towards the same result. We may add that the introduction of parian took place several years ago.

There is one other claim to novelty of invention in our class which, perhaps, goes nearer to fulfil the necessary conditions: we allude to the process of M. Bapterosses for the manufacture of buttons by pressure applied to a dry body in the state of powder; but here also we consider the merit to be to a great extent divided. The original idea of this process is due to Mr. R. Prosser; and, under a patent obtained by him, it was carried on for some time by Messrs. Minton. The improvements, however, effected upon the process by J. F. Bapterosses, have been so great and so important, that the invention has, in a great measure, become his own, and has enabled him to beat the English manufacturers entirely out of the market. The principle, however, is identical. Under these circumstances, we have been unable to recommend M. Bapterosses to an award of the Council Medal on the ground of novelty of invention; although his merit is undoubtedly so high that we deem him well entitled, not merely to the award of the Prize Medal, but to very Special and Honourable Mention, on account of the inventive talent displayed in his process.

As the Jury do not, therefore, think that any sufficient ground for the award of the Council Medal has been presented, as regards priority of invention, it has only remained to consider whether they could recommend that award on the ground of "beauty and originality of design."

Although we do not hold ourselves bound to any very close or literal interpretation of this definition, we should still be departing from the whole intention with which the Council Medal was withdrawn from the direct award of the Juries, if we were to recommend it for any article or set of articles on account simply of superior execution in the same class of subject; and that, in as far as possible, we ought to limit ourselves in such recommendations to merit capable of being clearly separated from others *in kind*, and not merely *in degree*. It is only by adhering to this distinction that we can comply with the important instruction to avoid giving encouragement to "individual competition;" and although it is a line which cannot always be laid down with perfect precision, it is still capable of being followed with substantial fairness. For example, if two manufacturers exhibit each vases, plates, &c., with flower or landscape painting, and if the articles of the one were of great superiority *in execution* to the other, this superiority, however great, ought not to be expressed by a recommendation to the Council Medal, because these two exhibitors are evidently competitors in the same kind of merit; whereas, if one manufacturer shows articles of the above description, whilst another shows articles of new and beautiful form, and of high artistic merit in the grouping and design of figures, such two exhibitors are evidently *not* competitors in the same kind of merit, and the latter might be recommended for the award of the Council Medal without any "individual distinctions in the same class of subject" being drawn between them. The same distinction may be traced even in kinds of merit, which are both in a certain sense imitative. The successful introducer, into this country, of important processes of manufacture formerly confined to other lands, possesses a merit very different in kind from imitations more or less successful of the paintings and ornaments of old Sèvres or old Dresden.

Having thus explained the principles on which we have thought it our duty to consider recommendations for the Council Medal, we have only shortly to point out the consequences which result on the value to be assigned to the Prize Medal. Being the only one which we have to award for the whole articles of our Class,—except the few which answer the conditions demanded for the Council Medal,—it follows that very wide differences in degrees of merit must indiscriminately receive the same acknowledgment—so far as the Medal merely is concerned. This circumstance will be strongly felt by many of the exhibitors who receive the Medal, and will diminish the value set on our awards. We have only to explain that it has tended equally to diminish the satisfaction with which we have made them; but that no evil or injury can arise from the result, provided the cause of it is publicly known and understood. The task of marking distinctions of merit between individual competitors in the same class of article was not only not given to us, but was advisedly withheld; and we have, therefore, only to explain emphatically that we by no means regarded as on the same level, or even near the same level, all those exhibitors to whom, nevertheless, we have been obliged to give the same award. In our Report we have held ourselves at liberty to depart, to a certain extent, from the rule which applies to Medals, and to point out the broader individual distinctions observable in our Class.

One other circumstance has presented itself respecting our awards, which we feel it necessary to mention. Our Class contains the produce of royal, national, or imperial manufactories; and it has been argued that these ought not to be brought into competition with the produce of private enterprise. In a certain sense we admit this argument to be just. The Sèvres manufactory, for example, being supported by national funds, and carried on as a school of national design, without reference to profit or loss,—the latter, indeed, being the admitted result,—we certainly feel that its productions cannot be fairly considered as standing on the same footing with those of private manufacturers. The latter have a greater number of conditions to fulfil, and of difficulties to overcome. The element of price, being an element of the most important character, does not enter into the view of the one, whilst, for the most part, it strictly limits the efforts of the other. The *merit*, therefore, as regards commercial value of their respective works, cannot be easily compared, and is certainly not measured by a comparison simply of their beauty. We are relieved, however, from the difficulty which might arise out of these considerations by understanding that we are to judge of the articles in our Class as they appear before us, without reference to extraneous considerations respecting origin. We think it our duty, however, in the Report to point out the important distinction above referred to, and to explain distinctly that, in admitting, as we unanimously do, the very high character of the Sèvres Exhibition, and in recommending it to an award of the Council Medal, we do not hold that in point of merit it can be justly compared with any other series of articles in our Class, except those which are similarly circumstanced.

Before proceeding to notice particulars, we may observe that the ceramic art of the world is represented by a series of articles, which, though not calculated to illustrate its past history and progress, is at least sufficient to give a very adequate idea of its present condition. The imperial, royal, or national manufactories of Russia, Austria, Prussia, Saxony, Bavaria, Denmark, and France, have all sent specimens of their production. Private enterprise in the same art is honourably represented from France, from many of the States of the Zollverein, and from Austria. A few exhibitors appear from Portugal. One article is shown from America. The manufacture of Turkey is also exhibited in a limited number of articles. The East India Company show specimens of the graceful forms of Indian pottery; whilst the well-known productions of China are among the articles collected from that country. But, undoubtedly, the collection which most largely represents the commercial importance of the ceramic art as a branch of manufacture, and the advances it is capable of making under no other influence than that of private enterprise and public taste, is that which is exhibited on the British side, and mainly contributed by the Staffordshire potteries.

Minton, H., and Co., Stoke-on-Trent, Staffordshire (1, pp. 709–711), stand foremost among the British exhibitors for the number, variety, and beauty of their articles.

We have found it necessary to view this collection in two divisions: first, in respect of a group of articles which we have considered distinguishable *in kind*, and not merely in degree of merit, from all others in the class; and, secondly, another group which, though of high excellence and beauty, must be looked upon as claiming merit of the same kind with articles exhibited by several other manufacturers. The first of these is the great dessert service, which has attracted universal notice.

Some objection has been felt, and has been stated in our Jury, to the principle of mixing together the two different bodies of porcelain and parian, as detracting from unity of effect, and, to a certain extent, from merit of manufacture. But it may be questioned how far this objection could be sustained, except on a general rule which would be far from receiving universal assent. Another objection has been started to this service,—with reference to the position of the figures, as being too purely and evidently for ornament alone, and having too little connection with the structure and support of the vessels to which they are applied. To this it may be replied, that such use of figures, for ornament simply, is familiar in the best examples of ceramic art; although it is clearly one which requires to be very strictly governed by good taste, lest it should become redundant, and cease to be subordinate to the general design. It has been further remarked that the figures in some pieces of the service present too many salient points, which render the whole peculiarly liable to injury. In articles not purely decorative, but intended for use, this objection refers to a point well deserving the attention of designers and manufacturers.

The Jury were, however, unanimously of opinion that the dessert service of Messrs. MINTON, being one of original design, presents a very high degree of beauty and harmony of effect; and that the design and modelling of the figures in many of the pieces are full of grace and spirit, evincing a remarkable degree of artistic merit.

The Jury must specially mention, as belonging to the first group of articles, the garden-pots and vases exhibited by Messrs. Minton, modelled in imitation of the old Majolica ware, and not only remarkable for the success with which the effect of that ware is attained, but for novelty and beauty of design. A large vase, intended for similar purposes, designed by Baron MAROCHETTI, and executed by Messrs. Minton, is worthy of notice, both for beauty of style and great size.

Thirdly, the attention of the Jury was directed to the manufacture of hard porcelain for chemical purposes, lately established by Messrs. MINTON. It is well known that for such articles the laboratory has hitherto been dependent on the Dresden, Berlin, and other foreign manufactories: these crucibles and capsules have been subjected by Mr. Henry, at the instance of the Jury, to the severest chemical tests, along with specimens from Dresden, and have been found to stand these tests with perfect success; and besides being fully equal to the German ware in quality, they have the additional merit of being considerably cheaper. The Jury have considered the successful establishment of this manufacture in England as a matter of much importance and interest in a scientific point of view.

The second group of articles exhibited by Messrs. MINTON includes articles of very remarkable merit and beauty in almost every department of the ceramic art in which other English exhibitors compete, and would alone place Messrs. Minton among the very first of these. It is unnecessary in this Report to specify details minutely. It is sufficient to say that the articles exhibited by Messrs. Minton in imitation of old Sèvres, their flower-painting on a great variety of plates, on their small tea-services, on their earthenware basins, ewers, &c., and their smaller articles of a more purely decorative character, are all remarkable for great freshness of effect and excellent taste. Their parian figures are very good; and a chimney-piece of this material is a new and remarkable adaptation of it.

The Jury were unanimous in recommending Messrs. MINTON for a Council Medal, but founded it only on those articles first referred to, in respect of which originality and beauty of design, and not mere excellence of execution, were prominent merits.

COPELAND, W. T., Stoke-on-Trent, Staffordshire (2, pp. 711–714).—This exhibition is remarkable in several respects, especially for the great beauty of the parian groups and figures, several of which are eminently successful, and show complete mastery over this material in its best and most legitimate application. The Jury especially desire to mention the large porcelain slabs or panels decorated with flower-painting and other patterns, and now much used for fire-places, panels, tables, and a variety of other purposes connected with useful and ornamental furniture. The large flower-painting on some of these has a very handsome effect; and some Pompeian patterns are particularly pleasing.

Mr. COPELAND shows a large assortment of plates and other articles of ornamental porcelain. The flower-painting and gilding are, in many of them, very good; and especially in the centering of the plates, much taste is observable in the arrangement of the pattern. Some large vases of Etruscan shape and style of decoration are handsome. Mr. Copeland has also some articles, in which the effect of inlaid pearls and other jewels is rendered with considerable success. The value of this novel style may be a question of taste; but it undoubtedly exhibits much skill in the processes of manufacture. Other articles are of a colour which is claimed as new, and has a certain richness of effect; but as no extensive series of articles with this colour are exhibited, the Jury are unable to state how far it can be reproduced with the certainty and uniformity of tint requisite to establish it as an improvement in ceramic decoration.

The earthenware of Mr.Copeland is of excellent quality; and on some plates the Jury observed prints worthy of special notice on account of simplicity and effect.

A Prize Medal is awarded him for the general high merit shown in his extensive collection.

WEDGWOOD, T., and SONS, Etruria, Staffordshire (6, pp. 717–719).—The articles exhibited by this firm are of great as well as of long-acknowledged merit—which consists chiefly in a faithful revival of the forms originated by the enterprise of the elder Wedgwood, some of the most remarkable of which were suggested by the genius of Flaxman. The classic beauty of some of these designs in terra cotta, jasper, and fine stoneware, has never since been surpassed or equalled; and no better desire could be entertained for the popular taste of this country in respect to this class of article than that it should again be familiarized with these productions, which are of purely national origin, and are capable of being applied, and that cheaply, to almost every variety of domestic use. The white and printed earthenware of this firm, long celebrated, and particularly adapted for the export trade, maintains its old and well-merited reputation. The Jury have had great pleasure in giving a Prize Medal to this exhibitor.

ROSE, J., and Co., Coalbrook Dale, Shropshire (47, p. 727), have exhibited porcelain services and other articles, which have attracted the special attention of the Jury. A dessert service of a rose ground is in particular remarkable, not only as being the nearest approach we have seen to the famous colou which it is designed to imitate, but for the excellence of the flower-painting, gilding, and other decorations, and the hardness and transparency of glaze. The same observation applies to other porcelain articles exhibited by this firm. The Jury have awarded to Messrs. ROSE and Co. a Prize Medal.

Before proceeding to mention the remaining English exhibitors to whom the Jury have awarded the Prize Medal, it may be well to state generally that this reward has respect chiefly, if not entirely, to that branch of the ceramic art which has been so extensively developed in England, and which has constituted it an important branch of our national industry, viz., the manufacture of stone and earthenware for domestic use. Articles of porcelain are also exhibited by some of the firms hereafter named; but the Jury have not been able to consider these as furnishing any ground for an award. In many cases, indeed, they are open to much criticism. Violent colours, and forms of loose indefinite shape, with much overloaded decoration, are frequent. The Jury has also noticed in some cases a fault to which they deem it well to direct attention, viz., the application of elaborate gilding and flower-painting, very suitable for porcelain, and sometimes of taste and execution which would have been well adapted to that material, to the inferior substances of stone and earthenware. This they consider a misapplication of skill and labour, expended with no adequate result, or with effects which, to a severe taste, are positively displeasing.

Ridgway, J., and Co., Cauldon Place, Staffordshire (5, p. 714), is one of the most important manufacturers of earthenware in the Staffordshire Potteries, and exhibits articles in this department of first-rate quality. He has, with much spirit, ingenuity, and success, adapted this material to a variety of sanatory purposes; and in his stall the Jury observed the application, or the proposed application, of it to the banister and hand-rail of staircases. The specimen shown has at first sight a fresh and pleasing effect; but it may be questioned how far the mechanical difficulty of preserving accuracy of outlines in such large pieces as are requisite for this purpose can be successfully overcome. Lawn and conservatory fountains are also shown. The excellent quality of Messrs. Ridgway's ware, fully accounting for the commercial importance of their manufacture, has well entitled them, in the estimation of the Jury, to an award of the Prize Medal.

Mayer, T. J. and J., Burslem, Staffordshire (9, p. 719), is another firm in this great branch of manufacture, and have exhibited a most interesting assortment of articles illustrative of the ordinary course of their trade, which is principally connected with the markets of the American Continent. Messrs. Mayer adapt their excellent material to every variety of useful purpose. One of these appears to be novel. They have made tea-urns of stoneware of a hard vitreous body, capable of withstanding the variations of temperature required in this application. They have also exhibited a variety of jugs in parian, to which material they have applied colour with success, and in the composition of which they claim to have introduced some important modifications, with the view of rendering it proof against the effect of sudden changes of temperature, from boiling water, &c. The Jury have awarded to Messrs. Mayer a Prize Medal.

Dimmock, T., Shelton, Staffordshire (12, p. 722).—This manufacturer has exhibited also earthenware of first-rate quality; and the Jury have much admired the neatness and good taste of his printed patterns, the agreeable effect of his "flowing blue," and in general the excellence of his ware. They have awarded a Prize Medal to this exhibitor.

Alcock, S., and Co., Burslem, Staffordshire (7, p. 719).—This is another very important stall, as exhibiting the productions of a most extensive manufacturer, as well in porcelain as in the cheaper wares. Fancy articles in parian or biscuit, of most delicate execution, are shown in this stall; and the Jury may mention as remarkable for fancy and freshness of effect a number of vases and jugs, of various forms and colours,—in particular some with white figures on a blue ground,—and some with green ornaments on the same ground. The Jury have awarded a Prize Medal.

Meigh, C., and Sons, Hanley, Staffordshire (10, p. 720), have exhibited excellent earthenware, and some specimens of very remarkable size, especially two great vases, of one piece each. Their white enamel ware is of first-rate quality, and has an extensive hold on the market. The Jury have awarded a Prize Medal.

Boote, T. and R., Burslem, Staffordshire (11, p. 722).—The articles exhibited in this stall are well worthy of special notice, on account both of some new processes in the manufacture of earthenware, and for the remarkable grace and beauty of some of the productions. The inlaying of one clay upon another,—as white upon blue,—is a process patented by Messrs. Boote, and has important results in rendering simple and easy certain effects and combinations of colour, which it was before impossible or difficult to produce. Some vases or jars exhibited by Messrs. Boote, of a pale brown clay colour, with vine leaves and tendrils in high relief, are deserving of much praise as both extremely beautiful in design and in effect, and manifesting great skill in the management of material. The Jury have awarded a Prize Medal.

Bourne, J., Derby Pottery, Derby (35, p. 725).—This manufacturer has the merit of making stoneware bottles, which have the property of resisting the action of blacking in a manner which had been found extremely difficult of attainment. Their bottles are consequently employed to a large extent by Messrs. Day and Martin in the export trade to India and elsewhere. The Jury have awarded Mr. Bourne a Prize Medal.

Green, S., and Co., Lambeth (Class XXVII., 125, p. 775).—This firm exhibits some very remarkable specimens of stoneware, of great size, designed for the use of breweries, distilleries, &c., and which, on account of their hardness of glaze and other qualities, are of great value in many processes of chemical manufacture. The Jury have awarded a Prize Medal.

Finch, J., London (38, p. 725), exhibits articles of earthenware for wash and steam-tubs, and other sanatory purposes, which have appeared to the Jury deserving the award of a Prize Medal.

The Jury, in addition to the Exhibitors before mentioned, to whom they have awarded Medals, desire to notice, as deserving very Honourable Mention, the following names:—

Kennedy, W. S., Burslem, Staffordshire (4, p. 714), who exhibits a large assortment of door-handles, "placques," and other similar applications of china and earthenware, which has become in his hands a separate and important branch of ceramic manufacture. In the objects in this stall, utility of application is combined with cheapness and agreeable appearance.

Keys and Mountford, Newcastle-under-Lyne, Staffordshire (14, p. 722), exhibit a series of statuettes in parian, well executed, and of a pretty effect.

Pratt, F. and R., and Co., Fenton, Staffordshire, (22, p. 724), exhibit some very remarkable specimens of a process which they seem to have greatly improved, viz., that of coloured printing under the glaze. The freshness and truth of the colouring, in some of these specimens, from pictures by Mulready, Wilkie, &c., are excellent. They also exhibit some earthenware of very good forms and style of ornament.

Bell, J., and Co., Glasgow (26, p. 724), being the only exhibitors in this Class from Scotland, are deserving of notice, not only on this account, but on account also of the good quality and design of the ware they show.

Chamberlain and Co., of Worcester (44, p. 726), exhibit some perforated china of agreeable effect.

Edwards, J., and Sons, Dale Hall, Staffordshire (37, p. 725), exhibit a very large and fine model of the Warwick vase, in terra-cotta, and an earthenware tea-tray, &c.

Grainger, G., and Co., Worcester (46, p. 726), exhibit articles of semi-porcelain, the good quality of some of which, for chemical purposes, is well attested.

Southorn, W., and Co., Brosely, Shropshire (29, p. 725), exhibit superior tobacco-pipes.

Wood, G., Brentford (34, p. 725), exhibits some ornamental orange-tree garden-pots of remarkable size.

Sharpe Brothers and Co., Swadlincote, Burton-on-Trent (36, p. 725), exhibit specimens of ironstone cane-ware and printed earthenware, which are worthy of notice.

Lee, J., Rotherham, Yorkshire (48, p. 728), exhibit the application of earthenware to letters for sign-boards, &c., which is a useful and pretty adaptation.

Challinor, E. (Class XXVII., 104, p. 772)—Earthenware.

The attention of the Jury has been much attracted by two designs, one of a bust, the other of a vase, executed by James Marsh (34, p. 732), a young pupil of the School of Design, Hanley, Staffordshire, which possess remarkable merit, and deserve very Special and Honourable Mention.

In the French Department of this Class the Jury need hardly state, that they have unanimously assigned the first place to the Sèvres Manufactory, and have recommended the Council Medal to be awarded to its productions. They must, however, again explain, that the light in which these ought to be regarded is wholly different from that in which the productions of commercial industry and enterprise are viewed. Their position is analogous to that of articles produced in a school of design; and in the French expositions they have never been allowed to come into competition with the ordinary products of private enterprise. There is no reference to cheapness of production. The manufactory is maintained by a large annual grant from the public funds, and the sale of its products, though the prices are very high, is so far from being successful, in a commercial point of view, that the result is a large annual loss. The articles are, for the most part, purely decorative. But considered as a school of design, which is not to follow but to guide the public taste, the importance of the Sèvres manufactory can hardly be too highly estimated. Its influence has extended over the whole of Europe, and a large proportion of the most beautiful forms and styles of decoration, which are exhibited in the English and other departments of this Class, are derived either by direct imitation, or by slight modification, from the old productions of the Sèvres school. The Jury are not prepared to say that the articles exhibited from Sèvres are equal, either as regards variety or excellence, to those which were sent forth from the same establishment at a former period, and on which its traditionary fame is principally founded: but without any attempt at the mere imitation of its own old forms, it still produces wares of admirable texture and workmanship, and equally remarkable for great refinement and purity of taste, both as regards form and decoration. It is to be observed, however, that in respect to texture, extreme lightness and fineness are incompatible with the strength requisite for domestic use, however beautiful for merely ornamental China. The Jury may specify in the Sèvres department several large vases,—one or two of unusually large size,—which are all remarkable for beauty of form, and some of them for flower-painting, of admirable freshness and force. A large tazza, of fine blue, mounted in or-molu, is extremely handsome. As a work of pure ceramic art perhaps no single article is so remarkable as (16) a Celadon green vase, with white figures in relief, manipulated in a novel and peculiar manner by the pencil. The handles are also of porcelain, the whole deriving no adventitious attraction from or-molu or gilding. The Jury also observed a beautiful adaptation of a cinquecento form to a porcelain tazza, in white and gold; also a large plate or slab of porcelain for picture-painting, remarkable for great size, combined with truth of surface. Two perforated porcelain lanterns are worthy of Special Mention for very elaborate and accurate execution. Some articles are exhibited with painting of figures (in Pompeian style), executed on an unglazed body, which produces a novel and agreeable effect. There are also two vases and covers, and a large tazza finely painted with figures in a subdued shade of blue, which are very beautiful.

MM. Jouhanneaud and Dubois, Limoges (1630, p. 1255), are exhibitors to whom the Jury have had great pleasure in awarding a Prize Medal. Articles in porcelain, of great size, good design, accurate execution, are among their productions. In particular, the Jury would refer to a stork vase, in which the birds are modelled with great boldness and effect, as also the green foliage. The white ground is of excellent colour and glaze, and the whole result most agreeable. Some large white perforated bottles and a white and Celadon green vase, with leaves of bleu-de-roi, &c., are objects well deserving special notice. Altogether much taste and spirit distinguish these exhibitors.

Le Baron A. Du Tremblay, Rubelles, near Melun (395, p. 1197), exhibits a series of articles equally remarkable for cheapness, for novel and agreeable effect, and for the ingenuity of the process by which that effect is attained. It is called "émail ombrant," and consists in flooding coloured but transparent glazes over designs stamped in the body of the ware. A plane surface is thus produced, in which the cavities of the stamped design appear as shadows of various depths, the parts in highest relief coming nearest the surface of the glaze, and thus having the effect of the lights of the picture. Much taste is evinced in the selection of designs to which the process has been applied; and perhaps there is no other in the ceramic art by which, at so cheap a rate, designs of high artistic merit can be reproduced in the most harmonious tinting, for dessert or table services, and for other useful domestic purposes. The Jury have awarded to Baron Du Tremblay a Prize Medal.

Gille, J. M., Porcelain Manufacturer, Paris (848, p. 1220), exhibits a variety of articles of fancy porcelain, which show taste and skill in the management of the material. Some statuettes, birds, &c., are executed with great delicacy and sharpness. The Jury have awarded a Prize Medal to this exhibitor.

M. de Bettignies, St. Amand les Eaux, near Valenciennes (1086, p. 1230).—This manufactory is remarkable for keeping up the old "pâte tendre," which was so celebrated a product of Sèvres during a part of the eighteenth century; and this and the neighbouring manufactory of Tournay, in Belgium, are now the only two in Europe which maintain this particular kind of body. Much improvement has lately been effected by M. de Bettignies in the colouring and decoration of this ware; and specimens are exhibited, especially some vases of turquoise blue, which fully deserve, in the opinion of the Jury, the award of a Prize Medal.

M. Mansard, Paris (1342, p. 1240), is an exhibitor whose *potterie grise* is excellent in its forms. There is an enamelled vase which is deserving of particular notice, and the Jury have awarded a Prize Medal.

Bapterosses, J. F., Rue de la Muette, Paris (409, p. 1197), exhibits buttons made by a process equally effective and ingenious, described in the earlier part of this Report, by which an importance has been given to this branch of ceramic manufacture, which could not have otherwise attached to it. The Jury have had no hesitation in awarding a Prize Medal to M. Bapterosses, and Special Commendation.

The Jury have also awarded Prize Medals to the following Exhibitors:—

Basto, Pinto, and Co. (Portugal, 1047 and 1168, p. 1317).

Copenhagen, The Royal Porcelain Manufactory at (33, p. 1357).

Madras Pottery, The (p. 921).

St. Petersburg, The Imperial China Manufactory at (318, p. 1376).

Strahl, Otto (Prussia, 206, p. 1059).

Villeroy and Boch (Prussia, 361, p. 1071).

Ziegler-Pellis, (Switzerland 260, p. 1283), terra-cotta, deserves Honourable Mention.

Besides these Exhibitors, the following names in the French Department have been thought deserving of Special Mention:—H. I. Nast (659, p. 1209); Alluaud, sen. (1051, p. 1229); E. Honoré (877, p. 1221); C. Avisseau (1543, p. 1250); J. Petit (1629, p. 1255); and Gorsas and Perier (1253, p. 1237).

Austria.—The Imperial Porcelain Manufactory of Vienna (615, p. 1038), has exhibited a series of articles for table-services, of different kinds, flower-baskets, a table painted with shells, corals, &c., &c., which have certain merits, and the Jury have agreed to award a Prize Medal.

Fischer, Moritz, Hungary (618, p. 1038), exhibits porcelain articles of table-ware, embossed with white and gold, and with other patterns. The texture and colour of the white are good, and the Jury have awarded a Prize Medal.

The Jury also considered, in the Austrian Department, the Messrs. Haidinger Brothers, Ellbagen, Bohemia (620, p. 1039) as deserving Honourable Mention; as also C. Fischer, Bohemia (617, p. 1038).

In the Department of the Zollverein, the Royal Porcelain Manufactory at Berlin (Prussia, 213, p. 1060), exhibits a variety of articles, of which the chief merit consists in the landscape-painting, which is extremely well executed, and is employed in the decoration of vases, plates, &c. The same good execution is carried out in picture-paintings, chiefly copies of pictures of the Flemish school, on similar articles of porcelain. Much of the Berlin china is so covered with gold and painting that the body of the ware is almost entirely concealed. There are also exhibited from Berlin some statuettes in porcelain, and candelabra of the same material, with leaves and figures on a pale greenish-grey ground, which are of good execution and design. The Jury have awarded a Prize Medal.

THE ROYAL SAXON CHINA MANUFACTORY, Meissen (Saxony, 10, p. 1105), exhibits the hard porcelain for chemical purposes, for which it has been long celebrated; also a considerable variety of ornamental china, as well as of dinner and coffee services, &c., &c. Some of these with enamelled paintings are well executed. A camellia plant in full flower, entirely executed in porcelain, is a very remarkable example of a kind of work which has long maintained its ground in this manufactory, aided by the natural ductility of the clays which are employed. The flowers of this plant are executed in white of the greatest purity; and the leaves are all finely glazed. The Jury have awarded a Prize Medal.

THE ROYAL BAVARIAN PORCELAIN MANUFACTORY (Bavaria, 64, p. 1101), Nymphenburg, near Munich, exhibits articles in biscuit, and a variety in hard decorated porcelain, which manifest decided advance in taste both as to form and decoration. The picture-painting on some of these is extremely well executed. On the whole the Jury observe in this exhibition much spirit and originality, and have awarded it a Prize Medal.

Honourable Mention is accorded to the following:—

ARNOLDI, C. E. and F. (Prussia, 778, p. 1093).
Constantinople, PORCELAIN FACTORY at (p. 1397).
MATTSCHASS, J. G. H. (Widow), and Son (Prussia, 217, p. 1060).
TIELSCH, CARL, and Co. (Prussia, 219, p. 1060).

ARGYLL, REPORTER.

October 1851.

CLASS XXVI.

REPORT ON DECORATIVE FURNITURE AND UPHOLSTERY, INCLUDING PAPER-HANGINGS, PAPIER MACHÉ, AND JAPANNED GOODS.

[The Figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Professor Roesner, *Chairman and Reporter*, Austria; President of the Imperial Academy of Fine Arts.
Lord Ashburton, *Deputy Chairman*, 82 Piccadilly.
John Lewis Aubert, 20 Lower Road, Islington; Paper-stainer.
Charles de Beyne, Russia; Architect.
François Coppens, Belgium; Architect.
J. G. Crace, *Joint Reporter*, 14 Wigmore Street, Cavendish Square; House Decorator.
Charles Crocco, Sardinia; Manufacturer.
John Jackson, 49 Rathbone Place; Manufacturer of Composition and Papier Maché Ornaments.
W. Meyer, North Germany.
N. Rondot, France; late of Embassy to China, and Member of Central Jury.
Edward Snell, 27 Albemarle Street; Upholsterer and Cabinet-maker.
John Webb, 8 Old Bond Street; Upholsterer and Cabinet-maker.

Associates.

Lieut.-Colonel Demanet, 99 Warwick Street, Pimlico.
L. Gruner, 12 Fitzroy Square; Architect. (Juror in Class XXIII.)
Chev. Lencisa; Commissioner to the Exhibition for H.M. the King of Sardinia.
M. Wolowski, France; Professor to Museum of Arts and Sciences, Member of the Central Jury, and of the Legislative Assembly of France. (Juror in Class XXIX.)

The objects comprised in this Class are of a kind intimately associated with the comfort and adornment of our dwellings; of great importance from the vast amount of skilled labour employed in their production; and of high interest, as displaying the state of industrial art in various countries.

A popular taste must be greatly influenced by those things which are ever before the eye as household companions, and in the manufacture of these it is therefore most essential to attend to the principles of tasteful design, for by those principles an article obtains its power of attraction.

Furniture.

It is important, both for the strength and good effect of furniture, that the principles of sound construction be well carried out, that the construction be evident, and that if carving or other ornament be introduced, it should be by decorating that construction itself, not by overlaying it and disguising it.

It is not necessary that an object be covered with ornament, or be extravagant in form, to obtain the element of beauty; articles of furniture are too often crowded with unnecessary embellishment, which, besides adding to their cost, interferes with their use, purpose, and convenience; the perfection of art manufacture consists in combining, with the greatest possible effect, the useful with the pleasing, and the execution of this can generally be most successfully carried out by adopting the simplest process.

The Jury, though fully sensible of the great beauty of many of the ornamental works in furniture collected at the Exhibition, yet regret that there have not been more specimens of ordinary furniture for general use; works whose merits consist in correct proportion, simple but well considered design, beauty of material, and perfect workmanship. Few have the means of purchasing such beautiful works as the sideboard of M. Fourdinois, or the cabinets of M. Ringuet-Leprince, which come almost under the head of fine art rather than of manufacture; and it is much to be desired that attention be directed towards improving the taste of those more ordinary objects that come into daily use by the many.

Cabinet furniture first became an article of general luxury about the beginning of the 16th century. At this period inlaid, as well as richly-carved furniture, was manufactured in Italy, and exported to various parts of Europe. Among the works now exhibited by Italy, some are distinguished by great excellence, particularly in the carved examples.

From Tuscany.—M. A. Barbetti, of Florence, Sienna, (91, p. 1298), exhibits, with other things, a casket of great merit, most elaborately carved, introducing bas-reliefs of figures, ornaments, chimeras, &c.

A large cheval screen frame, in walnut wood, by Luigi Marchetti, of Sienna (96, p. 1298), is very beautifully wrought with delicate ornament of good taste. An oval medallion frame, by Pietro Giusti (123, p. 1300), is also a fine specimen of carving.

From Sardinia.—M. B. Capello, of Turin (64, p. 1304), exhibits a very elegant inlaid table, a curule chair, and a pedestal—all ornamented in very pure taste in the Etruscan style, and of good execution.

In France ornamental cabinet-work had acquired considerable reputation in the time of Louis XIV. Its manufacturers have since then continued to produce works of great beauty, and have brought the art of marqueterie inlay to a high state of perfection: this work consists in inlaying woods of a great variety of tints in the form of flowers, ornaments, &c., and was greatly advanced in the last century by Reisner, who produced very beautiful specimens.

In buhl-work, also, wherein metals are inlaid upon grounds of tortoiseshell or ebony, or *vice versâ*, the French have greatly excelled. This kind of ornamental inlay takes its name from M. de Boule, a celebrated French cabinet-maker in the time of Louis XIV.

In Germany there has long been established cabinet-work of a high class, more especially for those exquisite ebony cabinets, inlaid with precious stones, and various woods and metals, surmounted with carved figures, and elaborately fitted with innumerable drawers, and with perspective recesses—presents fit for kings and princes: of these an excellent example is presented in the ebony cabinet of M. Groger, of Vienna (631, p. 1039)—a most beautiful work, exquisitely finished.

Cabinet-work of a more useful description has been carried to a high state of perfection in Great Britain, whose manufacturers have studied to produce objects in which the prominent excellence is substantial quality and finished workmanship.

It was in England that mahogany, now so generally used, was first employed for cabinet furniture, about 1720. Dr. Gibbons, an eminent physician, having had some planks of this wood given to him by his brother, a West India captain, who had brought them in his vessel as ballast, wished to use them for a house he was building in King Street, Covent Garden, but the carpenters complained that the wood was too hard; it was therefore laid aside as useless. Soon after, Mrs. Gibbons wanted a candle-box, and the Doctor called in his cabinet-maker, Mr. Wollaston, to make him one of this wood, then lying in the garden. He also declared that it was too hard: the Doctor said he must get stronger tools; the candle-box was completed and approved, insomuch that the Doctor then insisted on having a bureau made of the same wood, which was accordingly done; and the fine colour, polish, &c., were so pleasing, that he invited his friends to come and see it. Among them was the Duchess of Buckingham. Her Grace begged some of the same wood from Dr. Gibbons, and employed Wollaston to make a bureau for her also; on which the fame of mahogany and Mr. Wollaston was much raised. The wood became the fashion, was much admired, and from that time has continued to be used for furniture more than any other.

It will not be possible to give a description of the various details of the manufacture of cabinet-work, but an account of some of the more ornamental processes and results connected with it may be desirable.

Of these the marqueterie inlay is one of the most beautiful and interesting. In this work the design, having been first drawn on paper and properly coloured, is pricked with a fine needle, so that the outline of the ornament or other objects can be pounced on the various coloured woods proposed to be employed; these outlines being carefully marked in, are cut with a fine watch-spring saw, worked in a lathe: in most cases the wood forming the ground is cut with that forming the ornament, so that a piece cut out of white wood corresponds exactly in shape and size with the opening left in black wood, in which it therefore fits and forms the required pattern.

Tarsia-work, or the art of inlaying woods, had been practised from a very early date in Italy, and extensively employed in the decoration of wall panelling; and remains of this kind of work, revived by Fra Giovanni di Verona, in the 15th century, still exist in some of the Italian churches.

The earlier specimens of this work were executed in woods of different shades, but natural hues; afterwards, when flowers, birds, and coloured ornaments were introduced, various stained woods were employed: these, in most cases, have the disadvantage of fading, but in the admirable specimens of marqueterie inlay exhibited by M. **Cremer**, of Paris, (1573, p. 1252), the woods are stained by the process of M. Boucherie, which is stated to give them a permanent dye to a considerable depth. Notwithstanding, however, the beautiful effect of this work, it is desirable to adopt, as far as possible, the employment of woods of natural hues, as being more harmonious and more consistent with the nature of the work.

In those ornaments which are shaded, the effect is given by immersing the pieces in hot sand. The various parts, being cut out of the required tints in the proper form, are then placed according to the design, and fixed on paper; afterwards they are applied, like veneer, to the piece of furniture; being mounted, they are cleaned off and slightly polished, and the finer lines are then engraved.

The manufacture of buhl inlay is by exactly the same process, only that metals, tortoiseshell, and ebony are here the materials employed; the nature of the design is somewhat different, depending more upon simple outline forms. There are many beautiful specimens of this kind of work in the Exhibition, more particularly the cabinets of M. **Fortuer**, of Wurtzburg, Bavaria (69, p. 1101), where the figures and ornaments are designed and finished with infinite talent and skill.

There is another kind of inlay applied to furniture, which may be called mosaic inlay. The beautiful boxes made in India give some good specimens of this work in ivory and metal, equalled, however, by the inlaid furniture and boxes of M. **Marcelin**, of Paris (606, p. 1207): the extraordinary table of Señor **Perez**, of Spain (271A, p. 1346), gives a fine example of this style of work, executed entirely in minute portions of wood; the same principle is carried out in a table by **Nye**, of Tonbridge Wells (54, p. 733).

Where the patterns assume geometric forms, this kind of work is executed by laying together slips of wood or metal, &c., in the particular forms required; these united slips are then cut transversely, and affixed to the grounds, as in marqueterie.

Immediately connected with inlaid cabinet-work is the manufacture of parqueterie, for floors; in this work the same principle is carried out as in marqueterie, only on a bolder scale; woods of different colours are cut to pattern, and inlaid one in the other, or so arranged as to produce very beautiful effects for floors. The specimens exhibited of MM. **Couvert** and **Lucas** (404, p. 1163), and M. **de Keyn**, of Belgium (406, p. 1063), of MM. **Leistler** and **Son**, of Vienna (633, pp. 1039–40), and of Mr. **Miller**, of Russia (299, p. 1376), show the perfection to which this art has been brought.

A very beautiful novelty at this Exhibition was the introduction of porcelain inlaid in furniture like marqueterie, by Messrs. **Rivart** and **Andrieux** (1439, p. 1245); in these examples, not only were panels of porcelain inserted, but the painted flowers were cut to form, and inlaid like the ornamental woods. In the cabinet of Mr. **Dowbiggin**, of London (404, p. 760), porcelain of a very high class of art is mounted in the panels and pilasters; and M. **Gambs**, of St. Petersburg (297, p. 1376), contributes a cabinet in tulip-wood, mounted in or-molu, containing beautiful panels in porcelain. M. A. E. **Ringuet-Leprince** (1437, p. 1245) has introduced carvings of ivory, mounted with ormolu, on one of his cabinets, with excellent effect; and in his most beautiful ebony cabinet for medals, relieved with exquisite carvings, fine stones are inlaid so as to form part of its decoration. Many of the pieces of furniture owe much of their attraction to the metal ornaments with which they are mounted; but the ebony cabinet of M. **Barbedienne** (1709, p. 1258) combines, in the very element of its construction, bronze ornaments and figures of a high class of art, so arranged as to form one united whole.

Of carved furniture there are many magnificent examples in the Exhibition. In the struggle to produce objects that might be specimens of the talents of the parties employed upon them, utility and purpose have in some degree been forgotten, and works brought forward that are objects of art rather than manufacture; still it is one of the advantages of this result that it tends to improve the art workman; it gives opportunity for the display of his skill; it causes a school of art to grow up and extend itself; and if it err by excess, it at any rate creates the ability to do right. Of the carved furniture, the grand buffet of M. **Fourdinois**, of Paris (1231, p. 1236), is of the highest merit; whether for its composition, the carving of the more artistic portions, or its general execution, it is a noble work. The specimens by M. **Lienard**, of Paris (1326, p. 1239), though not large, are of great excellence, showing to what perfection and beauty the art of sculpture in wood can be brought. A large frame in pear-tree wood, very beautifully carved by M. **Lechesne** (573, p. 1205), affords another fine specimen of this branch of art.

The grand collection of furniture by MM. **Leistler** and **Son**, of Vienna (633, pp. 1039, 1040), exhibited in four rooms, displays considerable fancy and excellent workmanship, though the ornament is far too redundant for ordinary purposes.

The grand bookcase of Messrs. **Holland**, of London (161, p. 745), is another example of carved furniture of a high class, and the sideboard and bookcase of Messrs.

Jackson and Graham (261, p. 755), the buffet of Messrs. Cooke, of Warwick (110, p. 827), the bed and toilet furniture of Messrs. Trollope (162, p. 745), the carved glass frame and other furniture of Messrs. Snell (170, p. 746), the beautiful cradle and other objects by Mr. Rogers (353, Class XXX., p. 842), a writing-table in walnut wood, with other specimens, by Messrs. Gillows (186, p. 748), and many works by other manufacturers of Great Britain, show that industrial art is well represented in this country.

There is another branch of cabinet-work which merits particular notice, that in which mechanical action is introduced; the specimens exhibited by MM. Daubet and Daumaret, of Lyons (1579, p. 1252), are most ingenious and curious; in their secretaire, which is full of contrivances, one key unlocks all the drawers. These run in the most easy and perfect manner, if touched in the slightest degree; and the closing of one particular drawer shuts and fastens all the others. M. Krieger, of Paris (1283), also exhibits some furniture of excellent mechanical action, such as card-tables, toilets, &c.; and M. Von Hagen, of Erfurt (770, p. 1093), has a cabinet of fine workmanship, in which the secret mechanism is skilfully carried out.

In the Austrian Collection are some curious chairs and furniture by M. Thonet, of Vienna (641, p. 1040), in which the wood, inlaid with metal lines, is bent to the required forms without the usual framing.

Many excellent billiard-tables are exhibited: in one, by M. Bouhardet, of Paris, (1106, p. 1230), the carving is of very beautiful design; another, by M. Knill, of Vienna (632, p. 1039), is handsomely mounted in buhl inlay, and the inlaid cues of this manufacturer are very beautiful specimens. The billiard-tables of Messrs. Thurston (17, p. 731), and of Messrs. Burroughs and Watts, of London (4, p. 730), are of simpler construction, but solid, and of excellent workmanship.

Decorations.

The specimens exhibited under this head are decorations for walls and ceilings, imitations of woods and marbles, and painted blinds.

Several of the ceilings under the galleries of the Exhibition Building have been decorated with more or less taste, principally in the arabesque style. One, painted by Signor Montanari, of Milan (738, p. 1044), in one of the Austrian apartments, deserves particular notice: it is a coved ceiling, executed with great breadth of effect. The imitation of gold is excellent, and the general treatment is full of spirit and force.

In wall decoration Mr. Morant (164, pp. 745, 746) exhibits a handsome panel, mounted with gilt ornaments and mouldings; the latter upon a ground of looking-glass. In the centre of the panel is painted a figure surrounded by foliage arabesque.

Mr. Moxon's panelling (252, p. 754), over a chimney-piece, by Mr. Thomas (252, p. 754), in the English Furniture Court, is a tasteful specimen of decoration; and the imitations of woods and marbles by this gentleman are executed in a very superior manner, united with an ornamental character of a high class.

Messrs. Holland, of Warwick (407, p. 760), exhibit table-tops in imitation of marbles, ornamentally arranged in the old Italian style, with good effect.

Mr. Kershaw's imitations of woods, Class XXVII. (1, p. 764) are also very excellent; and those by Messrs. Nicoll and Allen, Class XXVII. (69, p. 768) of wood and marble, have likewise considerable merit. Some of these imitations of woods are painted on glass, the polished surface of which gives great finish to the work.

Among the painted blinds, of which there are many exhibited, those by M. Bach Perès, of Paris (1061, p. 1229), were considered good specimens.

The wax-cloth hangings, by M. Vivet, of Paris (734, p. 1215), are painted ornamentally in the style of Francis I., and are stated to be so prepared as to resist the effect of moisture.

Paper-hangings.

Paper-hangings form a manufacture of considerable importance, carried on in most of the principal cities of Europe, employing many artists and designers, and thousands of operatives, consuming also vast quantities of paper, colours, wool, and metal. They are important also, because they may be made the means of extensively diffusing taste for art; and from the low price of the cheaper kinds, enabling the humblest mechanic to give to his home an air of elegance and comfort.

It is difficult to determine the period when paper-hangings were invented. They are supposed to have been first made in China, and the introduction of these hangings into Europe probably suggested the manufacture here.

They may be divided into three kinds—the flock, the metal, and the coloured; and each of these seems to have been invented at a different time as an imitation of a distinct material. The flock, to imitate the figured tapestries and stuffs; the metal in imitation of the gilt leather hangings; and the coloured as a substitute for painted decoration.

It is generally allowed that flock-hangings were first manufactured in England, and invented by Jerome Lanyer, who obtained a patent in the reign of King Charles I., dated 1st May, 1634, and carried on his art in London.

In this patent it is stated, "that by his endeavours he hath found out an art and mystery of affixing wool, silk, and other materials of divers colours upon cloth, silk, cotton, leather, and other substances, with oil, size, and other cements, to make them useful for hangings and other occasions, which he calleth Loudriniana; and that the said art is of his own invention."

M. Savary, in his Dictionary of Commerce, 1720, says that tonture-de-laine or flock-hangings were first made at Rouen, but in a coarse manner, being only used for grounds, on which, with flocks of different kinds, were formed designs of brocades. They essayed to imitate tapestry-hanging, but not satisfactorily; and at last a manufactory was established at Paris, in the Faubourg St. Antoine, and there flowers and grotesques were introduced with success.

The manufacture is thus described by him:—"The artist, having prepared his design, drew on the cloth with a fat oil or varnish the subject intended to be represented; and then the flocker, from a tray containing the different tints of flocks, arranged in divisions, took the colours he required, and sprinkled them in a peculiar manner with his finger and thumb, so that the various shades and colours were properly blended, and an imitation of the wove tapestry produced."

These descriptions, though detailing the manufacture of flock-hangings, yet do not allude to the use of paper as a ground, nor to blocks for printing. A French author, writing in 1723, says that paper-hangings, called tapestry in paper, were, till lately, only employed by the country people for their cottages, or by small tradesmen in their shops and rooms; but towards the end of the seventeenth century, the manufacture was raised to such a point of perfection and beauty, that, besides the quantities that were exported abroad, and to the principal cities of the kingdom, there was scarcely a house in Paris not decorated with it. The manufacture at that time is thus described:—

The design, having been drawn in outline on paper, pasted together, of the size required, was then divided into parts of a suitable form, and given to the carver or wood-engraver, to cut the design on blocks of pear-tree, much in the same manner as at present. The outline thus cut was printed in ink, with a press, on separate sheets of paper: when dry, these were painted by hand in distemper colours, and afterwards joined together, so as to form the required design. Grotesques and panels, in which were intermingled flowers, fruits, animals, and small figures, were then executed by the above process. M. Reveillon, of Paris, is considered to have introduced many improvements in this manufacture, and was celebrated for the beauty of his productions in the latter end of the last century. The pillage of the workshops of this manufacturer in the Faubourg St. Antoine was one of the first incidents of the Revolution in 1789.

In England this manufacture continued from the time of Lanyer, and obtained a high reputation. In 1712, a duty of 1¾*d.* per square yard was imposed; and a Mr. Jackson, who established a factory at Battersea, for paper-hangings of classic design in chiaro-oscuro, writes, in a work published in 1754, in praise of his own productions, and condemns the fanciful paper-hangings at that time so much used, comparing them with the Chinese.

In the year 1786, there was established at Chelsea a manufactory for paper-hangings of a very superior description, by George and Frederick Echardts. Works excelling even those of the present day were produced at this place; some of the blocks used are at present in possession of the writer of this Report: they have great merit in the designs, and are some of them 8 feet in length. These manufacturers carried the art to its highest point in England: they printed not only on paper, but also on silk and linen, and employed a number of artists in addition to workmen and children. M. Sheringham, of London, also excelled at that time in decorative paper-hangings.

During the present century the French have not only restored this branch of manufacture to a high state of perfection, but have also introduced many important improvements, such as the embossed flocks and the shading of flocks, the perfect imitation of chintz, improvements in the satin-grounds, and the introduction of work printed from engraved cylinders.

In England, the trade was protected by a duty of 12*d.* per square yard up to the year 1846, when the late Sir Robert Peel reduced it to 2*d.* This high duty acted almost as an exclusion to foreign makers, and there was therefore no competition with them, nor any inducement to improve. Since that time, however, the English manufacturers have made great progress in their art, both in style and workmanship, the trade has greatly increased, and the improved productions are sold at a greatly reduced price. They have, besides, applied themselves to the improved application of machinery, by which very beautiful papers are made at an extremely cheap rate.

The process of manufacturing ordinary paper-hangings, as now carried on, may be thus briefly described:—

The pattern being first carefully drawn, is then pricked, and the outlines of the various tints are pounced each on a separate wood-block made of pear-tree, mounted on pine. These blocks are pressed on the sieves of colour, and then applied to the paper, each block following the other on the guide-marks left by the previous impression. An idea may be formed of the enterprise and labour required to produce some of the decorative paper-hangings for this Exhibition, by stating that more than 12,000 blocks have been employed on a single one of them.

In making flock-paper, the pattern is first printed in size, and then with a preparation of varnish or Japan gold-size. When this is partly dry, coloured flock, prepared from wools, is sifted on the varnish pattern, to which it adheres. Great improvements have been made of late years in this manipulation, more especially by French manufacturers.

Paper-hangings, where gilding is introduced, are prepared much in the same way as for flock: the leaf metal is laid on the varnish pattern, or, if worked in bronze powder, it is brushed over with a hare's foot.

The English manufacturers have attained great perfection in the preparation of metal papers. The gilding, having to encounter the damp and variable climate, is most severely tested; but by means of good material, careful manipulation, and a preparation washed over it, it remains unchanged for a considerable period.

Paper-hangings have been printed in England by means of hand machines for many years, the papers being made in lengths of 12 yards, or single pieces, in one or two colours, and these colours falling separately on the ground. It was not until about ten years since what is now understood as machine printing was fully introduced, and this was done by Messrs. Potter, of Darwen (74, p. 734), who, by means of steam-power, artificial drying, and an endless roll of paper, were enabled to produce patterns with good effect by surface-roller printing in several colours, on the principle of calico-printing: specimens showing 14 colours were exhibited by this house. Messrs. Heywood, Higginbottom, and Co., of Manchester (71, p. 734), have also effected great improvements in the manufacture, and exhibit patterns showing 20 colours made by 14 rollers; and Messrs. J. Woollams and Co., of London (322, p. 758), likewise exhibit excellent specimens made by machinery in addition to those they make by block-printing.

These machines are now each capable of printing from 1,000 to 1,500 pieces per day; and although the work is not equal to block-printing in the solidity or permanence of the colours, yet the small price at which it is produced commands an extensive sale, superseding to a great extent the cheaper kinds made by hand.

The above remarks apply only to paper-hangings of the cheaper qualities, for machine-printing has not yet been successfully applied to those with glazed or satin grounds. There is also another evil which it is most desirable to remedy—the colours are liable to run, without great care, in the hanging.

It is perhaps impossible to give the correct statistics of the manufacture of paper-hangings. A statement has, however, been prepared with some pains by M. Zuber, of Rixheim, which approximates to the actual condition of this branch of industry in the principal countries of Europe and in the United States; but is founded on rather loose data in reference to this country, the result of whose products I am convinced it understates.

Statistics of Paper-hangings, 1851.

Country.	Number of Tables.	Number of Machines.	Workmen.	Number of Pieces produced.	Value in Pounds Sterling.	Mean per Piece.
					£.	*s.* *d.*
Great Britain - - -	600	—	1,900	2,300,000	300,000	2 7
Ditto - - - -	—	20	100	3,200,000	100,000	0 7
France - - - - -	1,200	—	4,500	6,000,000	330,000	1 1
Ditto - - - - -	—	12	50	200,000	8,000	0 9½
Zollverein - - - -	300	6	1,200	1,600,000	80,000	1 0
Belgium - - - - -	150	6	600	600,000	40,000	1 4
Holland - - - - -	50	—	200	250,000	12,000	0 11
Switzerland - - - -	30	—	100	100,000	4,000	0 9
Austria - - - - -	60	—	250	250,000	24,000	1 11
Piedmont - - - -	40	—	150	200,000	8,000	0 9½
Russia - - - - -	100	—	400	500,000	60,000	2 4⅘
Denmark - - - -	30	—	100	100,000	8,000	1 7
Spain - - - - - -	100	—	400	400,000	28,000	1 5
United States of America -	400	—	1,250	4,000,000	160,000	0 9½
Ditto - - - - -	—	40	50	—	—	—
Total - - -	3,060	84	11,250	19,700,000	1,162,000	—

There are very beautiful specimens of paper-hangings in the Great Exhibition; works which not only possess considerable artistic excellence, but also show great progress in the manufacture.

France has justly acquired a high renown for her works in this branch of industry. M. Delicourt, of Paris, (1715, p. 1258), exhibits a tapestry-like picture entirely printed by blocks, representing a chase in a forest, surrounded by a rich ornamental frame, with pilasters containing animals, birds, and attributes of the chase: 12,000 blocks were required to execute this most creditable work. He likewise exhibits flower decorations entirely executed in flocks, of which there are about 70 different shades; also very beautifully-finished plain flock-papers, called silk and wool. His two bas-reliefs of *the Descent from the Cross* and *the Resurrection* are good specimens of printing.

M. Zuber, of Rixheim, France (1536, p. 1250), exhibits one of his beautifully-executed landscape papers—one of a series of works for which this house is so celebrated: it represents the floral vegetation of the four quarters of the globe, and the richness and brilliancy of the colouring and the perfect workmanship are alike remarkable. M. Zuber also exhibits many other excellent specimens of the various kinds of paper-hangings, &c.: he is, besides, the author of many improvements in this trade.

Messrs. Mader, of Paris (327, p. 1192), exhibit a picture representing a garden scene—a very clever example of paper-printing, left, perhaps purposely, in a state where a few touches by the hand of a clever artist would complete a beautiful effect. A well-executed figure in a panel, and other decorations of flowers and ornaments, besides some specimens of the more ordinary kinds of paper-hangings, attest the skilled workmanship of this house.

The English manufacturers of paper-hangings have produced many beautiful specimens also, both as decorative, damask, chintz, and flock-papers; those made by machinery have been previously alluded to.

Messrs. Townsend and Parker, of London (318, p. 758), exhibit paper-hangings of various kinds, of considerable beauty in design and execution: two of their decorations introduce fruit, flowers, and arabesque ornament of excellent execution. Messrs. Hinchliff and Co., of London (310, p. 757), have also produced good specimens of decorative and other paper-hangings; and the collections of Messrs. W. Woollams and Co. (309, p. 757) J. Woollams and Co. (322, p. 758), and Messrs. Turner and Co., include many examples, showing that the art is well carried on in this country.

Messrs. Spörlin and Zimmermann, of Vienna (651, p. 1041), exhibit paper-hanging decorations for ceilings, &c., in good taste. They have also adapted the process of block-printing in distemper colours, as a cheap form of illustrating works of science and art: the specimens they exhibit give illustrations of machinery in isometrical perspective, very beautifully executed.

M. Devis, of Brussels (Belgium, 401, p. 1163), exhibits a large collection of paper-hangings, more particularly in flock, of excellent execution.

MM. Rahn and Vetter, of Warsaw (Russia, 262, p. 1375), have forwarded a collection of paper-hangings, which possess considerable merit, both as regards design, colouring, and execution.

Japan Ware.

The articles under this head form an interesting series, and include the products of India, China, France, Germany, and England.

Japan ware may be divided into two classes: works lacquered upon wood or metal grounds, and those formed of papier maché; these last are superior to the former, being lighter, sounder, and admitting of a more beautiful finish.

Japan ware derives its name from the lacquered ware manufactured in Japan, and introduced into Europe towards the end of the seventeenth century. The lacquered work of that country is of a superior description; some of it higher in quality even than the Chinese, which is also very beautiful, and is very extensively manufactured.

It is called lacquered ware because the articles are coated with varnish prepared from lac. This lac is a resinous gum, the sap of a shrub Tsei-shoo (*Rhus vernix*) in Japan, and of the *Augia Sinensis* in China; the juice thence extracted is of a poisonous nature, and great caution is required in collecting it.

The method of applying the lacquer in China is pursued as follows:*—"The article to be ornamented, if formed of wood, is always very dry, light, and smooth: it is first coated with a preparation of ox-gall and rottenstone; this is rubbed to a smooth face and then varnished. This varnish is thus composed: 605 grains of fine gum lac are put in 1,200 grains of water, to this is added 38 grains of oil of Camellia sasanqua, a pig's gall, and 19 grains of rice vinegar. The whole is well mixed in full daylight, the lac gets deeper and deeper, and the varnish shortly becomes a brilliant black; a very thin coat of this is laid on with a flat hair-brush. The article is left in a steamy heat, and at length comes into the hands of a workman who rubs it down in water with very fine pumice. The work then receives a second coat of the lac varnish, and after that a second polish, and these two operations are successively continued till the surface is perfectly even and brilliant. As the operation advances, a still finer quality of lac is used: there are never less than three coats laid on, nor more than eighteen. The decoration of the object is confided to an artist workman, who first draws in the design with white-lead; if he is satisfied with the sketch, he engraves it, and fills in the thousand little details of the subject. There then remains only to paint with the camphorated lac of Kouang-si, which serves as a mordant on which to gild either with leaf-gold or powder. The reliefs are obtained with one or two coats of hoa-kinn-tsi, and these gilt designs are then enriched with the lac of Fo-kienn."

Little is known of the fine lacs of Sou-tchou and of Nann-king; the price is very high; this is explained by the cost of the work, which requires the application, the hardening, and the polishing alternately of eighteen or twenty coats. In their lacquered objects the purity and brightness of the varnish, the infinite minuteness of the decoration, and the finished workmanship of the furniture, are most admirable. In the work from Japan, pieces of mother-of-pearl cut to form are inlaid in the lacquered grounds, and the last coats of the varnish are polished with a reed.

Several interesting specimens of Japan ware are exhibited from China, particularly a very elaborate folding screen by Mr. Braine (19, p. 1424).

England has obtained some celebrity for her Japan ware executed in papier maché. About a century ago, Mr. Baskerville, of Birmingham, manufactured extensively japanned iron tea-trays, &c., and a pupil of his, named Clay, first invented papier maché, as applied to this particular manufacture in 1760, and obtained a patent for the same: to this invention is owing the importance which this branch of trade has acquired, not only from the greater perfection of form and appearance this material is susceptible of, but also from the larger variety of articles to which it can be applied.

Messrs. Jennens and Bettridge, of Birmingham and London (187, pp. 748, 749), are the largest manufacturers of this material in England; they have been established about fifty years, and have introduced many improvements. About thirty years since they obtained a patent for a new application of pearl to Japan ware, and this firm have, from their enterprise and taste, greatly developed the trade by adapting this material to many new purposes. Tables, chairs, screens, work-boxes, inkstands, portfolios, even a piano, are among the endless variety of objects to which it is applied by them. They exhibit a very large collection of japanned ware, executed both in papier maché and other materials; the most conspicuous among them is a cottage pianoforte, of which the entire case is made in papier maché, japanned black, and inlaid with mother-of-pearl: the ornaments of this piano are in good taste and well executed, but scarcely suitable in style for the materials employed, which, being necessarily in small pieces, would have probably told with better effect if arranged in the form of mosaic. A wine-tray, and many others of the specimens where the principles of the design are perfectly flat, are excellent examples. In some of the work-boxes, too, the introduction of the jewelled work under glass is appropriately designed and well executed, and forms a pretty addition to the papier maché. The style of work of some of the large objects, such as a reclining chair, a cot, tables, &c., however well designed and ingeniously executed, did not appear suitable to the material. The Jury, nevertheless, recognise the great merit due to this house, and felt pleasure in awarding the Prize Medal.

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* I am indebted to an article by M. Natalis Rondot, of Paris, one of our Jury, for this description of the Chinese mode of japanning.

In 1832, Mr. Brindley, of Birmingham, obtained a patent for producing papier maché articles by pressure between dies, either in wet sheets or in the form of pulp; this is employed for a cheaper kind of objects.

In France this manufacture has also obtained considerable success, though there are no objects exhibited. In Holland, Belgium, the Zollverein, Austria, the art of japanning is carried on, but not so extensively as in England.

The mode of manufacturing the papier-maché Japan ware in this country may be thus briefly described:—paper of a porous texture is saturated with a solution of flour and glue, and then applied to a mould somewhat smaller than the object required; these moulds are of iron, brass, or copper: repeated layers of this paper are made to adhere by means of the glue, a drying at 100 degrees of Fahrenheit taking place between each coat. When the proper substance is obtained, it is taken from the mould and properly planed and filed to shape; the thickness of the article varies according to circumstances; an ordinary tea-tray takes about ten layers; a tar varnish, mixed with lamp-black, is now laid on, after which the article is stoved; several coats of this varnish are applied, followed in each case by a stoving. When sufficiently covered with this preparation, the inequalities are removed with pumice-stone, and the work of the artist commences; after he has executed the design, either in bronze powder, gold, or colour, as may be desired, several coats of shell-lac varnish are applied, and this is hardened in the stove at a heat of 280 degrees Fahrenheit. The article is now rubbed with rotten-stone and oil to obtain a polish, and perfected to a brilliant surface by rubbing with the hand.

Associated with the papier-maché ware is the introduction of imitation jewels on coloured grounds under glass; these are cemented to the under surface of the glass, which is also diapered over with gold, and the ground is then painted the required colour, a foil being fixed behind the glass jewels.

Another variety has also been lately introduced; that, where laminæ of mother-of-pearl are fixed behind glass, and so associated with the pictures or ornaments as to produce very beautiful effects. Mr. LANE, of Birmingham (128, p. 742), exhibits some excellent examples of this work.

Messrs. CLAY and Co., of King Street, London (189, p. 749), are the representatives of the descendants of those who invented this manufacture; they exhibit a large selection of articles of papier maché, among which many of the tea-trays are of very good design and execution.

Messrs. HALBEARD and WELLINGS, of Birmingham (131, p. 342), exhibit a handsome toilet table in the Elizabethan style inlaid with mother-of-pearl, in addition to many other specimens.

Mr. WALTON, of Wolverhampton (Class XXII., 701, p. 668), exhibits some tea-trays of good design, where the principle of the ornamentation is founded upon geometric forms, depending on outline and contrast of colour, not on imitation of relief. The large table in papier maché, well painted in flowers, is also a fine specimen of the manufacture.

Messrs. SPIERS, of Oxford (70, p. 734), exhibit numerous examples of papier maché, many of them beautifully ornamented.

Messrs. BECKER and KRONICK, of Vienna (643, p. 1040), exhibit japanned screens well executed, besides other objects.

Messrs. ZEEGERS, of Amsterdam (96, p. 1148), exhibit a folding screen, in which the execution of the various details is excellent, and the peculiarities of the Chinese work admirably sustained.

This Jury feel called upon to remark on the redundancy and inappropriateness of much of the ornament applied to the European specimens of Japan ware; and to direct attention to the better examples of this work from Japan and China, where i twill be found that in the subordinate parts the ornament is kept subdued and simple, thereby giving more effect to the principal features.

Ornaments in Relief Mechanically Produced.

Under this head are included ornaments in Carton-pierre, in papier maché, and in stamped leather; and carving produced by machinery. The first of these, *Carton-pierre*, has but recently been manufactured in England, although employed for nearly forty years in France; it is an important introduction for architectural decoration from its lightness, strength, facility of application, and other advantages. It is composed of the pulp of paper mixed with whiting and glue; this preparation is pressed into plaster piece-moulds, backed with paper, and then, when sufficiently set, removed to a drying-room to harden. The manufacturers of Paris have, since the invention of this material, executed in it works of great extent and beauty of design; it has the advantage over plaster of Paris, that it is stronger, lighter, and perfectly hard, and dries in a few hours.

M. CRUCHET, of Paris (810, p. 1219), exhibits an enriched frontispiece, ornamented with groups of dead game, and various other specimens of great merit.

M. HUBER, of Paris (879, p. 1221), exhibits a frieze of foliage ornament and children, of beautiful design, and also various specimens of pilasters, ornaments, &c.

M. GROPIUS, of Berlin (226, p. 1060), exhibits several statuettes executed in this material, and also various ornaments.

Messrs. JACKSON and SONS, of London (5, p. 730), are the first who have extensively manufactured this material in England, and have through its means been enabled to produce a series of ornaments that have added much to the character of art in this country: they exhibit many specimens; a part of their decoration at the Army and Navy Club—a chandelier—an Elizabethan ceiling, and many other objects; but one of the firm being on the Jury, they could not be rewarded by a Medal.

Papier maché, as used for architectural works in England, differs in some respects from the ordinary material known by that name. It is prepared by laying sheets of brown paper one over the other, a coat of glue being given between each. These sheets of paper thus glued together are then pressed into a metal mould of the ornament required; the papier thus stamped to shape is afterwards trimmed; a composition of the pulp of paper mixed with rosin and glue is now put in the mould before used: the papier maché ornament, previously stamped, is again inserted, and is again pressed upon the pulp composition, which thus adheres to it, and produces a sharp, well-defined ornament.

Messrs. BIELFELD, of London (157, p. 744), exhibit many specimens of this manufacture, as do also Messrs. JACKSON and SONS, before mentioned.

Stamped Leather.

The manufacture of this material was revived about fourteen years since at Paris, with many improvements upon the old leather hangings of the seventeenth and eighteenth centuries, as regards the perfection of embossing the ornament.

The old leather hangings were made by a comparatively simple process, without the aid of machinery. The skins being properly moistened, were laid on a mould of the embossed ornament: into the various parts of this mould the leather was pressed by small wooden tools, till it acquired the embossed pattern; when dry, the leather was coated with silver-leaf, and varnished with lacquer to produce the colour of gold. After this the proper colouring was laid on by hand, and certain parts of the leather stamped by a hand-punch to produce the small figure peculiar to some kinds.

In the French revival of this manufacture the ornament is stamped by hydraulic pressure, producing very perfect and very high relief: to prevent the relief subsiding as the leather dries, the reverse of the leather is covered in the embossed parts with some composition.

Messrs. Dulud, of Paris (1202, p. 1235), at present represent the house which first manufactured by this improved process: they exhibit many specimens of good design, and showing the excellence of the emboss.

Mr. Leake, of London (Class XXX., 63a, p. 823), also exhibits a collection of specimens of leather embossed by the same process, many of them of good design.

Carving by Machinery.

Messrs. Jordan and Co., of London (80), exhibit various specimens of carved work executed by machinery, a large Gothic oak screen, dead game, foliage, &c. The operation of this machine is by a series of drills, pointed from a model: where there is a considerable repetition of the same ornament, this machinery can be employed with very great economy, but the work requires finishing by hand.

Conclusion.

The Jury have carefully examined the various works in this Class, numbering probably more than five thousand objects; there were many works of very considerable cost and labour, which they would have been pleased to reward if they could have done so conscientiously, but they considered that it was not the size or the amount of labour in the object that should entitle it to distinction, but rather the merit of pure design, of execution, or of contrivance.

The Jury unanimously regretted the withdrawal of the Third Medal; if this had been retained they would have been able to discharge their duties more satisfactorily to themselves, and they think also to the exhibitors. They are bound to add, that they were only empowered to recommend certain names for the distinction of the First or Council Medal, and that the Council made a selection from that list.

AWARDS IN CLASS XXVI.

THE COUNCIL MEDAL.

Nation.	Number in Catalogue.	Name of Exhibitor.	Objects Rewarded.
France	1709	Barbedienne and Co.	Ebony bookcase, mounted with bronze.
France	1715	Delicourt, E.	Paper-hangings.
France	1231	Fourdinois, A. G.	Carved sideboard of walnut-wood.
Austria	633	Leistler, C., and Son	Carved furniture in four rooms.
France	1326	Lienard, M. J.	Clock-case, and other articles.

THE PRIZE MEDAL.

Tuscany	74	Barbetti, A.	Carved coffer.
Bavaria	67	Barth Brothers	Lady's work-table.
Belgium	439	Beernaert, Antoine	Oak cabinet.
France	1077	Bellangé, A. L.	Inlaid buhl furniture.
France	1106	Bouhardet, C. P.	Carved billiard-table.
France	778	Bourgery, Madame	Models (Carton-pierre).
China	–	Braine, C. T.	Japanned screen.
United Kingdom	4	Burroughes and Watts	Billiard-table.
Sardinia	64	Capello, G.	Inlaid table, chair, and pedestal.
United Kingdom	110	Cooke and Sons, of Warwick (Class XXX.)	Carved sideboard.
Belgium	404	Couvert and Lucas	Mosaic floor and table.
France	1573	Cremer, J.	Marqueterie inlaid furniture.
France	810	Cruchet, V.	Carton-pierre and carving.
France	1579	Daubet and Daumaret	Cabinets with mechanical action.
Belgium	406	De Keyn Brothers	Mosaic floor.
China	–	Dent, L.	Bedstead.
India	–	Deonarain Singh	Bedstead.
United Kingdom	122	Doveston, G.	Cabinet and chair.
United Kingdom	404	Dowbiggin and Co.	Inlaid cabinet, ornamented with porcelain.
France	1207	Durand, E. P.	Cabinets, &c.
Bavaria	63	Fortner, F. X.	Inlaid cabinet.
Russia	297	Gamba, —	Cabinet, ornamented with porcelain.
United Kingdom	186	Gillow and Co.	Writing-table.
Tuscany	117	Giusti, P.	Carved frame.
Austria	631	Gröger, F.	Ebony cabinet, inlaid with marble, &c., and ornamented with carved figures.
Prussia	226	Gropius, P.	Carton-pierre, figures, &c.
Prussia	770	Hagen, A. von	Cabinet.
United Kingdom	344	Hayball, Arthur (Government School of Design, Sheffield).	Cabinet.
United Kingdom	407	Holland, W., of Warwick	Table-tops, in imitation of marble.
United Kingdom	161	Holland and Sons, of London	Carved bookcase.
United Kingdom	345	Hoyles, Henry, (Government School of Design, Sheffield).	Sideboard.
France	879	Huber, J.	Carton-pierre.

THE PRIZE MEDAL—*continued.*

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	261	Jackson and Graham	Carved sideboard, and other furniture.
France	889	Jeanselme, J. P. F.	Cabinet and sofas.
United Kingdom	187	Jennens and Bettridge	Inlaid Japan pianoforte case.
United Kingdom	10	Johnstone and Jeanes	Expanding table.
France	890	Jolly-Leclerc, —	Cabinet work.
United Kingdom	80	Jordan, T. B. (Main Avenue, West).	Oak screen, &c., carved by machinery.
United Kingdom	1	Kershaw, T. (Cl. XXVII.)	Imitation of marbles and woods, for house decoration.
France	282	Knecht, Emile	Carved figures.
Austria	632	Knill, J.	Billiard-tables and cues.
France	1283	Krieger and Co.	Card-tables and mechanical furniture.
United Kingdom	128	Lane, T.	Paintings on pearl glass.
France	573	Lechesne, A.	Carved frame.
France	327	Mader Brothers	Paper-hangings.
France	606	Marcelin, —	Inlaid mosaic table.
Tuscany	79	Marchetti, L.	Carved frame.
France	927	Mercier, P. E.	Ebony cabinet.
Russia	299	Miller, G., jun.	Inlaid floor.
Austria	738	Montanari, A.	Painted ceiling.
United Kingdom	164	Morant, G. J.	Decoration and furniture.
United Kingdom	252	Moxon, C.	Imitation of inlaid marble, for decoration.
Spain	271A	Perez* and Co.	Table of inlaid wood.
Hamburg	69	Plambeck, C. F. H.	Inlaid table.
France	1410	Pretot, L. H. E.	Collection of inlaid furniture.
India	–	Reade, C. W.	Carved box.
Russia	262	Rahn and Vetter	Paper-hangings.
United Kingdom	207	Richardson, C. J.	Collection of furniture and designs.
France	1437	Ringuet-Leprince, E.	Carved cabinet for medals.
France	1439	Rivart and Andrieux	Furniture inlaid with porcelain.
United Kingdom	353	Rogers, W. G.* (Cl. XXX.)	Carved cradle.
United Kingdom	264	Rogers and Dear	Bedstead.
Austria	651	Spörlin and Zimmermann	Application of block printing, to illustrate works.
France	1556	Tahan, A.	Ornamental cabinet work.
France	1499	Théret, J.	Inlaid cabinet.
Austria	641	Thonet, M.	Chairs (bent wood).
United Kingdom	17	Thurston and Co.	Billiard-table.
United Kingdom	318	Townsend, Parker, and Townsend.	Paper-hangings.
United Kingdom	162	Trollope and Sons	Ornamental furniture.
United Kingdom	160	Wills and Bartlett	Bookcase and candelabra.
Netherlands	96	Zeegers, F.	Japanned screen.
France	1536	Zuber, J., and Co.	Paper-hangings.

HONOURABLE MENTION.

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom	303	Arthur, T.	Decoration.
France	1061	Bach Perès	Transparent patent blinds.
France	1066	Balny, jun., J. P.	Chairs by mechanical process.
United Kingdom	166	Banting, W. and T.	Collection of furniture.
Austria	643	Becker and Kronick	Japanned screen.
United Kingdom	206	Caldecott, Messrs.	Sideboard.
Sardinia	68	Ciaudo, J.	Inlaid table.
United Kingdom	189	Clay and Co.	Articles in papier maché.
France	1159	Cordonnier and Co.	Bookcase.
Belgium	421	Deruelle-Delevoye, F.	Circular mechanical buffet.
France	815	Descartes, J.	Mechanical sofa.
Belgium	401	Devis, E.	Paper-hangings.
France	1202	Dulud, J. M.	Embossed leather hangings.
United Kingdom	57	English, E. F.	Cabinet work.
Tuscany	1284	Falcini Brothers	Chair.
France	1219	Faure, Jean Marie	Chairs.
France	23	Florange, jun.	Bedstead, &c.
Switzerland	224	Fluckk, John (Brienze)	Carved table.
United Kingdom	24	Galli and Cotti (Bay M.)	Ceiling decorations.
France	1714	Genoux, F.	Paper-hangings.
France	1254	Gradé, L.	Inlaid table.
United Kingdom	131	Halbeard and Wellings	Papier-maché toilet-table, &c.
United Kingdom	197	Hanson, S., and Sons	Carved mirror frame.
Cape of Good Hope	57	Hart, J.	Chair.
Bavaria	73	Hartmann, J. J.	Parquet floor.
China	–	Hewett and Co.	Collection of Chinese furniture.
United Kingdom	71	Heywood, Higginbottom, Smith and Co.	Paper-hangings produced by machinery.
United Kingdom	310	Hinchliff and Co.	Paper-hangings.
Prussia	773	Hoffmeister, T., and Co.	Sideboard.

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* These Exhibitors have been awarded a Prize Medal, Class XXX., in whose list their names appear.

HONOURABLE MENTION—*continued.*

NATION.	Number in Catalogue.	NAME OF EXHIBITOR.	OBJECTS REWARDED.
United Kingdom -	202	Hunter, W. J., R. and E. -	Chairs.
France - - -	1276	Jeanselme, A., jun. - -	Chairs.
United Kingdom -	321	Ingram, J. W. (Cl. XXX.) -	Ornamental cabinet.
Spain - - - -	285	Jimenez, M. - - - -	Inlaid panel.
United Kingdom -	70	Jones, A. J. (Cl. XXX.) -	Bog-yew furniture (Fine Arts Court).
France - - -	554	Kissel, J. - - - - -	Mechanical bed.
Austria - - -	645A	Kölbel, B. - - - - -	Oval mirror frame.
France - - -	1297	Laurent, François - - -	Parquet floor, and frames.
United Kingdom -	63A	Leake, F., and Co. (Cl. XXX.)	Embossed leather hangings (Fine Arts Court).
United Kingdom -	203	Levien, J. M. - - - -	Sideboard.
Tuscany - - -	87	Maggiorelli Brothers - -	Inlaid table-tops.
France - - -	600	Marguerie - - - - -	Paper-hangings.
Belgium - - -	400	Menge, A. G. - - - -	Gothic canopy.
United Kingdom -	211	Minter, G. - - - -	Invalid couch.
United Kingdom -	69	Nicol and Allen (Cl. XXVII.)	Imitation of woods.
United Kingdom -	54	Nye, E. - - - - -	Wood mosaic table.
Austria - - -	637	Palhüber, V. - - - -	Work-table.
United Kingdom -	74	Potter, C. H. and E. - -	Machine-made paper-hangings.
India - - - - -	-	Pugh, D. - - - - -	Indian carved furniture.
United States - -	193	Ragan, W. - - - -	Mechanical reclining chair.
Hamburg - - -	70	Rampendahl, H. F. C. - -	Cabinet.
Belgium - - -	419	Roulé, A. F. - - - -	Gothic sideboard.
United Kingdom -	456	Simpson, W. B. - - -	Decorations.
Sardinia - - -	71	Speich, P. - - - - -	Carved ebony table.
Austria - - -	638A	Speluzzi - - - - -	Buhl table.
United Kingdom -	70	Spiers and Son - - -	Articles of papier maché.
United Kingdom -	108	Stalon, J. (Cl. XXX.) - -	Inkstand.
United Kingdom -	9	Taylor and Sons - - -	Cabin furniture in cork.
United Kingdom -	178	Toms and Luscombe - -	Buhl pedestals.
Tunis - - - -	-	Tunis, The Bey of - -	Gates.
United Kingdom -	320	Turner, H. N., and Co. -	Paper-hangings.
France - - -	734	Vivet, E. T. - - - -	Wax-painted cloths.
United Kingdom -	69	Walton, F., and Co. (Cl. XXII.)	Japanned ware.
United Kingdom -	179	Watson, G. - - - -	Inlaid work.
Switzerland - -	237	Wettli, M. L. - - - -	Carved table.
Wurtemburg - -	70	Wirth, T. F. - - - -	Writing-table.
United Kingdom -	322	Woollams, John, and Co. -	Paper-hangings.
United Kingdom -	309	Woollams, W., and Co. - -	Paper-hangings.
United Kingdom -	19	Wynne and Lumsden - -	Carved oak chimney-piece.

PROFESSOR ROESNER, } JOINT REPORTERS.
J. G. CRACE,

London, January 1852.

CLASS XXVII.

REPORT ON MANUFACTURES IN MINERAL SUBSTANCES, USED FOR BUILDING OR DECORATIONS, AS—IN MARBLE, SLATE, PORPHYRIES, CEMENTS, ARTIFICIAL STONES, CLAY, &c.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Benedetto Pistrucci, *Chairman*, Italy; Royal Mint; Her Majesty's Chief Medallist.
Lord Sudeley, *Deputy Chairman*, 35 Dover Street.
D. T. Ansted, F.R.S., *Reporter*, 17 Manchester Street, Manchester Square; Professor of Geology, King's College.
Bernardo di Bernardis, Austria; 43 Clarges Street; Architect.
George Godwin, F.R S., 24 Alexander Square, Brompton; Architect.
Sir Charles Lemon, Bart., F.R.S., M.P., 46 Charles Street, Berkeley Square.
Emmanuel Psycha, Greece; Civil Engineer, and late Professor of Physical Sciences.
Viscount Hericart de Thury, France; Member of Institute.

Associates.

F. Barker, 71 Lower Grosvenor Street.
T. H. Henry, F.R.S., 18 Lincoln's-Inn-Fields; Analytical Chemist.
George Lowe, C.E., F.R.S., 39 Finsbury Circus; Engineer to Chartered Gas Company.

The objects taken into consideration by the Jury of Class XXVII., and defined by the general term *Mineral Manufactures*, have been understood to embrace a very great variety of articles manufactured in stone, marble, and clay. These may be, conveniently enough, grouped into two principal divisions: the one including all dressed, carved, sculptured, and polished work in solid material; whether stone, marble, granite, or other mineral substance; and whether solid, wrought, or inlaid in stone; while the other includes modelled and moulded work in clay, cement, certain kinds of glass and pottery, and artificial stone. The difference is essential between these two kinds of work, which are rarely undertaken by the same artist. Each of these divisions is capable of arrangement into groups, as follows:—

Division I.—*Works in Solid Material.*

Group 1. Unpolished stone.
  ,, 2. Polished and inlaid work in stone, marble, granite, and *pietra dura*.

Division II.—*Works in Plastic Material.*

Group 3. Cements and artificial stone.
  ,, 4. Clay.

To these there may also be added a group of miscellanea, which will not be found very numerous.

It will be convenient still further to subdivide these groups in speaking of the exhibitors, *seriatim*, and the lists may be arranged in the following order:—

Division I.

Group I.—Manufactures in Unpolished Stone.

A. Flagstones, pavements, &c., roughly dressed.
B. Carved and sculptured works in freestone, granite, &c.
  a. Large monumental works.
  b. Smaller works in granite.
  c. Works in Caen stone.
  d. Works in Bath stone.
  e. Sundry works in freestone.
C. Slate.
D. Sundry materials.

Group II.—Manufactures in Polished Stone, Marble, and other similar materials.

E. Manufactures in marble and alabaster.
  a. Collections of marble.
  b. Chimney-pieces.
  c. Columns, pedestals, &c.
  d. Slabs, tables, &c.
  e. Sundry objects.
F. Works in ornamental stone, granite, and spar.
  a. Serpentine, granite, and porphyry.
  b. Jasper, jade, agate, crystal, and spar.
G. Mosaics, or inlaid work in stone.
  a. Inlaid work in pietra dura.
  b. Inlaid work in marble.
  c. Inlaid work in malachite.
H. Polished and enamelled slate.

Division II.

Group III.—Manufactures in Cements, Scagliola, and Artificial Stone.

I. Massive and encrusted cements, scagliola, and plasters.
  a. Hydraulic cements.
  b. Plasters and scagliola.
  c. Artificial stone with silica base.
  d. Bituminous cements.
  e. Metallic cements.
K. Glass and porcelain mosaics (including Roman mosaic).
  a. Roman and Venetian mosaic.
  b. Porcelain mosaic.

Group IV.—Manufactures in Clay.

L. Bricks and tiles.
M. Terra cottas.
N. Fire-clay goods, unglazed.
O. Glazed fire-clay goods.

It will at once be seen from this arrangement how considerable a variety of subjects must be treated of in this Report, and the important relation they bear to almost all questions of construction and decoration. With the exception of those building stones which are included in Class I. as "raw materials," the whole series of non-metallic mineral substances used for construction and decoration, may be considered as referred to Class XXVII., and it will be found that many manufactures of great interest require to be described and discussed.

The Reporter—not having the requisite technical and statistical knowledge of all these manufactures, himself —has endeavoured in various cases to obtain it from authentic sources; and where any new method has been introduced by exhibitors, he has attempted to make himself acquainted with it. He has also tried to obtain and communicate information, wherever there appeared anything remarkable in the manufacture, even where this was not, in any sense, new. The Report will thus contain the result of various inquiries, as well as the observations of the Jury, on the different objects considered worthy of special notice.

In order to assist them in coming to a right decision on some subjects as to which they required technical information, the Jury have called in, as Associate Jurors, the following gentlemen, to whom they beg, here, to offer their best thanks for the valuable assistance rendered:—

F. Barker, Esq., for polished marble and inlaid work.
T. H. Henry, Esq., F.R.S., for chemical utensils.
Geo. Lowe, Esq., C.E., for fire-clay goods.

It is difficult, amid such a multitude of objects, of natures so widely differing, to offer any useful general remarks on the whole Class. Apart from the works forwarded by English exhibitors, whose number more than equals that from all other countries together;—(and who have sent much that is interesting in carved stone, slate, granite and porphyry, serpentine, mosaic work, cement and scagliola, bricks, fire-clay goods, and salt-glazed ware;)—it may, however, be well to allude particularly to the malachites and jaspers of Russia; the mosaics of Italy and India; the bricks of Austria; the carved stone of Malta; and the terra cottas of France, as among the most important of the objects exhibited from abroad. The selection of material, and the method and perfection of the workmanship, have generally entered into the consideration of the Jury, as well as the adaptability of the material, and the economical production of a useful manufacture; and thus it will occur that here, as in other cases, similar prizes have been awarded to objects of very different degrees, as well as different kinds of merit.

In their recommendation of objects for the Council Medal, the Jury have thought it their duty to limit themselves to such as exhibited decided novelty, in addition to great merit of design and execution. The claims of the Society for the Improvement of the Dwellings of the Labouring Classes (124, pp. 774, 775) are so considerable in both respects, as well as in an economic point of view, that they have been at once admitted. They involve a vast improvement in style, safety, and cheapness in the construction of dwelling-houses, and this in the very cases where improvement was most needed, and most likely to conduce to decided sanitary improvement among the great masses of town populations.

To Mr. Minton (86, p. 770) we are indebted for introducing very many and important improvements in encaustic tiles, thus restoring a manufacture which had long been extinct, by the application of a method more generally available than that originally adopted; and to his enlightened appreciation of merit many modern improvements in pottery are due:—these claims were fully recognised by the Jury and Group of Juries, who recommended the award of a Council Medal, which was conceded by the Council of Chairmen jointly with that recommended by another Class (Class XXV.) for articles directly connected with the manufacture of porcelain.

With regard to the manufacture of Roman mosaic it need not be inquired whether the finished work of art by the Cavalier Barberi (Rome, 15, p. 1286), selected as also worthy of the Council Medal, is really the most perfect in its kind, or more excellent, both in design and execution, than any that exists in this country; since we may safely say that it is of the very highest order of merit, while the manufacture itself, though not modern, nor involving any peculiar novelty, has in this case the advantage of originality of design and great ingenuity in treatment and execution.

The remaining group of objects to which a similar reward has been voted, namely, the collection of Russian malachites exhibited by the Messrs. Demidoff (Russia, 323, pp. 1377—1381), offers examples of a manufacture remarkable not only for the rich magnificence of the articles, but also for a great improvement in style and execution which will be afterwards explained; so that little doubt could exist as to the propriety of rewarding the exhibitors with a peculiar mark of distinction.

If it had been possible to do so, the Jury would also have been glad to mark in the same way the great importance they attach to the extensive and admirable manufacture of bricks, belonging to Mr. Miesbach, of Vienna (610, p. 1038); to the remarkable works in jasper and hard porphyry, exhibited from Russia and Scandinavia; and to some of those beautiful and admirable works in pietra dura, sent by the Florentine artists; but the regulations not admitting of this, they can only here allude to these objects as among the most remarkable in their class, and proceed at once to discuss the various groups of objects in regular order, stating the reasons which have guided them in recommending some for reward.

Before concluding these preliminary remarks, the Jury wish to record their admiration of the rare works of manufacture belonging to this Class, exhibited by the Honourable East India Company (p. 921). Among the various examples of inlaid work in pietra dura, not one is more perfect in its kind, or exhibits more delicate and artistic taste, or greater mechanical excellence, than a small chess-table in their collection. Next to this, they may mention as remarkable for delicacy of workmanship, the manufactures in a peculiar white marble of considerable beauty, cut into garden-seats, &c., and also many smaller objects, and utensils hardly less striking. The cups and other vessels, and various ornaments, manufactured of jade and crystal, and for the most part inlaid with rubies and emeralds, are examples of great labour and ingenuity applied to a manufacture rare in this country, and in Europe generally, but long known and exercised in the East. For these, and many other manufactures, the Exhibition is indebted to the exertions made by the officers of the East India Company, acting on the instructions received from the Court of Directors in England. The Jury regret, however, that their ignorance of the names of the manufacturers has prevented them, in many cases, from rewarding them with Medals and Honourable Mention.

Division I.—Works in Solid Material.

Group 1.—Manufactures in unpolished Stone.

The total number of exhibitors in this group is upwards of eighty, of whom about sixty are British, five Maltese, and a few from India. The remainder are distributed as follows:—five French, two Belgian, two Italian, and one from Austria, Sweden, Spain, China, and the United States. The objects being for the most part heavy, and of rather large dimensions, the cost of transport has no doubt checked the transmission from a distance of many that might otherwise have been sent. But it must also be stated, that several of the raw materials properly referred to Class I. might have come under consideration here if they had not been so manifestly connected with that Class; while, on the other hand, some, though but few, of those now regarded as sculpture, &c., might almost be claimed for the present Class and group.

Many of the most interesting objects are of very great —almost national—importance, and some are certain to have attracted much notice; others again are small, and offer little at first that is likely to command attention.

A. Flag-stones, Paving-stones, &c.

Most of these objects may be considered as partly referable to Class I., and are reported on by the Jury for that Class, so far as the nature and value of the raw material is concerned. At present it is rather in reference to the method of manufacture and relative value when made into pavement, that they have to be considered; and the reader is referred to the annotations in the Illustrated Catalogue for some information regarding the nature and geological position of several of the more interesting among them.

The British paving-stones exhibited may be grouped as follows:—(1.) Yorkshire flags. (2.) Caithness flags, and Arbroath pavement. (3.) Manx flags. (4.) Irish flags. (5.) Welsh flags. (6.) Welsh road material from Penmaen-mawr; and (7.) Scotch granite paving. Some road-stuff is also exhibited in a rough state from several localities in Cornwall, but more as samples of what is already well known and used than illustrations of any new material or locality.

The Yorkshire flags—paving-stones of great importance in England—are obtained chiefly from a part of the carboniferous system of rocks developed in various parts of the county. They are remarkable for size, hardness, and toughness. The only exhibitors of such stones on a large scale are Messrs. BROWN, RUSBY, and BOOTH, of Sheffield (Outside, 29, p. 115),* who are Honourably Mentioned on account of excellence of material and its adaptability to the required use.

The Caithness flags and Arbroath pavement are obtained from the old red sandstone rock, developed in the north and east of Scotland. The former consist of dark-coloured and bituminous schists, slightly micaceous and calcareous, abounding near Thurso, and remarkable for toughness and durability. The latter are also rather dark-coloured, although much paler than the Caithness, and are of very different quality; but they are also derived from the lower part of the old red sandstone series. Few flags are more useful than these, and they are happy illustrations of the excellence of the old red sandstone, generally a barren rock, for at least some important purposes. The Jury think it right to direct special attention to Mr. SINCLAIR's large series of the Forss Rockhill flags from Caithness (Outside, 13, p. 114), and also to Mr. CARNEGIE's series of Arbroath flags (Outside, 20, p. 115), as in both cases offering excellent specimens on a large scale, of a very useful material. For this reason they consider that both are deserving of Honourable Mention.

The Manx flags of QUILLIAM and CREER (Class I., 151, p. 136), although not exhibited so largely, are worthy of being alluded to in this place. The following information has been obtained from the Rev. J. G. Cumming (Vice-Principal of King William's College, near Castletown, Isle of Man), who has strenuously exerted himself to obtain a fair representation of the industrial products of the island, and who writes as follows:—"The black flagstone of Poolvash" (found on the south side of the island, near Castletown, and belonging to the carboniferous limestone) "is a bed whose thickness varies from a few inches up to 20 feet. It is too soft to take a polish, and is generally finished with lamp-black and oil, or, in some cases, with French polish. It is very easily wrought, and its durability is well seen in the steps of St. Paul's Cathedral (presented about the commencement of the last century, by Bishop Wilson)." Messrs. Quilliam and Creer have the lease of the quarries from the Crown, and their works are in Castletown, on the sea-shore, at a convenient place for shipment. The cost of the plain slabs for hearths, &c., at the place of shipment, is 10*d.* per square foot. Inlaid with a hard composition in patterns, as exhibited in Class I., No. 151, the cost for the same pattern as the national tile is 2*s.* 3*d.* per square foot.

Besides the bituminous limestone, there is a flagstone worked at Spanish Head, not far from Castletown, obtained from rocks of the older Silurian date. Though soft and slightly elastic, and worked with great facility, it is very durable, as shown by the Runic monuments in various parts of the island. It has been used for flooring, and is admirably adapted for prison-cells. In addition to these materials, the granite of the island is considered to be very useful for curbstones and paving.

The Irish flags exhibited are few, and hardly sufficient to justify any extended description. The principal are those sent by Mr. FRANKLIN, of Galway, and appear to be of good quality (Outside, 17, p. 114).

The Welsh paving-stone from Penmaen-mawr is remarkable as being both the hardest and toughest material for road-stuff that has yet been discovered. It is indeed so hard as to assume a glassy surface after long-continued exposure, and actually becomes dangerous from this cause. It is a trap-rock, and appears to be abundant. Mixed with less hard material, it might in many cases be a most useful addition to our present resources in London.

The specimen of Scotch granite paving exhibited by Mr. SIM (Class I., 137, pp. 135, 136) is of excellent quality, and is well put together. It involves a new mode of construction, and is well executed. The material is adapted to withstand much wear, and the method of laying down is novel in design, whatever the opinion may be as to its applicability. The Jury have made Honourable Mention of the pavement of this exhibitor, as well as that of Mr. SINCLAIR, as both of them exhibit, to some extent, finished constructions, or working models of such objects.

Some beautiful specimens of slate flags from the quarries at Festiniog, North Wales (12, p. 114), are worthy of Honourable Mention (awarded a Prize Medal by Class I.), and careful attention, as presenting a cheap and admirable pavement of great beauty, and in slabs so large as to prevent much chance of an irregular surface being produced when much used.

The flags are of fine quality, and have had a severe trial at the Transept entrance of the Building, where some millions of footsteps have hitherto failed in producing any mark of unequal wear.

It is not astonishing that material of the kind we are now considering, hardly appears except from the various parts of our own country. From Belgium, Messrs. ZAMAN (136, p. 1155) have forwarded models of paving-stones and other manufactured stone of this kind, and of them the Jury make Honourable Mention.

A pavement is exhibited by M. DESAUGES (France, 1184, p. 1234), manufactured of a stone called Pierre de Tonnerre. It is in compartments, tolerably large, and well executed, the material being well adapted to the purpose. The same exhibitor sends also a chimney-piece and other works, which will be described elsewhere.*

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* The Reporter has found it difficult to obtain definite information with regard to this very important product of Yorkshire. By inquiries made with the kind assistance of T. Wilson, Esq., of Crumbles House, Leeds, assisted by the Rev. T. Thorp, he has obtained a list of 92 quarries in the vicinity of Leeds, Bradford, Wakefield, and Halifax, occurring in a thickness of from five to six hundred yards at the bottom of the coal measures, and upwards of fifty of them supplying flags and landings. The stones known as Yorkshire stones may be divided into two classes, called respectively grit stones and free stones, the latter being also sometimes called delf. Of one of these the Bramley Fall Stone (Class I., 190) is a fine example, being coarse-grained, hard, shining, and containing mica, obtained in large blocks but not laminated. The true flags are illustrated as raw material in Class I., 172, Elland flagstone, &c.; the specimens being fine grained, laminated, and cleaving into flags varying in thickness from two to three, six, or eight inches. It is stated by Mr. Wilson, that all the beds from the millstone grit upwards to the Barnsley thick coal are freestones, stratified and often splitting on the planes of stratification and alternating with beds of coal. Between the best flagstones and the millstone grit are some of the coal seams, such as the Halifax coal and the Halifax soft coal. The flagstones are of course those beds most remarkable for their fissile character, perfect evenness of texture, fineness of grain, toughness and hardness, and in many cases they can be obtained of very large dimensions. Leeds may be considered the centre of the district supplying the greatest quantities. The quarrying and dressing of these stones requires some practice and ingenuity, and the specimens laid down outside the Exhibition Building, and exhibited by Messrs. Brown, Rusby, and Co., are of very good quality.

* Vide page 557.

B. CHISELLED, CARVED, AND SCULPTURED STONE-WORK, NOT POLISHED.

a. Large Monumental Works, chiefly constructed of Granite.

These noble monuments, of excellent material and good workmanship, and remarkable for the public spirit which induced their respective owners to incur very great expense in preparing and transmitting them, may be considered as permanent records of the good feeling that has been perhaps the most characteristic feature throughout the preparation of the Great Exhibition. Three of these objects, of large size, are from Cornwall, and are fine specimens of the granites of that county. Another is a highly-interesting and more finished specimen of Swedish granite, by no means so large as the former, but hardly less remarkable. There is also one exhibited in the Nave, constructed of Caen stone.

The granite column sent by the **CHEESEWRING GRANITE COMPANY** (Outside, 54, p. 117) is a very beautiful specimen of a stone obtained from quarries hitherto little worked, on property belonging to the Prince of Wales, near Liskeard, Cornwall. The shaft, cut from a single block, and worked at the quarry, is highly creditable; and the pedestal and base, worked in London, are in good proportion and well executed. The capital is rather heavy. The total height of the column, pedestal, and base is about 30 feet. For the material, style, and workmanship of this column the Jury have awarded a Prize Medal.

The obelisk sent by Messrs. W. and J. **FREEMAN** (Outside, 14, p. 114) is from Lamorna granite quarries, Cornwall, well known for their excellent material. Its height is upwards of 22 feet, and its weight 21 tons. It is placed on a block of Carnsew granite, weighing 31 tons. The difficulties and expense incurred in quarrying, removing, and placing objects of these enormous dimensions can hardly be judged of by those who merely see the finished result. The preparation and erection of an obelisk formerly the work of years, and still involving enormous labour and trouble, was, in this case, completed within a few months, merely as a sample of the nature of the material and the resources of the exhibitor. A Prize Medal has been awarded for this work.*

Mr. **HOSKEN**'s obelisk (Outside, 75, p. 118) is from No. 2 granite quarry in Carnsew, near Penryn, the property of the exhibitor. It is 18 feet high, about 3 ft. 5 in. square at the base, and 1 ft. 6 in. square at the top. The weight is about 8 tons, and it stands on a granite block from No. 14 quarry in Killieven, in the parish of Constantine, also weighing about 8 tons. Both granites are of excellent quality, that of the obelisk more especially, the grain being fine, and the colour very good. A Prize Medal has been awarded.

The cross exhibited by Mr. **KULLGREN** (Outside, E. 100, and Sweden, 118, p. 118), and worked from a single block of granite, is remarkable for the extreme fineness and closeness of grain of the stone, and the delicacy of finish which its texture permits. The stone is obtained from extensive quarries on the island of Malmon, on the west coast of Sweden, whence the transport to this country is easy and cheap. It bears a high polish, and the cost of wages in the district whence it comes being very low, there is good reason to believe that it might be exported with advantage. The actual cost of a similar object has not, however, been ascertained. The Jury have awarded a Prize Medal to the exhibitor of this monument.

b. Smaller Miscellaneous Works in Granite, Porphyry, &c.

Concerning these objects, the Jury have but few remarks to offer. The cenotaph exhibited by Messrs. **POILLEU BROTHERS** (France, 962, p. 1225), to which the Jury have awarded a Prize Medal, is a small object constructed of a kind of greenstone trap, whose chief merit arises from the difficulty of working a material so hard and tough. The style selected is impure Gothic, with several figures, and some open work. The execution is more elaborate than successful, and the work is left with a smooth face, without any attempt at further detail. Some of the small figures are fairly sculptured. The colour and general effect are not very pleasing. The establishment of these exhibitors is in the west of France, whence the material is obtained.

A head-stone of Aberdeen granite, manufactured by Mr. I. **WRIGHT** (43, p. 766), is a beautiful specimen of material, admirably worked, and is worthy of special notice, as designed in good taste, well executed, and well adapted for its object. The Jury make Honourable Mention of this object, considering it as highly creditable to the manufacturer.

The bust and pedestal of blue Peterhead granite, worked and exhibited by Mr. **JOHN HUTCHISON**, of Monyray, near Peterhead (Class I., 161, p. 137), is also a creditable and interesting specimen of its kind. Its object is chiefly to show the adaptability of a stone of excellent quality and great hardness to purposes of art exposed in the open air in cities, and the Jury consider it worthy of Honourable Mention, especially as they learn that it has been very rapidly executed, under circumstances of some difficulty, by a young man who had not before attempted anything of the kind. The cost of granite statues has been stated by Mr. C. H. Smith * as nearly the same as that of bronze, and their durability, when exposed to the smoke and acid vapours of a town, is very much greater.

The slab of granite from Craignair, near Dalbeattie, exhibited by the proprietor, **WELLWOOD MAXWELL**, Esq. (Class I., 134, p. 135), is from a well-known quarry of excellent material, adapted for ornamental architecture. The composition is a grey quartz, with white or flesh-coloured felspar, and greenish hornblende, often in bands: it is therefore a Syenite. Another manufactured object is of a kind of trap rock found near Edinburgh, which may here be referred to as useful for various purposes, and extremely durable, if not very ornamental. The stone alluded to is not unlike that worked by Messrs. **POILLEU** (France, 962), and is called "Barnton Mount Granite." It is exhibited by Mr. G. **JOHNSTONE**, of Craigleith (Class I., 175, p. 138). The curling-stones, made of greenstone trap, and sent by Mr. A. **CASSELS** (Class I., 26, p. 123), and Mr. J. **KAY** (Class I., 27, p. 123), are also interesting from the great toughness of the rock of which they are made—a quality greatly required for the use to which they are put in the national game from which the name of *curling-stone* is derived. The material is felspathic, with small grains of quartz and minute particles of hornblende. Lastly, we may mention the ornamental works in Scotch granite, chiefly of jewellery, exhibited by Mr. **JAMIESON** (Class I., 25, p. 123), and Messrs. **ELLIS** and **SON** (Class XXIII., 12, p. 674), and remarkable for the delicacy and beauty with which they are finished. These will doubtless be noticed elsewhere, so far as they claim admiration for taste and execution. We only refer to them here as showing good samples of manufacture of the fine-grained granitic rocks found in some parts of Scotland.

c. Works in Caen Stone.

The stone obtained from the quarries of Allemagne and others near Caen, in Normandy, has been used in ecclesiastical architecture for so many centuries, that it would be useless to trace back its history for the purposes of this Report. The rock is an oolite belonging to about the same geological period as our own oolites worked near Bath; but the colour is better and more uniform, the texture far closer, and the material superior in almost every respect. It is at first absorbent, but improves on exposure. It cuts with perfect facility, and is thus admirably adapted for ornamental work in architecture, especially when sheltered from the weather. It may be had in blocks of any reasonable size and proportions, and is the finest and most valuable stone of its kind obtained from the secondary rocks. For certain kinds of exposure it is inferior to some of the English oolitic stones, but none excels it for internal work.

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* It was probably owing to some accidental misapprehension of the state of the case that the Medal awarded to Messrs. Freeman for their noble collection of building stones in Class I. was withdrawn in favour of the obelisk in Class XXVII. The Jury of Class XXVII. awarded the Medal for the obelisk as a manufactured block of granite remarkable for its dimensions; but according to the general rule adopted in other similar cases, the award of Class I. should have been retained, the Exhibitors being merchants and not manufacturers.

* Institute of British Architects, Report of Meeting of 24th March, 1851.

So readily worked and beautiful a material has naturally been selected by several persons to execute objects in sculptured stone worthy of the Great Exhibition; but it is, perhaps, somewhat remarkable that none of these come from France, where the material is so abundant. Of the exhibitors in this stone, the Jury have selected three as worthy of the Prize Medal, and one they Mention Honourably. We may proceed to describe these more minutely.

Mr. Myers (Class XXVI., 533, p. 761) exhibits a number of objects sculptured in Caen stone, most of which are placed in what is called the Mediæval Court. These are imitative of English mediæval architectural decoration, and are chiefly, though not entirely, ecclesiastical in their uses. The execution of the stone-work is in all of them extremely good; the different objects are perfectly correct in execution, and the distribution of the details is effectually and well combined with unity of design, showing clearly the artist's knowledge of his subject and of art. A Prize Medal has been awarded to this exhibitor.

The canopied niche, containing a figure of St. Peter, designed and executed by Messrs. Lane and Lewis, of Bristol (53, p. 767), is good both in style and execution, and so creditable in every respect, that the Jury felt no difficulty in awarding a Prize Medal to these exhibitors. The stone is of fine quality, and the treatment well adapted to the material. The statue of St. Peter especially is delicately and skilfully worked, and the smaller figures of our Saviour and the Evangelists are well executed. At the same time it should be observed, that the drapery and pose of the figures are not strictly Gothic, although in good keeping with the architecture, which is distinctly defined and well finished, especially in the ornamental parts. The work is not cut out of a single block, which could have been done, although with difficulty, and in this respect it cannot rank so highly as a work in one piece of stone would do.

The font by Messrs. Margetts and Eyles (91, p. 771), also rewarded with a Prize Medal, is a very fine specimen of sculptured stone, although there is a want of freedom and finish observable in some parts. The general style and execution is, however, excellent, and some of the details of the figures are very beautiful.

A sepulchral monument of the decorative period, by Mr. R. Brown (52, p. 767), has been considered worthy of Honourable Mention. It is well conceived and well executed, and is creditable both in design and workmanship.

A cross of large size, sculptured in Caen stone by the Hon. Mrs. Ross, and exhibited in the West Nave (79, p. 852), is worthy of notice as being the work not only of an amateur, but of a lady.

In addition to these objects, there is a chimney-piece by Mr. Frewer, of Ipswich (5, p. 764), showing much skill, and having a number of minute but imperfectly finished details. The design is allegorical, but not carried out completely. A singular monument of new form (that of a three-sided prism) has been sent by Mr. Baker, of Southampton (54, p. 767); and some small but creditable models, by Mr. Laurie, complete the list of sculptured works in Caen stone. The quality of the stone is shown in some specimens in Class I. (No. 176, p. 772), exhibited by Messrs. Luard, Beedham, and Co. (p. 138), importers; and these are of considerable interest and value, as, in addition to recently cut surfaces, they include fragments which have been exposed for several centuries to the weather both in England and France.

d. Works in Bath Stone.

The works in Bath oolite are neither numerous nor important. The material itself, although much used, is not capable of resisting the action of an English, and especially a London atmosphere; so that few artists have thought it worth while to exert their talents on a stone of so little durability. The substance is sometimes of good colour, works freely, and is obtained in considerable blocks; but it falls far short of Caen stone in every respect. A vase and pedestal, elaborately carved and exhibited by Mr. Vaughan (20, p. 765), show the extent to which the chisel may be used in it; and a bust of Milton, by Mr. Newman (60, p. 767), is a good sample of the whiter kinds, not ill adapted for internal architectural decoration. Mr. Plows (34, p. 767) has sent a number of small articles manufactured of the same substance.

e. Sundry Works in Freestone.

Purbeck stone and Purbeck marble, materials susceptible of polish, and formerly much used in ecclesiastical architecture, are exhibited in a sculptured form by only one person, Mr. Webber (Class XXX., 149, p. 830), who has sent a design for a tomb made of this stone, placed on a slab of the marble. The material is well adapted to church purposes when new, and retaining its polish; but that being soon lost, the surface becomes discoloured, and loses nearly all its former beauty. It is not much used at present, except for restorations.

The magnesian limestone, till lately seldom used in the vicinity of London, is a stone of great beauty and value, and remarkable for its durability, at least in those parts of the country in which it is found. The best quarries appear to be those near Bolsover, in Derbyshire; and the stone has been selected from that neighbourhood for the construction of the external work of the Houses of Parliament. A specimen showing its qualities has been forwarded by the contractor, Mr. Grissell, and is exhibited in Class I. (185, p. 139). Honourable Mention is made of this work, as good of its kind, and well illustrating the use of the stone.

A specimen of freestone is exhibited by Mr. T. King, of Morpeth (Class I., 136, p. 135), to show the quality of this material from Hartford Bridge, Northumberland, and the nature of the work of which it is capable. This has also been considered worthy of Honourable Mention, as a well-executed illustration of the use of a valuable material.

A very interesting exemplification of the quality and decorative use of Craigleith stone is exhibited by the proprietor, Mr. James Gowans, of Edinburgh (Class I., 132, p. 135). The stone is much used for building purposes in Edinburgh, and the Redhall Quarry, from which the larger blocks were taken, is of excellent quality. It belongs to the carboniferous system, and is generally of lightish grey colour, fine grained, and almost wholly composed of pure silex. It is rather costly at first, but very durable, and may be worked perfectly for every architectural purpose. It contains a small per centage of bitumen.

The objects exhibited are two: one is a group of two children (the Orphans), on a plinth of Binny stone, which is remarkable for the large quantity of bitumen it contains;[*] the other is a heroic statue of Sir William Wallace. Both are works of merit, and are especially valuable as demonstrating the capability of a stone hitherto not used in England for the execution of such works; and the Jury have awarded a Prize Medal as a mark of their appreciation of the exhibitor's efforts to introduce a material nearly indestructible, and for so admirably illustrating its use.

In Class XXVII. there is a chimney-piece constructed of a stone obtained from Cornwall, and known as the polyphant freestone. The material is hard, and is said to admit of a good polish, although this and another specimen exhibited are both varnished. The style of the chimney-piece is peculiar. The exhibitor is Mr. Brendon (3, p. 764).

A Prize Medal has been adjudged to M. Desauges (France, 1184, p. 1234), for two objects constructed in

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[*] This bitumen is obtained in quantities so considerable that it has been used in the manufacture of candles, of which specimens are exhibited in Class I.

Tonnerre stone, of which there appear to be distinct varieties, and of which the specimens sent are of fair appearance and good quality (obtained near the town of Tonnerre, Department of the Youne, Central France). One of these objects is a pavement, and the other a chimney-piece, the latter showing much labour of execution, and a complicated but poor design. In the architrave there is inserted a small tablet, in cement, representing the zodiac. At the top of the architrave, and at the corners, are groups of animals laboriously carved. At one side is a tall figure in relief. The whole is somewhat in the style of the sixteenth century. The stone in this composition is hard, and the colour not unpleasing, and it seems well adapted for some purposes of internal decoration.

Mr. Joostens, of Belgium (457, p. 1165), has exhibited a pinnacle made of Ordain stone, which the Jury consider worthy of Honourable Mention, as well for the nature of the material, which is hard, even-grained, and well selected, as for the execution, which is neat and well finished: the design is good and pure.

Several artists have sent vases and other objects sculptured in the soft stone of Malta, a material offering great facilities for working, but not remarkable for beauty of appearance, having a peculiar dead-white colour resembling plaster of Paris. The delicacy of workmanship in these sculptures is very surprising, and, in some cases, also, there is much ingenuity shown, and much talent in designing. The Jury have awarded Prize Medals to Mr. Decesare (27, p. 945) and Mr. F. Testa (33, p. 946); and consider that the works of Messrs. Dimech (28, p. 945), S. Testa (30, p. 946), and Soler (29, p. 945), are worthy of Honourable Mention. There are also some similar objects sent by Mr. Foster, an English exhibitor (Class XXX., 303, p. 840). The stone, of which these vases, &c., are carved, is a yellowish-white calcareous freestone, from forty to fifty feet thick, belonging to the tertiary period, and immediately overlying a semi-crystalline limestone, forming the base of the deposits in Malta and the neighbouring island. Very large quantities of the softer freestone are used in the island for building and other purposes, and are exported to all parts of the Mediterranean.

From Tuscany (97, p. 1293) a few articles are sent, sculptured in a kind of lithographic stone, found near Florence, and exhibited by Mr. S. Giovannini, the proprietor of the quarry. The material is fine-grained.

Several models of temples and other edifices are sent from India, constructed of a peculiarly tough but not very hard stone, of which there appear to be different varieties. A few of these are extremely well carved, and show great neatness and finish in execution. Some of them have been coloured artificially. There are also two small latticed windows of delicate open stone-work, showing remarkable skill in cutting stone, besides extreme elegance of design. The material is of pleasing colour and appearance, and is, in these respects, superior to the Gya stone, which is of grey colour, and of which there are several manufactured objects, chiefly small idols.

In concluding this account of the articles in sculptured stone, the Jury make Honourable Mention of a somewhat remarkable pair of vases, cut with a penknife out of sandstone from the neighbourhood of Jerusalem, and the work of an Israelite living in that city. These vases, executed by Mr. Schnitzer, and exhibited by Sir Moses B. Montefiore (Class XXX., 161, p. 830), show much ingenuity and patient labour. The material is worthy of notice, as a rare instance of stone of the kind being capable of such treatment.

C. Manufactures in Slate.

The collection of split, sawn, and other manufactured slates exhibited by Mr. Thomas Stirling, jun., of the Belvidere Road, Lambeth (Class I., 209, p. 141), exhibits such care in collection and arrangement, and so much novelty of application, excellence of material, variety, and usefulness, as to claim a Prize Medal. Almost all the really important uses to which slate is applied may here be seen; and many new arrangements are shown, some of which at least will be generally adopted. Mr. Stirling exhibits a construction, consisting of an open cabinet of five sides, made entirely of large slate slabs from different quarries and districts, and illustrating the use of slate in the construction of strong-rooms, powder-magazines, &c. On the top of this cabinet is a cistern, composed of slabs of slate, secured in panels by a method discovered by the exhibitor, and admitting of almost indefinite extension. The exhibitor has selected roofing-slates and slabs of the best quality, from the principal quarries in the United Kingdom, as illustrations of the material and of the qualities of slate prepared for the London market. These either compose the cabinet, or are exhibited within or near it.*

Besides the application of slates and slate slabs in the ordinary way, and as already mentioned, Mr. Stirling exhibits illustrations or specimens, showing its use for steps, balconies, larders, wine-cellars, dairies, skirtings, linings for damp walls, wine-coolers, bread, pickling, and pig-feeding troughs, urinals, head and foot-stones for graves, tombs, and monuments, clocks and sun-dials, sinks (cut out of a solid block), floors of conservatories, warehouse-floors, railway-station paving, stables, and many other purposes.

To these various miscellaneous articles there is added a set of models of roofs, covered with different descriptions of roofing-slate, in ten different colours. One of these roofs is covered with slab-slates, with a solid slate roll to cover the joint, as arranged and proposed by the exhibitor. The slate recommended for such purposes is that from Cornwall, as it costs less for repairs than the Welsh, and the colour more nearly resembles that of lead.

In addition to these interesting and useful specimens of manufactured slate, there are exhibited several objects in enamelled and varnished slate, now coming into use for various decorative purposes, which will be noticed elsewhere. Some specimens of filters are shown, and many applications of slate, to which it is not necessary here to allude. To these is added a model of a new machine for splitting and cutting slate, evincing considerable ingenuity.

To Bewicke Blackburn, Esq. (21, p. 765), of the island of Valentia, County Kerry, Ireland, the Jury have also awarded a Prize Medal, for his manufactures in Valentia slate, and for the excellence of the material exhibited. The slate from the south-west of Ireland, and especially from the Island of Valentia, is not so capable of being split into fine roofing material as that of Killaloe, County Clare; but its remarkable strength, and the evenness of its texture, render it extremely useful for various purposes, both in building and for flags.

Slabs of Valentia slate are easily obtainable 30 feet long, four or five feet wide, and from six to twelve inches thick; and the quality, as seen by the specimens sent by the exhibitor, is, in every respect, excellent. The slabs, sash-bars, and roof-ridges are all good examples of the quality of the material, and the garden-seat and table are excellent, both in themselves, and for the uses for which they are intended. The quarries of Valentia have employed as many as 200 persons at a time.

The Old Delabole Slate Company (Outside, 8, p. 114) have exhibited, besides some unmanufactured slates, a very large and well-constructed cistern of Delabole slate, capable of containing 2,000 gallons, and provided with a filter. The Jury consider that this deserves Honourable Mention, as a fit and useful application of a material of good quality at a moderate cost.

Several exhibitors have sent slate cisterns, furnished with filters, the mechanical arrangements of which belong to another Class. As far as relates to the material, and its application, the Jury consider that slate is admirably adapted for such purposes. The exhibitors of such filters are, besides those already mentioned, Mr. T. Stirling, sen. (120, p. 773), Mr. Struthers (Outside, 16, p. 114), and Mr. C. Hunt (109, p. 772).

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* The slates are from the following localities:—Penryn quarries, near Bangor; Llanberis quarries; quarries of the Dorothea Slate Company, near Caernarvon; various quarries at Festiniog and Machynlleth, all these being in North Wales; and from the Delabole quarries in Cornwall, and various quarries at Coniston, in Lancashire; and Langdale, in Westmoreland.

A peculiar application of slate in the manufacture of coffins for vaults is illustrated by a model exhibited by Mr. J. Ekins (13, p. 764). The material is, perhaps, better adapted for such purposes than lead, and the cost may be less; but such means of preserving the human body in a state of partial decomposition are of questionable value.

An inkstand, of very beautiful Penrhyn slate (Class XXVII., 63, p. 767), manufactured by I. Rowlands, of Llandegai, near Bangor, is an ingenious and very carefully worked illustration of what can be done with this material. The Jury make Honourable Mention of it, as an encouragement to this kind of industry, and the endeavour to make an useful and ornamental object of the only material which the exhibitor had before him.

The school-slates of Messrs. Dawbarn and Co. (Class I., 208, p. 141) are of large size and good quality; and the same may be said of the slate ridges and rolls exhibited by Mr. D. Williams (Class I., 215, p. 142). The application in both cases is correct, and the manufacture important.

The model exhibited by Mr. J. George (Class I., 213, p. 142) is intended to show the applicability of slate in conjunction with iron to constructive purposes.

Three Companies exhibit collections of French slates, all of which include split and dressed slates and slabs. The Jury consider the slabs from Angers, exhibited by the Agent of the Angers Slate Works, M. Lariviere (290, p. 1190), as worthy of Honourable Mention. The others are from the Joint-Stock Company of the Slate Works of Rimogne (Ardennes), A. Moreaux, Agent (378, p. 1195); and the Slate Works Company of Rimogne and St. Louis (694, p. 1212). The slates, especially those from Angers, are of large size and fine quality, and are well dressed and manufactured. Messrs. Forton, Duponceau, and Co. (France, 1228, p. 1236), of Chattemoue (Mayenne), exhibit a slate billiard-table, considered worthy of Honourable Mention. In the manufacture of billiard-tables slate is now rapidly superseding all other material.

Some slates of good quality are exhibited by Mr. S. Solesi, of Chiavari, Sardinia (2, p. 1302). These include not only roofing-slates, but a table and polished writing-slate. They are fairly worked.

D. Manufactures in various kinds of Stone and other Minerals.

Under this head are several miscellaneous articles, such as steatite, or soap-stone, coal and jet, tufa, &c., not very easily included under other headings. Though unimportant, they possess some interest. The steatite especially, although at present little used in this country, is well worthy of attention, as possessing valuable properties, and capable of being supplied from America and elsewhere in blocks of large size. The articles manufactured of coal are more curious than useful; but those of jet are not without value in a commercial sense.

The Maryland Soap-Stone Company (United States, 180, p. 1449) has received Honourable Mention for articles manufactured in the steatite abundantly found near Baltimore, and exhibited by the Company. This stone, hitherto little used for economic purposes, may be obtained, without flaw, in large blocks, adapted for many useful purposes, those especially instanced by the exhibitors being baths and sizeing-rollers used in cotton mills. For the latter purpose it possesses the great advantage of not being affected by the acids ordinarily used in sizeing, and of not warping, contracting, or expanding by changes of temperature and moisture. It is also recommended as an admirable material for fire-stone, kitchen-sinks, wash-tubs, bath-tubs, urinals, &c. It is readily wrought, being bored, turned, and planed by the ordinary tools of the carpenter, and it may be screwed together with nearly the facility of hard wood.

The wholesale prices of blocks of steatite, delivered on board at Baltimore, are as follows:—

Sawn or chiselled blocks, per cube foot, 1 dollar (4s. 3d.)

Slabs, per square foot super. 1 inch thick, 25 cents. (1s. 1d.)

Slabs, per square foot super. 1¼ inch thick, 28 cents., and more in proportion to thickness.

The manufactured articles would be supplied at corresponding prices, but it is considered that if the blocks cannot be admitted duty free, as raw material, it would be necessary to charge double the price quoted for selected blocks tested for special purposes.

This steatite is a silicate of magnesia, and the form of it here exhibited is compact, of greyish colour, soft to the touch, of specific gravity 2·65 to 2·8, hardly affected by sulphuric or muriatic acids, and little altered by exposure to intense heat. Other objects of steatite are exhibited from India, where the material appears to be abundant, and where it has long been used for household utensils.

A couple of vases manufactured of the tufa, obtained from the hot-water springs of Carlsbad, are considered by the Jury worthy of mention, for the nature of the material. The vases themselves offer nothing remarkable. They are exhibited by Mr. Gottl (Austria, 724, p. 1043).

Several persons have exhibited articles manufactured o cannel coal and jet, materials derived originally from the vegetable kingdom, but now existing in a mineral condition. These, although not sufficiently important to require any lengthened description, are interesting, especially the small objects in jet, from their manufacture giving employment to many persons in various parts of Europe.

Cannel coal is chiefly used in the manufacture of gas, but some of the harder and more compact bands are occasionally cut into various ornamental objects, several of which are represented in the Exhibition. The most interesting of these as a finished work, well designed, and well executed, is a garden-seat, exhibited by His Royal Highness Prince Albert (140, p. 777), manufactured by Mr. T. W. Waun, from the design of L. Gruner, Esq. This is made from a fine kind of cannel, called 'Parrot-coal,' obtained in the Fifeshire coal-field, on the estate of Admiral Wemyss. The Jury consider that both for design and execution this object is worthy of Honourable Mention.

A well-constructed model of the Durham monument (Class I., 269, p. 146), and a wine-cooler (90, p. 771), both made of cannel-coal, are exhibited by Mr. G. H. Ramsay. This coal is obtained from a part of the Newcastle coal-field, and is a kind largely used for gas-making in London. Being compact and brilliant, and not soiling the fingers, it is well adapted for working into ornaments.

A number of small articles are exhibited by the Ince Hall Coal Company (Class I., 268, p. 146), manufactured of their cannel, which is little inferior to that of Newcastle, and is obtained from a part of the Wigan (Lancashire) coal-field. A collection of yet smaller objects is shown by Mr. Mitchell (Class I., 270, p. 146), illustrating the uses to which a hard variety of the same substance from the vicinity of Edinburgh may be applied.[*] A set of chess-men, manufactured of coal and alabaster, is exhibited by Mr. C. Vokens (30, p. 765), as another illustration of a similar kind, and a snuff-box in coal is described amongst the goods from China.

Jet is a material chiefly used for ornamental purposes. It is hard, brittle, opaque, scarcely heavier than water, and takes a very high and beautiful polish. It is found in various parts of Europe, America, and Asia Minor. In Roman Catholic countries, a large quantity of small ornaments (as crosses, beads, rosaries, &c.) is made of this material, and it is extensively used with us for mourning decorations.

The principal exhibitors of jet are Messrs. Slater and Wright, of Whitby (Classes I., 2, and VIII., 312, p. 121), where the raw material is obtained in abundance and in very good condition. Their articles belong to the class of jewellery. Another exhibitor of

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[*] From an analysis forwarded to the Reporter by the exhibitor of these articles it appears that this variety of cannel yields as much as 15,000 cubic feet of gas per ton.

English jet is Mr. GREENBURY (Class XXIII., 8, p. 673). The jet of the Asturias, which has long been known in Spain, is represented by some specimens forwarded by the town authorities of Oviedo (Spain, 33, p. 1331). These articles are sold at an extremely low price on the spot.

The Jury might here refer to amber, as being a mineral production; but the articles exhibited partake so closely of the nature of jewellery, that it is considered better to omit noticing the substance and its exhibitors in this Class.

Group 2.—POLISHED AND INLAID WORK IN STONE, &c.

Under this head are included all kinds of earthy mineral substances, as stone, marble, alabaster, granite, porphyry, jasper, quartz, jade, agate, and gems used in a polished state either in constructing or inlaying various objects of decoration and use. The working, polishing, and inlaying of several of these are generally in the same hands; but in describing the objects, we propose to treat of the inlaid work as a separate subject. The cutting of jasper, quartz, jade, &c., is a peculiar manufacture, when performed on a large scale.

The total number of exhibitors in this group is about 120, of which those from the United Kingdom amount to something less than one-half. Tuscany and France take the next place in point of number and variety, but the most attractive objects are from the former country, consisting of mosaics or inlaid work, those from the latter being principally chimney-pieces. Austria has four exhibitors, three of them Italian, and the objects exhibited are chimney-pieces, strictly Italian in character. Rome has three exhibitors, one of them extremely remarkable for the beauty of the workmanship shown. Italy is thus strongly represented, a fact which might have been anticipated from the habits and history of the people. Russia has long been celebrated for work in mineral manufactures, and the exhibitors from that country have not failed to take this opportunity of showing the progress that has been made of late years in the processes of polishing and inlaying, especially with regard to Florentine mosaic and veneering in malachite. From Germany there are several exhibitors, but the progress there made in the art of decorative work in marble and mosaic does not appear to be well represented in the Exhibition, although there is one very creditable exception, showing that the polishing of granite is thoroughly understood in Berlin. Belgium exhibits a few, but very few, objects of interest. The countries of the Peninsula are contented with sending their marbles rather as specimens of material than workmanship. It remains only to speak of Sweden and Norway among European countries, but these are extremely remarkable, and present good proof of a thorough knowledge of the art of granite-working in its best applications.

From the south coast of the Mediterranean we have a few fine slabs exhibited from Egypt, though chiefly as raw material, and one inlaid table from Tunis, interesting for the marbles, and also illustrating a manufacture. India and China, especially the former, are much more remarkable, and show a degree of skill and taste in the most difficult and important decorative work in stone and *pietre dure* that puts to shame all that is done in Europe, and shows how much yet remains to be learnt from a country which has so long been the seat of a certain kind of civilization.

America presents a few objects, which will be found noticed in the proper place.

E. MANUFACTURES IN MARBLE AND ALABASTER.

Manufactures of this kind partake of that higher art which is recognised as sculpture, but there is so much of a purely mechanical nature, and so much more in which a certain degree of taste in execution redeems the character of questionable models, that in every country there has been from time to time a characteristic style, and a distinct manufacture in marble, the history of which would be valuable and interesting.

Italy is pre-eminently the country where this manufacture has been found most congenial to the artistic feeling of the mass of the people, and there, or in its vicinity, at the present day, a large part of the best marbles used in Central Europe are obtained and worked. Of late years, however, France, Spain, Portugal, and parts of Germany and Belgium, have employed for their own use, and in their own style, many useful and valuable marbles with which they abound; and in England manufactures have arisen, at first and chiefly in Derbyshire, but also in Devonshire and Cornwall, in which much has been done to raise the character of marble decoration, by employing the excellent material which abounds in those places, and by introducing various useful objects of house decoration at a price which, though somewhat too high for the mass of consumers, is far below that of foreign goods of the same kind in this country. Ireland also, in which several fine marbles occur, has given proof of some activity in this manufacture, for which, indeed, nature has offered many facilities.

There are some marbles from Greece, and also from Italy and the coast of Asia Minor, which were greatly admired and used by the ancients, but of which the quarries are now exhausted or concealed by rubbish. Amongst them are the true Parian of Greek sculptors, and some other fine white marbles; the *nero antico*, now a very rare black marble, considered purer and better than the known kinds; the *rosso antico*, a deep blood-red marble, with veins and spots; the *verde antico*, a green and very beautiful porphyritic breccia; the *giallo antico*, not unlike the modern Sienna marble, of very rich yellow tint; with some others. Most of these are only known in sculptured specimens, but many, if not all the colours, are closely approximated by recent marbles.

Marble is cut with a thin plate of soft iron used as a saw, and supplied continually with water and sharp sand. Both the hand and machine power are used, and the cutting is carried on continuously in most marble-works. The polishing is commenced by rubbing down the surface with sharp sand till it is perfectly flat. Finer sand is then gradually used, and at length emery, after which tripoli, the last polish being given with tin-putty. The coarse sand is usually rubbed on the marble with a plate of iron. The polishing rubbers are coarse linen cloth. Water is required in every stage.[*]

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[*] The Reporter is indebted to Messrs. Hall, of Derby, for the following account of the mode of turning and polishing marble, spar, and alabaster, as practised by them:—

Having chosen a piece of marble about the size required and free from veins, vents, &c., to which black marble is very subject, the first process is to level one face, and with a pair of compasses strike a circle round the outer edge, then with a mallet and pointed chisel work it roughly to a circular form. It is then ready for the lathe, and being fastened with a resinous cement to an iron chuck, it is screwed to the lathe-spindle, and a very slow motion given to it. The only tool used is a bar of fine steel about 30 inches long by ¾ in. square, drawn to a point, and well tempered. This is forcibly applied to the marble, which it reduces to the proper form by slowly spelching off small pieces. After the correct outline is acquired with this tool, it is ready for the grinding process, the first being to apply a piece of coarse and hard sandstone with water (the lathe now having a rapid motion) until all the tool marks are ground out. A finer piece of sandstone is then used to remove the coarse scratches of the previous one, and so on with a few other and still finer stones, until all the scratches are quite obliterated. This prepares it for polishing. A piece of cotton cloth, washed quite clean, and well rubbed with flour emery, is applied to the marble, and polishes it to a certain extent. A similar piece of cloth is then rubbed over with putty powder (white oxide of tin), which gives a very high polish.

This is the method, with a few trifling variations, by which all kinds of marble are turned and polished.

Fluor spar undergoes nearly the same process, but requires much greater care and skill on the part of the workman, as the spar, being composed of a mass of crystals, whose cleavage is in various directions, requires a more delicate manipulation than almost any other stone.

Alabaster is a soft stone, and can be sawn with a common tooth-saw, and is turned and polished in a very similar manner to marble.

The chief marble manufacture of England is in a part of Derbyshire, remarkable for its picturesque beauty, extending along the valley of the Derwent and its principal tributary the Wye, from below Buxton to Derby. The machinery for sawing and polishing was first established in Derbyshire, at the village of Ashford, near Bakewell, in the year 1748, water being the motive power. About the year 1810, similar machinery was erected at Bakewell. Both these works are situated near the quarries. Within a few years other works have been established at Buckland Hollow, near the line of the Midland Railway. These works give employment to upwards of seventy persons: about one-fifth work in the quarries: the rest are marble masons, polishers, &c., employed in part upon foreign marbles. Besides these three works, others have been established in Derby for many years.

The most important marbles of Derbyshire are the black, the rosewood, the encrinital, the russet, or bird-eye, and a mottled dark and light-gray kind, occasionally containing numerous small corals. Of some of these there are several varieties. Others might be added to the list of those found in the northern part of the country, one of which is a beautiful red, resembling the *rosso antico*, but it is obtained only in small blocks or lumps.

At Wetton, in Staffordshire, near the borders of Derbyshire, are marbles differing much from the above, but they have not been brought into any considerable use, and are generally subject to flaws.

The *black* marble is of very fine colour and texture, but large slabs free from small veins of calcareous spar are rare. The best quality occurs in beds of from 3 to 8 inches in thickness; some beds are thicker. This marble is, perhaps, superior to the similar kinds found in other parts of Europe, and is greatly valued for inlaying. It is tough, and contains a good deal of carbon, which imparts the colour. Within a very recent period the finer slabs have been inquired for, for exportation to Florence, Malta, and St. Petersburg, besides being used in Devonshire and Derbyshire.

Black marble is extensively used for ornamental objects, such as vases, pedestals, chimney-pieces, &c., for which it is admirably adapted. It is occasionally ornamented in various ways, as by etching, engraving, and inlaying. In the two former processes the polished surface is removed, and the brown colour of the rough marble exposed. Powdered white-lead is sometimes rubbed into the etched surface to increase the effect. By a peculiar process used at Derby, the brown colour is sometimes exposed without the polish of the marble being destroyed. The ornament produced by this process is more durable than the ordinary etching.

The *rosewood* marble is extremely hard, and of close texture. The beds are of considerable thickness; but the most beautiful part of the marble is only about 6 inches thick. The name is derived from the marking of the marble being somewhat similar to that of rosewood.

The *encrinital* marble is the one in most extensive use, and contains very numerous fossils, consisting almost exclusively of the broken fragments of encrinital stems often entangled in coral. It may be obtained in blocks of large superficies, and of a thickness of 2 to 2½ feet.

The *russet*, or *bird-eye*, takes its name from its colour and appearance, the shades varying from light gray to brown. It contains numerous minute fossils, also encrinital, and is found in beds of from 6 to 18 inches in thickness.

The dark and light mottled gray marble (called Newburgh marble), and the overlying bed, which is coralline, can be obtained from 1 to 2 feet thick.

The manufacture of Devonshire marble is much more modern, and the material is generally less manageable. Almost all the beautiful marbles of this county, especially those near Plymouth, are fossiliferous, brittle, and very apt to contain veins and cracks. They are illustrated by some beautiful and interesting specimens, which will be alluded to as the works of individual exhibitors. The marbles of Devonshire belong to an older geological period than those of Derbyshire, the latter being exclusively of the carboniferous limestone series, underlying the coal measures and the millstone grit, while the former are of the Devonian, or middle Palæozoic epoch.

The other kinds of marble, obtained from various localities, do not appear to involve any peculiar method of manufacture, nor is it necessary to give further details on this subject. It may well be supposed that the cutting and polishing of alabaster, a material much softer than marble, is in a corresponding degree easier. It is said that soap is used in polishing alabaster, and some of the objects constructed of this material are rendered translucent by being soaked in some kind of oil. The chief locality of this manufacture has long been in the north of Italy, near Leghorn, where the material is very abundant. A considerable number of alabaster ornaments are now made in Derbyshire, chiefly from Italian models: those originated on the spot are not yet remarkable for excellence of design. The material is obtained in that county in considerable quantities.

In proceeding to mention the different exhibitors in these materials, we may begin with an account of the series of manufactured marbles sent from various places.

a. General Collections of Marbles.

There are several collections of marbles exhibited from foreign countries, in which the specimens are at least partly manufactured, and some even finished, although the general intention in such cases seems to have been to exhibit them rather as raw materials than as specimens of manufacture. Many of them thus belong to Class I. (Raw Materials of the Mineral Kingdom); but others partake so distinctly of the character of the objects in Class XXVII., and so clearly involve processes of manufacture, that the Jury of this latter Class have thought it necessary to allude, however briefly, to them. To some of these they have voted Medals.

The collection of Italian marbles forwarded by the **ROYAL TECHNOLOGICAL INSTITUTE** of **TUSCANY** (Tuscany, Nos. 1 and 98, p. 1290) is of very considerable interest, and includes many varieties little known in this country, some of them remarkable for their beauty and excellence. The Jury mark their sense of the value of this series by awarding a Prize Medal to the Institution by which it has been sent.

To M. **DÉJEANT** (Portugal, 232 to 247, 250, 251, 259 to 274, p. 1310) a Prize Medal has been awarded, for a most interesting series of Portuguese marbles, of great variety, and including many of considerable beauty. A fine collection of Pyrenæan marbles is sent by Messrs. **DERVILLÉ** and Co. (France, 162, p. 1181), to whom also a Prize Medal is awarded (Prize Medal given by Class I. also); and an almost equally interesting series of specimens from Languedoc is contributed by M. **CAFFORT** (France, 444, p. 1199), of whom Honourable Mention is made. M. **COLIN** (France, 1564, p. 1251), who has exhibited a series of polished marbles, granites, and serpentines from the Vosges mountains, is also Honourably Mentioned.

The **GREEK GOVERNMENT** (Greece, 26-49, pp. 1404-05) has sent samples from some of those quarries whose reputation dates as far back as history can record, but they are not in a condition of manufacture to justify extended notice here. The marbles are decidedly inferior in quality to some of those obtained more recently in greater abundance from nearer localities, but if the quarries were properly and extensively worked, far better material might probably be obtained.

The **EGYPTIAN GOVERNMENT** (Egypt, 1-4, p. 1408) has been induced to open, of late years, the rich stores of oriental alabaster, a material celebrated in antiquity, and of which is made one of the most interesting works in mineral manufactures in the Great Exhibition.* The condition of this marble is very peculiar, but it would seem that considerable quantities of excellent quality might readily be obtained. It is a peculiar condition of lime-

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The columns formed of pieces of black marble and alabaster (exhibited in Class I., No. 146, by J. and G. Hall) show the various processes, beginning with the rough stone at the bottom, and ending with the final polish at the top.

* The object alluded to is the Tazza, by Mr. Dallamoda (Rome, 19).

stone (a true carbonate of lime), apparently formed in the manner of stalagmite, and on account of its peculiar tint and translucency was called by the ancients alabaster.

From India are sent many specimens partly manufactured, indicating the existence, in that country, of valuable material more or less resembling our marbles, and suitable for similar purposes. A few of these are coloured, and the quality of the white marble is very peculiar. One of the coloured kind may be mentioned as affording a tint of pale green, unknown in Europe. This is from Bellary (Madras, p. 868), and is a magnesian rock, probably a variety of serpentine. Many of the harder materials might also be mentioned.

A small series of partly manufactured jades recently forwarded from China, by Dr. BOWRING, is interesting on account of the material, which is, however, too difficult and costly in working to be much used for economic purposes, unless indeed mortars and pestles and some other objects for chemists could be manufactured of it of larger size than can now be made of agate, and at moderate cost.

Many collections of marbles and other substances referred to this Class are not noticed here, because they are less decidedly manufactured. Taken as a whole, it cannot be said that these collections are in any sense complete; but they may, if afterwards brought together, form a nucleus of much value, which will suggest many useful hints. We proceed now to describe in succession the various manufactured objects which are most easily and readily compared.

b. Chimney-pieces.

The chimney-pieces sent for exhibition involve so many differences in style and material, and are of so many degrees of merit, that it were unreasonable to judge them all by one standard, or regard them from one point of view. Architectural decoration and sculpture, beauty and excellence of material, adaptability to the special purpose required, cheapness, and many other considerations, must all be taken into account; and the Jury have endeavoured to select for reward from the whole number those most remarkable for each of these qualities.

The works of this kind of the greatest pretension and highest claim to originality are three chimney-pieces of statuary marble (of Carrara), exhibited by GIUSEPPE BOTTINELLI, of Milan (Austria, 726, p. 1043). They are all characterized by elaborate design, and excellence in the details of execution. They also show much freedom and boldness of sculpture, and deserve much praise for the vigour and life with which the numerous figures and various objects are represented. The Jury fully appreciate this high excellence in many points, and adjudge a Prize Medal to the exhibitor; but they would direct attention to the fact that the style of ornament is not adapted to the object, nor are the designs altogether in good taste. On the whole, however, their artistic merit is of a high order: the figures are correctly modelled, and full of life and delicacy, and this effect is produced by the chisel, and is by no means the result of mechanical assistance. The faults of style seem to have arisen from an attempt at great originality, which is but partially successful. It should be remarked, also, that the material is not of the finest quality.

The chimney-piece, by G. MOTELLI (Austria, 728, p. 1044), also of Milan, is marked by the same excellences, and some of the same faults, as those of Bottinelli. The design is generally good; but the countenances, especially of the Cupids, are unpleasing, and a part of the marble is left rough to heighten the effect, which is hardly admissible in a chimney-piece. In other respects the execution is highly creditable to the artist. This, and a marble mantel-piece by G. BENZONI (Austria, 725, p. 1043), are considered by the Jury as worthy of Honourable Mention, both of them bearing evidence throughout of the taste, judgment, and feeling of an accomplished artist.

Next to the works of these Milanese sculptors, the Jury place the chimney-piece exhibited by A. LECLERCQ, of Brussels (Belgium, 425, p. 1164), which is constructed of very beautiful Carrara marble. The architectural design is of considerable merit, and the details very admirably executed. The general work of the figures and principal features of the design are also commendable; but the purely ornamental part is inferior in composition, sometimes confused, and has little life and delicacy of expression. It is also finished too much with the file and pumice-stone. Notwithstanding these faults, the work, as a whole, has very great merit, and has been recommended as worthy of a Prize Medal.

A very beautiful and carefully-worked specimen of the black marble of Belgium, executed in that country, and fitted to an English stove, is exhibited in Class XXII., (491, p. 650), by I. NOIRSAIN. It consists of a chimney-piece and large mirror-frame above, without ornament, but of noble proportions. The effect is rather heavy, but the work is so good that the Jury award a Prize Medal to this exhibitor. The material is also excellent.

There are no less than five exhibitors of marble chimney-pieces from France, one of whom exhibits several works of good general character, and in good taste; and another, a group chiefly remarkable for combining a certain degree of excellence with moderate cost. The rest all offer some points of interest, but they are confined to the simpler kinds for house decoration.

The Jury award a Prize Medal to Mr. SÉGUIN (France, 692, p. 1212), for a carefully finished work in veined Carrara marble, of very ingenious design, and some merit in workmanship. They also give a Prize Medal to Mr. J. A. LEBRUN, jun. (France, 572, p. 1205), for three similar objects in white and veined marble, which are stated to be of moderate price, and are well adapted, by their style and comparative simplicity, for the usual purposes of chimney-pieces. The cost of a moderately ornamented chimney-piece by this maker is said not to exceed 12*l*. in Paris.

Three chimney-pieces by Mr. MARGA, of Paris (France, 608, p. 1207), deserve notice, and one of them, of veined Carrara marble, is in good taste and well executed. Of this exhibitor the Jury make Honourable Mention. Mr. J. DUPUIS, also of Paris (France, 184, p. 1183), sends three similar objects, one of which, with a simple geometrical pattern, is in good taste, without any high pretensions. Generally speaking, the French works of this kind exhibit a somewhat over use of the file, and too little of that free handling by the chisel which gives life and expression to a sculpture.

We come lastly to the English chimney-pieces, which are not very remarkable either for design or execution. Excluding those which do not owe their chief excellence to inlaid work, few are left that will detain us long. In the Nave, West (82, p. 756), there is one by Mr. THOMAS, of white marble, with a bust of Shakspere and various figures, the sculpture of which is tolerable, but the whole is too much like a monument. In the same part (86, p. 847) is a rather elaborate white marble chimney-piece, by Messrs. BRINE BROTHERS and T. SHARP. The design is not remarkable, but the work is good. The gilt ornament is perhaps more novel than admirable, but the Jury have recommended the exhibitor for Honourable Mention.

In Class XXVII. (17, p. 764) the LONDON MARBLE WORKING COMPANY exhibits a good white marble chimney-piece, for which, and several other objects in marble, a Prize Medal is awarded. Mr. TENNANT and Mr. HALL (37 and 38, p. 766), exhibiting together several Derbyshire and other marbles, of which Honourable Mention is made, have, amongst the rest, a black marble chimney-piece, with stove, and porcelain tiles. Others will be afterwards described amongst the inlaid work.

There are several chimney-pieces in Class XXII., which rather illustrate improvements in stoves than offer anything new or remarkable in marble working. One of them, however, by Messrs. THOS. and JAMES NELSON (102, p. 603), is well executed and handsome, in a stone somewhat difficult to work, and the Jury consider it deserving of Honourable Mention. An alabaster chimney-piece is exhibited by Mr. W. PIERCE (107, pp. 604, 605), but the material is manifestly unsuited for the purpose.

Lastly, there is a veined Carrara marble chimney-piece, by Messrs. Porzelt and Harperath, of Cologne (Prussia, 317, p. 1068), which is mentioned as being the only work of the kind from North Germany. It should be remembered that this kind of house decoration is little needed in countries where close and ornamental stoves take the place of our open fire-place.

On the whole the Jury cannot highly praise the group of objects now under consideration: those of greatest pretension lack simplicity, and the rest are destitute of any originality or elegance which can entitle them to rank above ordinary furniture and house decoration.

c. Columns, Pedestals, &c.

It is unnecessary to enumerate here all the exhibitors of columns, pedestals, &c., and only a few will be mentioned, which appear to require notice on account of material. Many of the others may have the same kind of merit of execution, which is, however, too simple to need description.

From Tuscany are several fusts of columns, one of which, sent by C. Nobili (91, p. 1292), is remarkable for the extreme beauty of the material. It is a brecciated marble, of a remarkable soft brown colour, fine texture, and good polish, and is well adapted for house decoration. It has been selected for Honourable Mention. Other columns from Tuscany, by Guidotti (94, p. 1293,) and Maffei (95, p. 1293), are not without considerable beauty, but they are not so new. They are for the most part of brecciated marbles.

The Belgian columns exhibited by the Viscount Desmanet de Biesme (Belgium, 16, p. 1151), and Honourably Mentioned by the Jury, are chiefly interesting as examples of the black marble of the country. The French have contributed few objects of this kind.

Of English columns there are some of considerable interest. Two of large size and great beauty, adapted for church or palatial decoration, are sent by Mr. Champernowne (Main Avenue West, 158, p. 848), from a quarry in Devonshire, capable of yielding much excellent material, in slabs of large size. The marble is of the kind called "madrepore," being almost entirely made up of coral-limestone, greatly altered, but retaining its organic texture. The colour is good and richly varied, but it has the demerit of being cut the wrong way of the grain, and is built up as stone-work although polished as marble. The Jury make Honourable Mention of these columns.

The Royal Dublin Society (71, p. 768) has sent bust-pedestals, one of a white marble, and the other of a well-known green colour, both from Connemara. The latter is remarkable for its rich green hue and great beauty; and the selection of material being important in ornamental marble-work. The Jury have made Honourable Mention of the Society for the success attained in the present collection. There are two marked varieties of colour of green Connemara marble, one being much darker than the rest. Mr. Franklin, of Galway (73, p. 768, and Class I., 144), has sent two black marble pedestals, one prepared for polishing and another finished. These show the quality of the material, which is unquestionably good, and both are from his neighbourhood.

Messrs. Oldfield and Co. (p. 969), Messrs. Lomas and Sons (81, p. 969), and some other exhibitors from Derbyshire, have supplied specimens of Derbyshire marbles of various kinds, which well illustrate the character of the stone and its uses. The so-called rosewood marble, which is one of them, has been already described. It is very beautiful, but so much harder than the others, that the saw will cut the encrinital marble of the same district three times as quickly.

Various pedestals of granite and porphyry are exhibited from Cornwall, but these will be elsewhere described.

d. Slabs, Table-tops, and Tables.

These objects are chiefly interesting in reference to the material of which they are constructed. Some of the marbles are beautiful, and a few are remarkable for rarity.

The Connemara marble tables exhibited by Mr. Lambert (70, p. 768) consist of two picked slabs from the Ballinahinch quarry, considered to be remarkably fine, and placed on pedestals of black Galway marble. There are flaws in the slabs, but they are Honourably Mentioned by the Jury as good samples of the material, which is worthy of more extensive use than it has hitherto obtained. The Galway marble is also exhibited by Mr. Hunter (Class XXVI., 202, p. 751). Mr. Champernowne (6, p. 764) exhibits a table of Devonshire marble, not very remarkable for beauty of material, but massive, well proportioned, and adapted for certain uses. An interesting and rather beautiful slab of the Plymouth limestone, used in the construction of the breakwater, has been formed into a table, and is sent by Mr. Stuart (55, p. 767). A magnificent slab of foreign marble is amongst the goods exhibited by the London Marble Working Company (17, p. 764), and is worthy of notice for its excellent finish.

It is pleasing to observe amongst the goods sent from Canada a table of polished limestone or marble, the material the same as serves for ordinary building purposes in that colony. It is remarkably fine-grained, but the colour is not particularly ornamental. It is exhibited by Mr. Hammond (118, p. 965), and is Honourably Mentioned.

A table is exhibited amongst the East Indian productions, the top of which consists of a slice of a column from Nineveh. It deserves attention from the condition of the limestone, though the material takes only an imperfect polish. It is the property of Colonel Sykes (p. 921).

The slabs of marble exhibited by M. Guislain, of Belgium (423, p. 1164), are good specimens of the ordinary material used extensively in that country, not only for ornamental, but for general domestic purposes. It is no doubt owing, partly, to the low cost of the labour required for preparing these slabs, and partly to the great abundance and variety of the material, that marble is so much more used on the Continent than with us; but it is worthy of consideration whether we might not introduce the cheaper kinds for many purposes of furniture, and in so doing, follow the example of our neighbours in France, Belgium, and elsewhere. M. Guislain has been deemed worthy of Honourable Mention.

The Italian marbles used for tables and slabs are sent by several exhibitors. Of these the Count de Guido (Tuscany, 93, p. 1293) exhibits two of red colour and excellent quality. The material is little known. The Marquis Panciaticchi (Tuscany, 96, p. 1293) shows a good specimen of "lumachella," or fire-marble, which is a dark-brown shell marble, having brilliant fire-reflections from within. He also has two smaller tables. M. Nanni (Tuscany, 29, p. 1293) has sent a circular table, of the marble called *verde di prato*, and M. Guidotti (Tuscany, 94, p. 1293) three tables, two round and one oblong, the latter of good colour, but not very close texture.

The Royal Technological Institute (p. 1290) has also forwarded a number of tables of various kinds of marble, sufficiently described in the Catalogue. To these some reference has already been made in speaking of the Tuscan marbles generally.

There are but few proprietors of those numerous quarries in Germany which furnish the various marbles in common use, who have thought it worth while to forward for exhibition fair samples of their produce. Amongst these is, however, one, the Ruebeland Ducal Establishment of Brunswick (Prussia, 780, pp. 1093, 1094), which deserves notice for the beauty of the slabs and the good condition in which they are sent. M. Cantian, of Berlin (Prussia, 235, p. 1061), has sent a beautiful slab of Prussian marble, very admirably executed. Of the former exhibitors, Honourable Mention is made for the group of objects they exhibit. The latter is rewarded with a Prize Medal, having sent several articles of considerable interest.

The collection of marbles cut into slabs and table-tops, and sent by M. J. J. Figueiredo (Portugal, 248, 249, 252 to 257, p. 1310), has been Honourably Mentioned by the Jury. This series is exceedingly remarkable for the beauty and great variety of many of the specimens, and illustrates the riches of Portugal in this respect. Some of the slabs, especially, must be very valuable if not too brittle for working, which cannot be positively ascertained in their present state. The specimens of M. Déjeant, of Portugal, have been referred to before, in treating of the collections of marbles from various countries.

The Egyptian Government (p. 1408) has sent a number of samples of that extremely beautiful marble known as "Oriental alabaster." This material is not really alabaster (sulphate of lime) in the modern sense of the word, but being of a very delicate colour, great clearness and transparency, and peculiar texture, it resembles that mineral, which has indeed been named from it. The table-tops of this stone are very beautiful, and admirably worked and polished. They have obtained Honourable Mention.

From the United States but few specimens of marble have been sent, but we observe a very beautiful and well-executed table-top of yellow marble, resembling Sienna, sent by Messrs. Doe, Hazleton, and Co., of Boston (418, p. 1462).

e. Miscellaneous objects in Marble, &c.

Miscellaneous objects in marble, alabaster, &c., are numerous. They include some fonts, a bust, a tomb, and various ornaments for the table and drawing-room, from England and Ireland. Numerous small toys and other objects are sent from India, with garden-seats; some vases and other things from Italy, and a few trifles from other countries. We proceed to enumerate them.

The fonts are several in number; some of white statuary marble, one of marble from Devonshire, and others of less pretence. Two of the former, exhibited by the London Marble Working Company (17, p. 764), are plain, but of elegant design and good execution. The third is by Mr. Peyman (Nave, 87, p. 850). The Devonshire marble font, by Mr. Bovey (p. 764), is a fair specimen of the stone, which is one of the richly variegated coralline marbles of Plymouth; but the material is not adapted to the object, nor is the style good, though the execution as marble work is praiseworthy.

A bust of Grattan, well executed in Irish marble, is very interesting, as proving the existence in Ireland of a highly crystalline, yellowish marble, adapted for the use of the sculptor, and more approaching the ancient Parian than anything known elsewhere in Europe. This marble is from Dunlavey Quarries, county Donegal, and the quality may be expected to improve, if the quarry should be further worked. It is exhibited by the proprietor, Lord Monteagle (72, p. 768), and is Honourably Mentioned by the Jury.

Mr. Porter (66, p. 768) has a collection of small objects in Connemara marble, all of Irish manufacture, and very neatly executed. Some small table ornaments by Mr. Rumley (59, p. 767), Mr. Wishaw (61, p. 767), and Mr. Simmons (Class XXX., 126, p. 829), may also be mentioned as neat and ingenious. A pair of small obelisks in polished oolite exhibited by Mr. J. Bell (57, p. 767) are very pretty illustrations of the material, and are well finished.

There still remain to be considered the ornaments of black and other marbles, chiefly from Derbyshire, exhibited by Messrs. Hall and Tennant (37 and 38, p. 767), Selim Bright (80, p. 769), and J. Turner (82, p. 769). The first (Tennant and Hall, 37 and 38) have sent a fair variety, which have been considered worthy of Honourable Mention, as exemplifying the present state of taste and skill in working marble in the district in England where the greatest pains have been taken, and where the improvement is of longest date. Mr. Bright's vases are also Honourably Mentioned.

The series of Derbyshire goods, by these exhibitors, is in some respects excellent, and the imitations or models from the antique, especially the obelisks, both Egyptian and Nineveh, are very pleasing. The process of etching on marble, illustrated by some of the objects they exhibit, is also shown by Mrs. Rayner (Class XXX., 47, p. 822), and Mr. E. Bird (83, p. 769); but as it is not likely to lead to any improved process, and is of itself only an ingenious but unfit application of one of the Fine Arts to a material ill adapted for the purpose, the Jury make no further remark upon it. The two vases, sent by Mr. Bright, and the jugs by Mr. Turner, all of black marble, are of elegant shape and perfectly well finished. Mr. Vallance, of Matlock, whose most important objects will be spoken of amongst inlaid work, has sent several articles of marble, among which may be mentioned five vases, some of good forms taken from the antique, an obelisk, three inkstands of black and rosewood marble, and a Roman bath of the same material. These are good specimens both of material and manufacture.

A tomb in alabaster, by Mr. Cundy (Nave, 60, p. 848), being a clever illustration of what can be done in this material, is considered by the Jury as worthy of a Prize Medal.

If from the British goods of this kind, we turn to those of other countries over which England holds rule, we shall find a number of striking and beautiful manufactures in marble sent by various persons from India, amongst which may be especially mentioned, the handsome white marble garden-seats, understood to be a present from the Rajah of Nattore to Her Majesty (p. 921), and a large collection of objects of the same, or nearly the same material, exhibited by the Rajah of Joudhpoor (p. 921). These latter, amounting in number to 56, are perhaps more curious than beautiful; but they illustrate well the capabilities of the material. The former exhibitor has been considered worthy of Honourable Mention. Besides these things from India, there are a few specimens of manufactured marble from Van Diemen's Land, sent by Mr. J. Boyd (233, p. 991). These have been Honourably Mentioned by the Jury.

From France the miscellaneous objects in marble are but few, except those where marble is applied to furniture, and general purposes of decoration, combined with wood-work. Mr. Simon, however (1016, p. 1227), has some marble ornaments.

Germany, like France, contributes few objects in marble of a miscellaneous character. There are, however, a model of a chandelier by M. Noe (1 Zollv., 418, p. 1074); a fountain by M. Tacchi, of Frankfort (5 Zollv., 21, p. 1122), and some small ornaments from the manufactory of Diez, in the Duchy of Nassau (8 Zollv., 5, p. 1132). The model by M. Noe has been deemed worthy of Honourable Mention.

The working of marble has been so long a staple manufacture of Italy, that we might well expect from that country a preponderance of such objects as illustrate the varied applications of this material to the arts, and to decorative purposes generally. To a certain extent, this is the case; but, although most of the productions of Italy are ornamental, they are not pre-eminent for novelty or variety. Among them, however, are some of extreme beauty and rare excellence.

The most remarkable of these objects, strictly belonging to the class of mineral manufactures, is a large vase of Oriental alabaster, executed by the Signor T. Dallamoda (Rome, 19, p. 1286). The material is peculiarly adapted for such a work, but it is not usual to obtain so large a block absolutely free from imperfection. In the execution of the vase, the handles, which consist of serpents, are of the same piece with the body of the tazza, so that the artist could not have used the lathe, either on the work itself, or in polishing. In most modern works of the kind, the handles are joined on after the completion of the object; and the great difficulties of marble-working are avoided (when there are no bas-reliefs round the outside) by placing the object between two centres. A considerable difficulty was involved in the nature of the material employed, and the necessity of chiselling away extremely minute portions in finishing the handles. In those parts which are most original, the perfect steadiness of the sculptor's hand is observable, and the confidence—amounting almost to rashness—in his own knowledge and experience. The whole of the tazza has been finished with the greatest care, the polish being everywhere complete, no part being at all injured, and every detail tending to produce the beautiful effect which has been so greatly and justly admired. The Jury have awarded a Prize Medal to this exhibitor.

From Rome we also have a number of other works; some of them by the same artist, and in the same material; but others by Mr. Van der Staat, exhibited by the proprietor, Signor Dies (pp. 1287, 1288). Among them are some models of architectural constructions and antiquities in fine Sienna marble, and a hollow altar of Oriental alabaster provided with a lamp, and intended to show the remarkable translucency of this material. All these are of excellent workmanship.

From Tuscany are exhibited several objects, constructed of the true alabaster, so abundant near Volterra. Among these a very beautiful and large vase by Messrs. G. Cherici and Sons (116, p. 1299) is Honourably Mentioned by the Jury, as well for the material as for the treatment of the subject and the mechanical execution. There is also a pair of large candelabra of brown alabaster exhibited by Solaini, of Leghorn.

Among the objects properly belonging to this group, may be mentioned, in conclusion, a bagnivola of lapis lazuli, extremely remarkable for its large size, and for the extreme purity and richness of the colour. For these reasons it is of great value, but has little beauty of form or excellence of workmanship. It is exhibited by Mr. Jones (Rome, 48, p. 1287), and is considered worthy of Honourable Mention.

F. Works in Ornamental Stone, Granite, and Spar.

a. Serpentine, Granite, and Porphyry.

We bring together these materials more for convenience than for any marked similarity in the modes of working. The serpentines of England are not harder than the commoner marbles, and are worked in the same way; whereas the granites are extremely hard, and require peculiar treatment. There are not many exhibitors in these materials.

To Mr. J. Organ, of Penzance, in Cornwall (85, p. 769), a Prize Medal is awarded for his fine and well-selected group of objects, manufactured in the serpentine of the Lizard. The material, employed only by Mr. Organ and one other exhibitor, is an extremely beautiful marble of moderate hardness, differing essentially in this respect from the serpentine of Italy and Greece. The colour is extremely varied, but that which is commonest and most admired is a rich dark olive green, spotted with red, and traversed with veins, often of the purest white, but sometimes of dark crimson. The articles exhibited by Mr. Organ are remarkable for their large size, and the good taste they manifest, as well in the style of manufacture as in the selection of the specimen for the kind of work. They include a pair of obelisks, a font, and a chimney-piece, besides vases, and other smaller ornaments.

The exhibitor has the right of quarrying over an extensive district, chiefly occupied by the serpentine: the work is generally pursued in summer. About one ton in four of the rock is of fine quality; the blocks are generally small, though they have been obtained 7 feet long, and from three to five tons weight. A very beautiful and large specimen, partly polished, is exhibited outside the western end of the Building (1, p.   ). It may be well to state that the cost per ton is from 5*l.* to 10*l.*, according to weight, and the price of slabs 1½ inch thick, and not exceeding 5 feet long, is 6*s.* per superficial foot from the saw, and 12*s.* per foot moulded and polished.

Mr. W. Pearce, of Truro (75, p. 768), is an exhibitor of various objects manufactured from the serpentine of the Lizard, from steatite, also from the Lizard, and from the fine granite from Lamorna, Withiel, Luxulian, and other places in Cornwall. The whole group is of remarkable excellence, and the Jury have awarded a Prize Medal to the exhibitor.

The steatites of the Lizard differ little from the serpentines in their essential components, both being silicates of magnesia; although the former contain a larger proportion of silica, and the latter much more water of consolidation. Both minerals vary, however, much in composition, when in a massive state, and probably pass into each other in the Lizard rock. The serpentine is much harder than steatite, and is generally more richly coloured, so that the latter, although often beautiful, is better adapted for smaller objects than the former, which, when in large blocks, has a rich and noble effect. Many of the small articles by this exhibitor, manufactured of steatite, are well worthy of notice.*

Mr. Pearce also exhibits several pedestals, a large slab, and a chimney-piece of granite, and pedestals of porphyry. The style of the chimney-piece is heavy and massive, but not unsuited to the material; and its workmanship is decidedly good. The difficulties in bringing granite and porphyry to a perfectly plane surface without the lathe, have been very successfully overcome in the case of the slab or table-top, which is of large dimensions, and exhibits no flaws, and no imperfections of work.

Mr. J. H. Meredith, of Fowey (Class I., 141, p. 136), exhibits three noble slabs of Cornish porphyry, one black, another red, and the third green; all of fine quality, and polished on both sides. The largest, which is of a fine red colour, took nearly four months to complete, the cutting being done by machinery, and the work going on night and day. It is absolutely without flaw or defect, and weighs about 8 cwt. The material is so beautiful, and the work so excellent, that the Jury have no hesitation in awarding a Prize Medal to this exhibitor.

The quarries from which these fine specimens of Cornish porphyry are obtained were first worked by Mr. J. T. Treffry, of Place, who commenced the erection of a hall, in which the various specimens are exhibited, and who greatly exerted himself to introduce the use of this material for decorative internal work, and for the Fine Arts.

The only exhibitors of Scotch granite in articles of any magnitude are Messrs. Macdonald and Leslie, of Aberdeen (74, p. 768), who have sent two vases, a pedestal, and a noble slab for a table-top. The Aberdeen granite differs from the Cornish, in being for the most part finer grained, and of a peculiar flesh tint. The specimens here exhibited are of the finest kind, and their workmanship is unrivalled. They are also in good taste, and although the material is not without flaw, this may be excused, when the large dimensions of the different objects and the rarity of perfect blocks are taken into consideration. To these exhibitors a Prize Medal is awarded.

There are one or two exhibitors of granite manufactured into articles of small size, and almost partaking of the nature of jewellery. Such are Mr. G. Jamieson, of Aberdeen (Class I., 25, p. 123), Messrs. Retties and Sons, of Aberdeen (Class XXIII., 24, p. 625), and Messrs. Ellis and Son, of Exeter (Class XXIII., 12, p. 674), the former of whom show some elegant forms sculptured in Aberdeen granite, and the latter, knife-handles in similar material from Devonshire.

Of foreign porphyries there are few examples in the Exhibition, but amongst these we may mention a table, small column, and tazza, exhibited by Mr. Cantian, of Berlin (Prussia, 235, p. 1061), with some marbles also worthy of notice. The table is a round slab of red colour, and fine texture, and the tazza-vase and pedestal are of the same material. They are all well-finished and creditable specimens, whether as regards material or execution. They are accompanied by a small column of polished garnet rock of very singular appearance. The Jury have awarded a Prize Medal to this exhibitor.

In the Scandinavian compartment there are several objects constructed of a very hard syenitic porphyry, found in detached boulders (erratic blocks) in various parts of Sweden, and also *in situ* in Norway. Of these, that numbered 43 (p. 1352) is from the Hjula quarry, in Norway, and is of a greyish-red material, probably rare. The Jury have awarded Honourable Mention to the Swedish porphyry work generally, including not only this vase, but another exhibited by Mr. Wallis (47, p. 1353).†

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* The articles here described are constructed of the more ornamental specimens of steatite, and are highly polished. Those previously alluded to (p. 559) are for economic purposes and are left rough. The material slightly differs also in composition.

† In the early part of the month of September, and after the awards of the Jury had been finally determined on, a

M. Colin, of Epinal, in the department of the Vosges (France, 1564, p. 1251), exhibits a collection of the marbles, granites, and serpentines of that part of France. Some are of considerable beauty.

A vase and group of figures in Italian serpentine, exhibited by Mr. Norchi (Class XXX., 309, p. 840), are mentioned here simply as illustrations of the material. Two large vases of a peculiar material called agate marble, harder than alabaster, and nearly as transparent, may also be seen among the objects sent by this exhibitor.

b. Jasper, Jade, Agate, Crystal, and Spar.

The jasper and quartz rocks of Siberia, well known as materials of extreme hardness, worked only in the Russian empire, and rarely met with except as Imperial presents to princes and distinguished foreigners, furnish a group of very remarkable objects exhibited among the Russian goods, and deserving of notice on all accounts.

The material of some of these vases is quartz rock, but most are of a kind of pseudo-jasper, or pseudo-jaspic lava, of greenish colour and extreme toughness and hardness, resisting almost every tool, and requiring to be cut with emery in the manner of gems. These rocks chiefly exist in Siberia, beyond the Oural, and are in great abundance and variety. The vases exhibited from Russia are of this jaspic rock, and were worked at the Imperial manufactories of Ekaterinburg and Kolyvan. In these manufactories it is stated that almost the whole of the work is performed by manual labour; the only machine used being, in fact, a very simple kind of lathe, on which the object to be turned is placed, and worked by iron tools and emery. No tool will touch these stones: both chisel and file of the hardest temper turning without producing any effect. The time necessary for finishing vases of considerable magnitude is often many years, and their value must be calculated by the cost of the large establishment kept at constant work for the sole purpose of preparing them.

Of the works of this kind in the Exhibition, there is one of square form at the top, measuring nearly three feet on each side, hollowed under the rim, and ornamented with foliage in the hollow. This vase is worked with great skill and accuracy; but the colour of the jasper is not satisfactory; there are also some flaws: the size, however, is unusually large, and the labour of execution must therefore have been enormous. It was made in the Imperial Polishing Manufactory of Ekaterinburg, in Perm (Russia, 326, p. 1379), to the Official Director of which the Jury have adjudged a Prize Medal.

Several vases of smaller size are sent from the Imperial Manufactory of Kolyvan, Government of Tomsk, Siberia, for which a Prize Medal is also adjudged (Russia, 327, p. 1380). One of them is very beautiful, both in form and material, being an olive-green jasper urn, decorated with admirably worked foliage in relief. The successful execution of some of the leaves must have involved extraordinary difficulties.

Although the vases exhibited from Russia are not, perhaps, the largest that have been prepared, the Jury are desirous of recording the expressions of their Chairman, in a memoir submitted by him to the Jury. "Such are the dimensions and weight of these masses of *pietra dura*, that I must say I know of no similar works; nor do I believe that any so difficult and well finished have been executed since the times of the Greeks and Romans. As examples of the same kind, and of those times, I would cite the statue of Rome in the Capitol, and a very beautiful fragment of drapery most exquisitely worked, both which are of porphyry. There are also, in Rome, some beautiful busts, of the size of nature, and of the most perfect finish, in basalt."

A large number of works in jade are exhibited, from India and China, together with a number of objects carved in quartz rock (rock crystal), many of them inlaid with gems, and of extraordinary richness and beauty. These works in crystal and jade involve nearly the same difficulties as those of jasper, just described; but many of them are of so small a size that they rather come under the denomination of jewellery, and are the work of the gem-cutter rather than of the sculptor. The same may be said of numerous objects in agate, cornelian, and other material, no doubt considered by the Jury of another Class. The objects of this description from India are remarkable for admirable execution, and elegance of shape. Those from China are equally well executed, but often exhibit monstrous and distorted forms. As, however, the members of the Jury were not permitted to examine the goods from China, they are not justified in recommending any reward to the exhibitor. The agates cut into various forms and exhibited abundantly from India, are well worthy of notice as mineral manufactures, but have been fully described both with reference to the material itself and the modes adopted in working it, in the Illustrated Official Catalogue. There will be found in that Catalogue a very interesting account of the large trade in hard stones and gems now regularly carried on in India; and great benefit might accrue if advantage were taken of the price of labour in the East, and opportunity given for supplying the European market with various articles made of these substances, and used in the arts.

The transition from gem-cutting, on this gigantic scale, to the true work in pietra dura, known as Florentine mosaic, is easy and natural. The material used in this latter kind of work is nearly the same in many cases, and the work differs only in its smaller size and greater delicacy of finish. Still the subject of mosaic or inlaid work is essentially distinct, and is more conveniently treated of under a separate heading.

Before concluding this part of the subject, it is necessary to allude briefly to the Derbyshire manufacture of fluor spar (locally called Blue John), often worked into vases and other ornaments. This material is beautiful, but rare, and requires great skill in working, owing to its extreme brittleness. It is only obtained in the massive state adapted for cutting from a single mine near Castleton. When the shades of colour are clear and well-defined, the mineral is used in its natural condition, and the fine specimens of this kind are very valuable; but in most cases it is necessary to expose the spar to heat, the temperature being regulated with great care. By these means some of the coloured bands become pale, and the remaining tints assume a peculiar purple or amethystine hue. All the varieties of colour of fluor spar are worked in Derbyshire; but the blue is the most esteemed. The manufacture of this material dates as far back as the middle of the last century.

The exhibitors of this mineral are, Mr. Vallance (40, p. 766) (who has a gigantic vase 39 inches high, eight other vases, twelve tazzas, and several other specimens), Mr. Hall and Mr. Tennant (37, 38, p. 766), Mr. Bright (80, p. 769), Mr. Woodruff (77, p. 769), and Mr. Jepson (132, p. 776). The objects are vases, tazzas, and sundry miscellaneous ornaments, chiefly small.

G. Mosaics or Inlaid Work in Stone.

The art of mosaic (*opus musivum* of the Romans), originally applied only to the combination of small dice-shaped stones (tesseræ) in patterns, has very long been an important source of labour to the inhabitants of several parts of Italy, and under various modifications is now carried on in the principal cities of Europe. The manufacture has long ceased to be confined to combinations of tesseræ, and is now understood to include all kinds of inlaid and veneered work, in whatever material.

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number of very beautiful objects were added to the Scandinavian exhibition, among which was one vase of polished granite of gigantic proportions, sent by His Majesty the King of Sweden, and manufactured at the Royal Porphyry Works of Dalecarlia, instituted to supply work for the poor peasantry. This vase is of very peculiar form, the principal and central portion being egg-shaped, and measuring 6 feet in height and 4 feet 4 inches in diameter in the largest part. Much larger objects have indeed been made in these works, one highly-finished tazza being described, the diameter of which is no less than 11 feet, but this was too large to be safely conveyed. The vase is of a delicate pink granitoid porphyry, and is extremely admirable and perfect, both in design and execution.

We have here to consider those specimens in which marble and gems are the materials principally made use of; the Roman mosaics manufactured in glass being referred to a different group.*

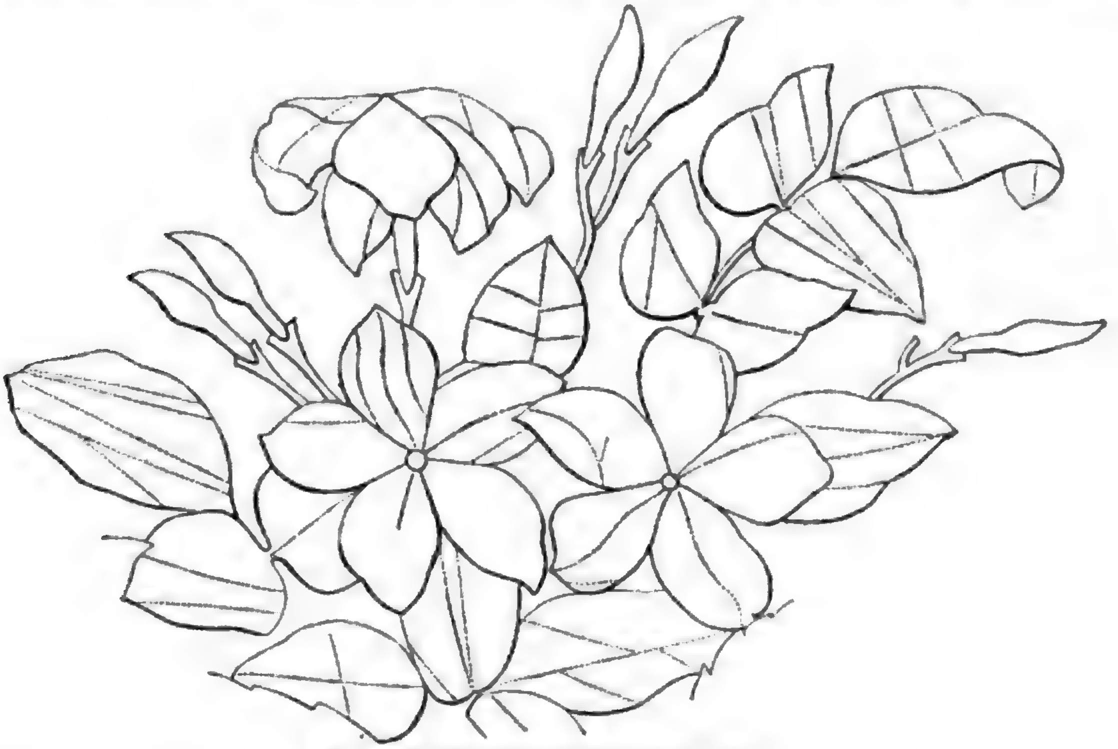
With this limitation there are still several kinds which we may conveniently treat of separately. They are,—

1. Florentine mosaic, or work in gems (*pietre dure*).
2. Derbyshire mosaic, imitative of Florentine, but in marble.
3. Russian mosaic, or inlaid work in malachite.

a. Inlaid work in Pietra Dura.

This manufacture consists of certain kinds of hard stone inlaid in a slab of marble. They are, for the most part, those pseudo-gems, generally varieties of quartz, known under the names of agate, jasper, chalcedony, cornelian, &c.: but stones such as lapis lazuli, remarkable for their brilliancy and depth of colour, are also included, and come under the general denomination of *pietre dure*. In this kind of work, a slab of marble (generally black) of the required dimensions, and about an eighth, or three-sixteenths, of an inch thick, is prepared, and the patterns to be inlaid are carefully cut out with the saw and file. The hard stones, worked into the required pattern by the ordinary methods of gem-cutting, are accurately fitted into the spaces thus prepared, in a polished and finished state; for, if the whole were to be polished at once, some of the substances, being softer than others, would be worn away too rapidly, and the picture, instead of presenting a smooth surface, would be unequally polished, and the outlines would be granulated or chipped. The work, also, is liable to be spoiled by the accidental placing of one stone lower than another, and mistakes of this kind will often lead to the ruin of the whole. After the surface is thus prepared it is veneered on a thicker slab, and is then fit for use. In point of difficulty of execution, durability, and taste, this process of inlaying in hard stones, or gems, may rank as the most important purely decorative work within the whole range of mineral manufactures.

In order to illustrate the peculiar mode of inserting the different pieces of agate, jasper, &c., in these beautiful works of art, and to show also to those not familiar with them the elegant and simple forms produced, it has been thought desirable to prepare a diagram showing a fac-simile of a portion of the inlaid work in one of the tables exhibited. In this diagram the hard line represents the outline of the flowers, leaves, &c., and the dotted part the lines where the different pieces forming a single object are joined together. The extreme delicacy and accuracy of the joints can only be fully appreciated by the examination of the original specimens.



Fac-simile of inlaid work in Florentine mosaic.

The principal exhibitors of true Florentine mosaic in pietra dura are the Brothers BUONINSEGNI (Tuscany, 118, p. 1299), G. BIANCHINI (Tuscany, 119, p. 1299), and the IMPERIAL MANUFACTORY of PETERHOFF (Russia, 298, p. 1376). The two former exhibit good examples of the best manufactures of this kind. Most of the designs are in good taste, and all are admirably executed, but they do not present any great amount of originality. The Russian table is from a manufactory established for some time at St. Petersburg, originally worked by Italians, but now solely by Russians. The workmanship is in the highest degree creditable; but there is nothing original, either in execution, or in the arrangement of the different ornaments. Many of the jaspers and other stones are of great beauty, and are obtained from Siberia. Most of the stones used in the Italian tables are pebbles from the Arno. Prize Medals have been awarded to all these exhibitors, but the latter establishment is especially rewarded for the relief work about to be described.

A very remarkable, and extremely beautiful variety of pietra dura work is exhibited in Russia (298, p. 1376). It consists of a jewel-case, understood to be the property of the Empress of Russia, constructed of wood, and having the four sides and top covered with groups of fruit cut in pietra dura, in a style which may be called *cameo-mosaic*, in rather high relief. The stones are so selected as to afford perfect fac-similes in colour, size, and even in internal structure, of the fruit they represent (currants, pears, plums, &c.), and the whole work is exquisitely finished. To the exhibitor of this, the Jury have also awarded a Prize Medal. They think it right, however, to add that, whilst fully admitting the extreme beauty of the general effect, and of the particular stones selected, they do not regard this style of mosaic as ranking so high as the inlaying of tables, inasmuch as the separate pieces are here cut and shaped independently of each other, and cemented on the surface they are to decorate, without having to be fitted to adjacent pieces before imbedding. There is, also, little danger of failure, even if the dimensions do not strictly correspond.

The goods recently added from the Royal Porphyry Works of Dalecarlia, and already referred to, include an inlaid oblong table of granite, porphyry, and jasper, which deserves notice in this place, as well for beauty of workmanship as for design. The pattern is geometric, but very regular and elegant, and in very good taste. The materials are hard stones of the country, and the mechanical execution admirable; but being apparently of equal hardness, they admit of being polished after the whole is completed. It is exhibited by the King of Sweden (51, p. 1353).

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* See p. 577.

Closely allied to the Florentine work, but of even greater delicacy, and employing material yet more difficult of management, is an Indian chess-table (p. 921) with an inlaid border; and a number of small objects also from India, inlaid in the same way. The ground in these is a white marble, showing a peculiar saccharoidal texture. The pattern is a fine scroll-work, remarkable for the extraordinary delicacy and exactness of the stems of flowers, and the perfect joints. It has been said that the stems are filled in with cement; but if this is so, which is unlikely, it is almost more extraordinary than the inlaid work, the stems being nearly as hard as flint. A Prize Medal was awarded for these objects. There is another interesting piece of Indian inlaid work in pietra dura, said to be of great antiquity, obtained from Agra. It is exhibited by Mr. W. Stewart (33, p. 765). No comparison can be instituted between these Indian and the European works, the mechanical execution of the former being at least equal to the best of those which have rendered Florence so justly famous, while the taste and design exhibited in them are greatly superior.

b. Inlaid Work in Marble.

The great expense of inlaying hard pebbles, which can only be cut as gems, and the excellent effect that may be produced by imitations, in which marble of various kinds, shells, cement, and glass, replace the jasper and agate of Florentine mosaic, have caused the introduction into England and elsewhere of a manufacture which may be called inlaid marble work. Specimens have been sent in great variety from Derbyshire, where this manufacture has become very important; from Devonshire, where it is rising into importance; and from Malta, where something of the kind has been for some time known.

There are two principal methods of producing marble mosaic; that followed in Derbyshire, where a recess is chiselled out of a solid block of marble serving as the ground; and that pursued in Devonshire, where the whole surface is, in fact, *veneered*, numerous marbles of various colours and forms being merely cemented on a base, which may consist of slate or any kind of marble, the whole surface being afterwards polished together. The Maltese specimens appear to belong to the former kind; while the Russian malachites, which we must treat of separately, may be regarded as more resembling the latter. At first we confine ourselves to the Derbyshire work, which is truly inlaid.

To a very limited extent, and by a very rude method, the art of inlaying in marble was practised in Derbyshire many years ago; but within the last quarter of a century it has made great and rapid advance, and about ten years since, the introduction of Florentine patterns, imitated in various coloured marbles, has exerted a very important influence on the trade.

The first manufacture of mosaic in Derbyshire consisted of coloured spars and marbles, of irregular shapes, imbedded in cement, and afterwards rubbed down and polished; these were called "scrap tables," and were succeeded by slabs in which the spar and marble were cut into definite forms arranged in patterns; but these also were rudely finished, as the workmen were not skilled in the art of making accurate joints, and the forms selected were simple and geometrical. Up to this time the process was little more than veneering, and the results were rather imitative of brecciated marbles than intended to produce pictorial effect.

The present Duke of Devonshire, by permitting his fine collection of Florentine work to serve as a guide and model to the Derbyshire manufacturers, and even lending them the inlaid butterflies, leaves, sprigs of jasmine, &c., for which the Florentine mosaics are celebrated, induced an imitation of a higher kind. The true art of inlaying was thus brought into successful operation, and materials foreign to the vicinity, as malachites from Russia, continental marbles, aventurine, and other glasses from Venice, with some cements, have been introduced. The use of these substances greatly diminishes the cost of the work.

The condition of the trade at present may be judged of from the articles in the Exhibition, which show much taste and skill, though but little originality. The manufacture is carried on at Matlock, Ashford, Bakewell, Buxton, Castleton, and Derby, and the number of persons employed as mosaic workers exceeds fifty. There appears to be a fair demand, and the prices, although sometimes high in London, are by no means extravagant at the place of manufacture.

Of the exhibitors from Derbyshire, Mr. Vallance (40, p. 776) may be mentioned as having sent two octagonal mosaic tables, and several small objects. One of these tables presents a wreath of flowers, of extremely complicated pattern, and very admirably finished, in a vast number of detached marbles. This table was exhibited, and is mentioned by the Jury as a finished specimen of Derbyshire work; but it must not be compared with Florentine work, inasmuch as all the materials are comparatively soft, and they include a somewhat undue proportion of shell, glass, and modified marbles. It is, however, a very creditable piece of workmanship, and deserves great praise for the skill and labour bestowed upon it. To Mr. Vallance a Prize Medal has been awarded, not for these tables only, but for his general collection of Derbyshire marble manufactures, which is in a very high degree interesting and instructive.

A large round inlaid table, four feet in diameter, partly composed of the productions of Derbyshire, is exhibited by Mr. G. Redfern, of Ashford (78, p. 769), to whom a Prize Medal has been awarded. The general style of this table is good, and the marbles are well selected. There is, perhaps, in this, as in most of the Derbyshire inlaid goods imitative of Florentine work, a little too much use of glass, shell, and stained marble, which produce very brilliant effects, but are not altogether in such good taste as might be. An inlaid panel with a border by this exhibitor also deserves very great praise, both for design and execution.

Mr. Woodruff, of Bakewell (Class XXX., 350, p. 842), exhibits two oblong inlaid tables, in cinque-cento style, designed by L. Gruner, Esq., and very well executed. The designs are particularly good and praiseworthy, and the Jury have noticed with much satisfaction that in this case effective aid has been afforded by an artist in elevating the mosaic manufacture of the district beyond the mere repetition of Italian patterns. It may be well to suggest here to the Derbyshire manufacturers, how much more creditable and ultimately successful it would be to place their work on a higher footing than it can be said to occupy at present, which might be done if the designs for their soft marble work were made with some reference to their material, which differs so much in hardness from the true pietra dura of Italy, and certainly admits of original treatment. In this view, and to mark their full appreciation of the originality of the design, as well as of the excellence of the workmanship, the Jury have awarded a Prize Medal to this exhibitor. In addition to these two tables, Mr. Woodruff also exhibits (77, p. 769) a black marble chess-table with a pretty inlaid border, equally creditable for taste and execution, and two vases, one of black marble, and one of changed fluor, already alluded to.

The other exhibitors of Derbyshire inlaid-work are Mr. J. Tomlinson (79, p. 769), who has several specimens, chiefly tables; Mr. S. Bright (80, p. 769), already mentioned for his black marble manufactures; Mr. J. Hall and Mr. Tennant (37, 38, p. 766), who exhibit together a number of articles of Derbyshire work, and among the rest various inlaid tables, and smaller objects of considerable merit; and Mr. Lomas (81, p. 769), who sends a chimney-piece of black marble, inlaid in mosaic, in a pattern to a certain extent original, though adopted from the antique. The attempt by this exhibitor to introduce good designs in Derbyshire mosaic into house decoration, is referred to with satisfaction by the Jury; and they consider not only the idea, but, in a great measure, the design and execution of the work as worthy of the Prize Medal. The inlaid work is well done, though the introduction of Sienna marble in the capital of the columns supporting the mantel-shelf is injurious to the general effect.

We pass on to the marble mosaics of other parts of England. Of these, by far the best, in every respect, are sent from Devonshire, where the manufacture seems to be greatly advancing. To Mr. Woodley, of Torquay (39, p. 766), a Prize Medal has been adjudged for one oblong, and two round tables, the latter of very great merit, and also of considerable interest as illustrating the marbles of the district. The Devonshire work is, as has been already said, rather a veneering than inlaying process; but the result is so similar in appearance to that obtained in Derbyshire that they can hardly be disconnected. Mr. Woodley's large round table is of the kind called specimen tables, and the forms are geometric, but the execution is excellent, and the selection of marbles admirable. There is not in any of the tables by this exhibitor any attempt at originality of design. The oblong table contains a fine specimen of red marble.

Messrs. Holland and Sons (Class XXVI., 161, p. 745) exhibit a cabinet made for Her Majesty. This includes a certain amount of inlaid work in British marbles, well designed and well executed. The Jury consider the mosaic work in this cabinet deserving of Honourable Mention. (Prize Medal awarded by Class XXVI.)

Mr. Bovey, of Plymouth, is also Honourably Mentioned as an exhibitor of inlaid Devonshire marble, in a chimney-piece exhibited by him (4, p. 764). The design of the work and the general effect are not particularly good, but the inlaying is well done, and the selection of material praiseworthy.

Mr. Humble (9, p. 764) exhibits an octagon inlaid table, containing a mixture of British and foreign marbles. The design is geometric, and the execution tolerable. Mr. Moon, of Godalming, in Surrey (56, p. 767), has an octagonal table, inlaid with several kinds of marble, and tolerably well executed; and another is sent by Mr. W. Pearson, of Harrowgate (65, p. 768), interesting as being chiefly composed of specimens from the neighbourhood of Knaresborough. Something of the same kind is shown by Mr. Plow (50, p. 767). It is satisfactory to find this branch of industry, which involves a considerable amount of skill, and admits of the display and cultivation of much taste, extending itself throughout the British Islands, wherever material exists for its execution. In Ireland, also, the taste for such decoration is cultivated, and the Jury have pleasure in mentioning the tables sent by Mr. M. Hoban, of Dublin (58, p. 767), which show much skill in manufacture, although they admit of improvement in design. Lastly, a mosaic chess-table is exhibited by Messrs. Quilliam and Creer (p. 136), manufactured in the Isle of Man, of Manx material.

Inlaid work has been executed for some time in Malta, on a considerable scale, and on a plan imitative of that pursued in Tuscany. Several tables have been sent for exhibition, and the Jury have awarded a Prize Medal to Messrs. J. Darmanin and Sons, of Valetta (Malta, 26, p. 945), as an acknowledgment due to them for the design and execution of the specimens they exhibit. In these a black marble back-ground is introduced for the inlaying, which generally shows much accuracy of work with a very skilful use of material to produce the desired effect.

The designs introduced into the Maltese tables are, to a certain extent, original. The variety is also considerable, but there is generally a largeness in the details, which rather injures the effect, in other respects very good.

The polished inlaid work in stone sent from France is connected so closely with articles of furniture, and offers so little specially belonging to the present Class, that the Jury have not thought it necessary to report specially upon each specimen. They notice, however, a table, by Mr. J. P. Bossi, of Paris (France, 773, p. 1217), having an elegant scroll pattern of inlaid marbles, amongst which are some stones of harder material. The design and execution of this table are good; and the selection of material is worthy of notice. A Prize Medal is awarded to the exhibitor. There is also another Medal awarded to Mr. Theret (France, 1499, p. 1248), for sundry articles of furniture, decoration, &c., showing some originality and much excellence of workmanship.

Few inlaid works of any kind, in which marble introduced, are exhibited from the States of the Zollverein. One set of tables and slabs, &c., are, however, sent by Mr. Devisse (1 Zollv., 837, p. 1095) in which an artificial breccia is introduced with various kinds of marble. The style is that which we have already referred to as belonging to the earlier period of manufacture.

In addition to the exhibitors already mentioned, the name of Mr. Gröoer, of Vienna (Austria, 631, p. 1039), may be added, as having sent a closet of ebony with mosaic ornaments, and some other inlaid work, tolerably well executed.

From Lisbon a somewhat interesting specimen of mosaic is sent by Mr. C. Bonnet (Portugal, 258, p. 1310), composed of sixty specimens, and various ornamental stones, all of the province of Alemtejo. This table was produced in the manufactory of M. Dejéant, a large exhibitor of Portuguese marbles.

From the Cape of Good Hope a peculiar kind of inlaid work in marble is sent, which, though hardly very ornamental, is not the less interesting, as illustrating the industry of that colony (58, p. 952). Another specimen of somewhat different kind, in a geometric pattern, exhibited from Tunis (p. 1413), illustrates a similar manufacture carried on in the northern extremity of the same continent.

c. *Inlaid work in Malachite.*

Malachite is a peculiar mamillated or stalagmitic form of the green carbonate of copper, chiefly found in an available state for inlaid work in a very few localities in Siberia, and lately in South Australia. It has been long employed in Russia in this manufacture. The mineral is remarkable for its fine emerald green colour (often presenting several distinct shades in the same specimen), its brilliant and silky lustre, and compact texture. It is softer than marble, very much heavier, and by no means so easily worked, owing to its brittleness and the concentric arrangement it generally presents. It can rarely be found in masses weighing more than ten to twenty pounds, and good specimens have a very high value, as the finer kinds are used exclusively for decorative purposes.

The most important locality at present known for the finer kinds of Siberian malachite is in the copper ground of Nijny Tagilsk, in the government of Ekaterinburg, situated on the River Tura, a tributary of the Irtish, on the Siberian side of the Ural Mountains, in latitude 57¼° N., longitude 56° E. In a mine at this place, belonging to MM. Demidoff, Sir Roderick Murchison has described an enormous mass of malachite, which, at the time of his visit, now several years since, had been recently discovered at the depth of 280 feet, strings of green copper conducting to it; and these strings, increasing in width and value, were found to terminate in a vast irregular botryoidal mass, estimated to contain not less than half a million of pounds of this valuable mineral.* The larger blocks, when exposed to

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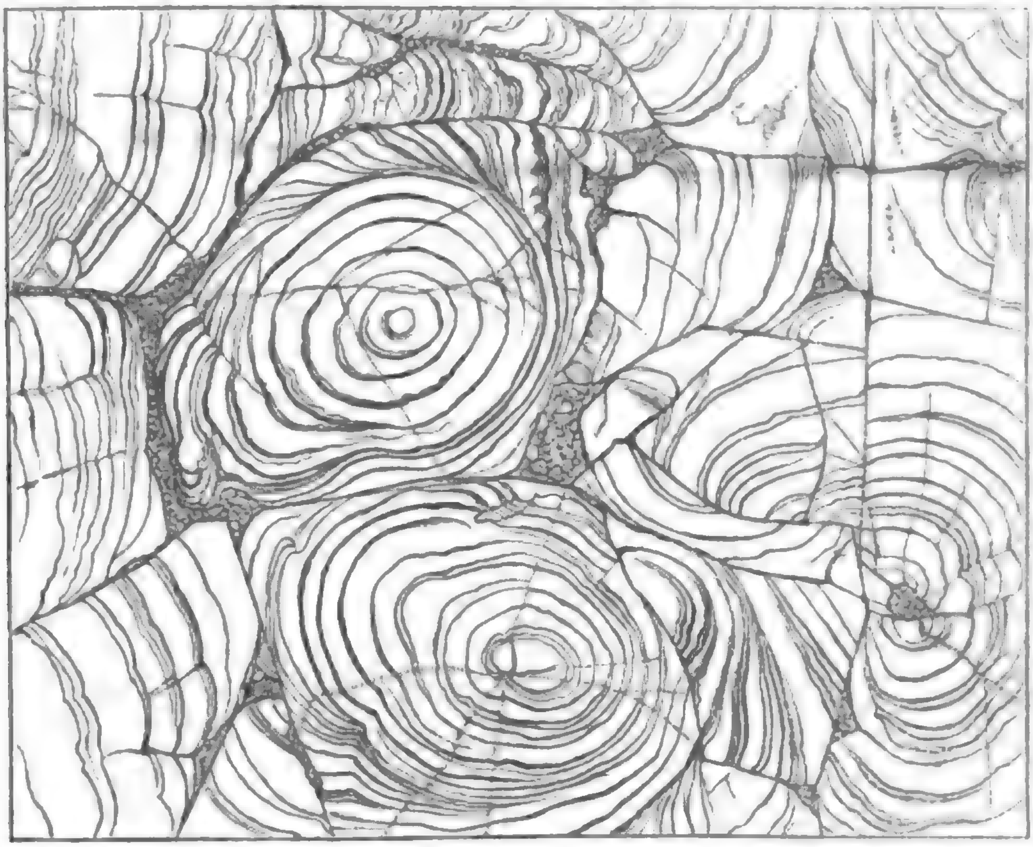
* "The geological interest attached to this mass lies in the indication it affords, that the substance called malachite has been formed by a cupriferous solution which has successively deposited its residue in the stalagmitic form. 'Mutatis mutandis,' this mass has only to be viewed as formed of calcareous spar, and it presents every one of the features so well known to those who have examined stalactite grottos with their stalagmitic floors in the clefts and caverns of limestone, or still more those large masses of tufa which have proceeded from calcareous wells. Wherever a portion of the malachite has been broken off, the interior is seen to consist of a number of fine laminæ (a fasciculus of radio-concentric globules), which invariably arrange themselves equably around the centre on which



Fac-simile of a portion of veneered malachite. The joints are marked by fine dotted lines, and the darker portions represent the artificial malachite breccia or cement. The dark lines represent the natural concentric markings of the mineral.

the air, break up into smaller fragments, rarely weighing more than from one to about four pounds.

It is by no means a modern application of this material to employ it in inlaying or veneering for various decorative purposes; and few palaces, or large public museums in the principal capitals of Europe, are without specimens, marking the progress of the manufacture from time to time, and generally regarded, from their great rarity, cost, and beauty, as worthy of being made Imperial and Royal presents. It is, however, only lately that MM. **Demidoff**, the owners of the mine in which the mineral occurs, have established at St. Petersburg a manufactory under the direction of M. **Leopold Joffriand**, where, after numerous trials, and the expenditure of much capital, labour, and ingenuity, it has been found possible to produce such works as those sent to the Exhibition. To MM. **Demidoff**, the owners of this mine and factory, the Jury recommended, and the Council of Chairmen awarded the Council Medal, in testimony of the magnitude and importance of the objects exhibited, their extraordinary beauty and richness, the excellence of the production, and the application of various new methods of manufacture. These are chiefly seen in the construction of the doors, and more especially in the ingenious and beautiful manner in which the pattern is adapted to the material, the detached pieces of mineral being fitted to each other so as to preserve this pattern. They may also be noticed in the nature of the cement, which, being mixed with broken fragments of the malachite itself, does not interfere with the plan, or in any way injure the effect of the whole.

The working of malachite on a large scale is extremely tedious and laborious, and is understood to be thus conducted:—The fragments of the stone are first sawn into thin plates, the thickness of which, for plane surfaces, is about a line, and, for curved parts, a line and a half. This cutting is performed by means of vertical circular saws: the blocks of malachite being cemented on a carriage, which, by means of a counterpoise, is made to travel along a small railroad placed on rollers, and is so contrived as to present the malachite in such a way as to insure the required thickness, and keep the mineral constantly pressed against the saw. Fine sand and water are continually supplied to the part in contact with the block, and the latter is thus slowly cut through, but retained in its position by means of the travelling frame already described. As soon as a plate is cut off, it is removed, the machine reset to cut another plate, and the work recommences.

The portions intended for curved surfaces are cut by bent saws fitted to the required shape, an operation which requires a large number of saws, and great care in cutting, as it would not be safe to trust to cement for filling up spaces, and some of the joints require to be very neat.

The next process in the manufacture is the fitting together the different plates, and cementing them. For this the first thing to be done is, to determine the pattern which the markings of the malachite are to represent. When this is decided on, the surfaces by which the separate fragments of the mineral are to be united are prepared, by the aid of wheels of copper, in such manner that for each joint two wheels are required, the projecting parts of one fragment entering a corresponding recess in the other. Joints thus made are not easily noticed, being formed with great accuracy, and not presenting any break or straight line to the eye. Until the establishment of their present factory by MM. Demidoff, the joints were straight, having no reference to the natural veins or lines of the malachite, and thus surfaces were placed together in which these lines were not continuous,

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they have been formed, and are adapted to every sinuosity of the pre-existing layer; here presenting a dark line, there a bright and light one, just as the solution of the moment, the day, or the hour, happened to be more or less impregnated with colouring matter. Besides round concretions, sometimes almost spherical, and also depressions of the surface, the under-sides of this malachite are singularly analogous to that of any large mass of calcareous tufa, in presenting pendent finger-shaped stalactites which are also composed of concentric laminæ. The external surfaces of these concretions are frequently covered with a black ore of manganese, which usually falls on being touched."—*Murchison's "Russia and the Ural Mountains,"* vol. 1. page 374.

and had no relation with each other or with any regular pattern. The annexed diagram will show in some degree how this disagreeable result is now avoided. It is a fac-simile of a small part of the superbly executed pair of doors, which formed so prominent an object in the Russian Exhibition.

The substance on which malachite is veneered is generally iron or copper, but may be stone or marble. When this is covered, the surfaces require to be levelled, which is done by means of sand. The interstices, of which many are left during the work, are then filled with a cement mixed with fragments of malachite, and coloured with powder of the same material; but in this part of the process, much care is required lest fragments should be introduced which do not adapt themselves to the pattern, and which would therefore injure the harmony of the work. The surface is finally polished.

In the above diagram any one acquainted with the usual veining of malachite, or even of stalagmitic carbonate of lime, will not fail to notice how completely the character of the natural markings is preserved in all essential places. When the nature of the work admits of it, however, the straight line is still preserved, as the joint can be made very accurate and extremely faint, although it is often purposely left thick and dark. In certain places, especially where a difference of pattern was rendered necessary, the presence of the breccia cement—which, owing its colour entirely to powdered malachite, is of precisely the same tint—forms an agreeable break, and greatly adds to the effect.

The quantity of malachite obtained from the mine, and brought into the market annually, is very small; and the price of the raw material is considerable, averaging about 16*s*. per pound avoirdupois. The loss in the manufacture being very great also, the cost is much increased, as one pound of the raw material after being sawn does not give more than half that weight of cut slabs; and this half is further reduced to a quarter of a pound before the slabs are fitted, cemented down, and polished. The ultimate value is thus upwards of three guineas sterling per lb. avoirdupois, and a square foot of finished work would generally contain at least two pounds and a half.*

The objects exhibited by MM. Demidoff consist of a pair of folding-doors, several vases, a chimney-piece, a table, a set of chairs, and sundry smaller articles. Of these the doors and vases are at once the most important, and the most highly finished; and it is understood that the former required the constant labour of thirty workmen employed by day and night during a whole year. They are most skilfully and beautifully planned, and the workmanship, as well of the plane as of the rounded surfaces, is in all respects admirable. The other objects are almost equally well executed, with the exception of the clock-stand, in which the joints are constructed according to the old system. It is said that there are in some of the churches, and perhaps elsewhere in St. Petersburg, fluted Corinthian columns of malachite, exhibiting the art of the manufacturer in a yet more striking manner than is seen in any of the specimens now in England; but certainly no examples have been seen out of Russia which at all equal in magnitude or artistic perfection those here described. It has been already stated that the Messrs. Demidoff have received a Council Medal for these magnificent and costly objects, and the exhibitors are regarded by the Jury as worthy of the highest honour for the vast and successful efforts they have made to do credit to the manufactures of their country, and add to the interest of the Great Exhibition.

It would not, perhaps, be fair to institute a comparison between the malachite goods from Russia and those manufactured elsewhere; and certainly the articles exhibited of this kind from Paris and Derbyshire must be mentioned but as attempts in the same material. We have only, therefore, to state, that Mr. Vallance (40, p. 767) has exhibited a large oblong table of considerable pretension, inlaid with malachite, partly Russian and partly Australian; and that a similar table of less pretence and much smaller size is among the goods sent by M. Matifat, of Paris (France, 923, p. 1224). The former is remarkable as introducing specimens in which azurite (blue carbonate of copper) is combined with the malachite; but the mechanical construction of the joints is according to the old method, and the lines of the different fragments are not connected so as to form a definite and recognisable pattern.

Numerous small objects in malachite are exhibited, but none of these require special notice.

II. Enamelled Slate and other Imitations of Marble.

The present seems the fittest place for describing various modifications of stone, slate, and marble, which exhibit permanent and useful imitations of other more expensive materials. It is manifest that good and lasting imitations of the finer marbles, executed in stone, slate, &c., are calculated to add to the advantages that arise from the employment of ornamental work in furniture and decoration.

The only exhibitor of an imitation of this kind, whose works can be described as extremely remarkable and worthy of detailed notice, is Mr. Magnus, of Pimlico (46, p. 767), who, by means of a new, very simple, and inexpensive process, has succeeded in producing works of great magnitude and importance, calculated to effect the introduction of slate for household purposes on a very extensive scale. The advantages of the material as thus used consist in its great strength, its lightness, as compared with that of marble, and its adaptability to all kinds of artistic decoration at a small cost.

With regard to the strength of slate, it is computed to be about four times that of ordinary stone, and slabs 8 feet long and upwards can be very safely used of thicknesses not exceeding half an inch. The extreme compactness of the material, and its perfect non-absorbent qualities, render it well adapted as a lining for walls, where it may be placed without even plastering. In this respect it is preferable to any kind of cement. In the decoration, the exact method of laying on the colour is not communicated; but the slate, after being coloured, is exposed for several days to a temperature of from 300° to 500° Fahr., and the colours are thus rendered so permanent that washstand-tops and other articles used in hotels for years have been scarcely injured by wear. In respect also of its peculiarly smooth and perfect surface and fine texture, it is admirably adapted for various ornamental and useful purposes; and grooves, mouldings, &c., are run with great despatch and at small cost by steam power.

In point of execution, both mechanical and artistic, the greatest possible credit is due to this exhibitor. He has produced a vast variety of articles, many of which are now in common use; and, in all, the price is so very much less than that of the substance imitated, and even of any other imitation that can at all compete with it, as to insure a large and permanent demand from the public.

The most remarkable object exhibited by Mr. Magnus is a bath-room of large dimensions, good design, and great beauty, wholly manufactured of decorated slate. The peculiar effect of the slate, as enamelled for use, is perfectly well shown in this specimen, which has received the careful attention of the Jury.

The following is a list of some of the principal objects manufactured by this exhibitor:—Chimney-pieces, table-tops, pilasters, skirtings, sideboards, billiard-tables, ornamental dairies, monuments, mural tablets, altar tablets, sun-dials, clock-faces, pedestals, baths, vases, chiffonnières, candelabra, lamp-tubes, &c. Of all these, the billiard-tables are, perhaps, the most important, as being decidedly superior to tables constructed of any other material. Slate for the bed of the tables has been employed for some time; but as its weight caused the mahogany legs to become rickety, slate legs and frames have also now been introduced by the exhibitor, which being dovetailed together, the use of iron is avoided, and the tables are steady and durable.

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* By information received since this Report was in print, it appears that the prices vary from 12*s*. to 17*s*. per lb. according to colour, rather than veining, the darker colours being cheapest. There are four shades quoted, denominated respectively *foncée*, *ordinaire*, *claire*, and *pale*, but these are also subdivided, the two first into *rondes* and *longues*, the others into *rondes*, *longues*, and *tachetées*. A large proportion of the malachite in the specimens exhibited was of very good colour, and the average value probably exceeded 15*s*. per lb., though it was less than 16*s*., as stated in the text.

To this exhibitor the Jury have had no hesitation in awarding a Prize Medal, in acknowledgment of his admirable and useful contrivances and applications.

Mr. T. STIRLING, jun. (Class I., 209, p. 141), who exhibits a large collection of unpolished slates already fully described (see page 558), and who has been adjudged a Prize Medal for these objects, has included within his group several specimens of enamelled slate highly decorative, but not prepared in the method adopted by Mr. Magnus. Mr. T. STIRLING, sen. (Class XXVII., 120, p. 773), has also exhibited similar articles, consisting of tables, inkstands, &c. These are handsome, and some of them show artistic merit, but they cannot be compared with the results obtained by Mr. Magnus.

There are several exhibitors of imitation marbles on slate and stone. Mr. BRADLEY (35, p. 766) has a small slate table, carefully painted in imitation of Devonshire marble. Mr. HALL (42, p. 766) illustrates the method of writing on slate. Mr. THORNHILL (48, p. 767) shows a pair of tables also imitative of marble.

DIVISION II.—MINERAL MANUFACTURES IN PLASTIC MATERIAL AND ARTIFICIAL COMPOUNDS.

Under this head it is meant to include manufactures in cement and artificial stone, scagliola work, and glass mosaic; manufactures in all varieties of clay, including bricks and tiles, fire-clay goods, stoneware, and terra cotta; and manufactures which have been referred to this class but are of a miscellaneous character, falling more naturally under this than any of the other divisions.

It may be necessary to state, as a more complete definition of the groups suggested, that all materials in which distinct chemical action takes place before they assume the form in which they become marketable, are regarded as *cements*, while those that are simply burnt, whether surface-glazed or not, are regarded as *clays*. The common cements and plasters, and various articles of manufactured glass, &c., considered to belong to this class, as Roman mosaics, thus belong to the former group, while terra cotta, salt-glazed ware, fire-clay goods, &c., are referred to the second group, being considered as manufactured clays.

GROUP 3.—MANUFACTURES IN CEMENT AND ARTIFICIAL STONE, &c.

The number of exhibitors in these materials is not very large, nor are the objects exhibited numerous or from many countries, but they are by no means unimportant. They include, however, the remarkable and beautiful mosaics in glass, manufactured chiefly in Rome, besides a number of other mosaics, and some miscellaneous articles not fitly included amongst glass and porcelain. They consist, principally, of all the varieties of manufactured cements, such as simple concretes and mortars, Roman and Portland cement, plasters of various kinds, scagliolas of all kinds, and many other like objects.

Of twenty-one English exhibitors in this group almost all have illustrated the decorative as well as the more substantial uses of cement, while several have only sent the former kind. Italy, which comes next in order, is much more remarkable for the beauty of the manufactures, the list including no less than seven exhibitors in Roman mosaic, and two in inlaid scagliola. From various parts of Germany, including Austria, there are about eight exhibitors, chiefly of the less decorative kinds, and from France there are six, also little decorative. Belgium has two exhibitors in ornamental cements, and Greece one in puzzuolana.

I. MASSIVE AND INCRUSTED CEMENTS.

Under this head will be included common mortar and other simple lime cements, Parker's, Portland, Medina, and other hydraulic cements, various artificial stones (not terra cotta), and scagliola work of the usual kind, as well as new modifications of this manufacture. It may be expedient to explain very briefly the basis of the various cements here enumerated, and the chemical principles involved.

When common limestone of any kind, unmixed with other mineral substances, is exposed to considerable heat, it changes its appearances and character, swelling out, and passing into a white powdery material, greedily absorbing water with the evolution of much heat, and known under the name of *quick-lime*. If a paste is made with this lime and water, and the mass be exposed to the air, the result is a loose and friable hydrate of lime; but if a thin bed of such paste is interposed between two porous stones or bricks, the water is absorbed into these substances, and the thin bed of hydrate of lime that remains takes the consistence of stone, and adheres strongly to the two surfaces with which it is in contact. This is assisted by mixing the paste with sand and gravel, to the extent of two or three times its own weight, since the adhesion is greater to the foreign substances than to the particles of the hydrate of lime itself. Such a mixture is the common *mortar*, used by masons and bricklayers, and as it only hardens after exposure for some time in dry air, it is not surprising that in damp places it sets with great difficulty, and in water has no tendency to consolidate at all. When it is required to fasten stones and bricks together in moist places or under water, another substance is needed, and this is called *hydraulic lime*, or *hydraulic cement*.

There are, however, many kinds of hydraulic lime. The simplest is obtained when about 10 or 15 per cent. of clay (silicate of alumina) is combined with the original limestone, and when the calcination is not carried too far. In this case the resulting lime solidifies under water, the hydrate of lime combining with the silicates of alumina and lime, and producing a new substance, insoluble in water.

Many calcareous clays or argillaceous limestones exist in nature, having such properties as lead to this result. When the proportion of clay is only about 10 or 12 per cent., the mortar made from them takes about 20 days to harden in moist places. When, however, the proportion of clay reaches 20 to 25 per cent., the hardening is complete in two or three days; and when it exceeds this, and is as much as from 25 to 35 per cent., the ratio of drying varies according to circumstances, but may be very rapid. One kind of lime obtained from such an admixture of material as the latter is called Parker's, or Roman cement, but there is much difference in the quality of the material, greatly affecting the value of the result. It is generally considered that a minute division of the clay, and a state in which part of the silica is given up on the application of caustic potash, gives the best results.

Roman or Parker's cement is made in England from nodules of calcareous matter, collected in bands in the London clay of Sheppey and Harwich, the Oxford and Kimmeridge clays (chiefly from Weymouth), and other similar deposits. Sometimes (especially in the former case) these have been washed out to sea and are there dredged up. The so-called Medina cement is of this kind but of lighter colour, and is made from the Hampshire septaria. A large quantity of excellent hydraulic mortar is also made from the lias (known as Atkinson's or Mulgrave cement) and from some other rocks. The price of Roman cement is now from 30*s.* to 40*s.* per ton, and upwards of two millions of bushels are annually made from the material obtained from the Essex coast, near Harwich.

A most important hydraulic cement, called *Portland cement*, is made from carbonate of lime, mixed in definite proportions with the argillaceous deposit of some rivers running over clay and chalk, pounded together under water, and afterwards dried and burnt. The strength of this combination is very remarkable, being nearly four times as great as that of any natural kind. Portland cement makes an admirable and most powerful concrete, the proportion of cement required being only a tenth or twelfth part.*

It is not difficult to procure artificially mixtures of limestone and clay, which are less costly than the natural kinds, though not equal in value.

On the Continent similar material is obtained in various localities, of which we may mention Boulogne, Vassy, Pouilly in Burgundy, and some parts of Russia. In some cases these cements appear to owe their hydraulic qualities to the presence of silicate of lime and silica rather than clay.

Certain substances also exist in nature, and can be imitated by art which, on being mixed with common quick-lime, form hydraulic mortar. These are called *puzzuolana*, and consist generally of volcanic ash, of which a vast quantity is found in the modern volcanic districts of South Italy, Greece, &c., and in the extinct volcanic districts of the Rhine, Auvergne, &c., but similar substances are found in our own country. Mortar made with puzzuolana has extraordinary hardness and durability, this substance having a great affinity for lime and hydrate of lime, and forming a perfectly insoluble compound.

The cements hitherto described are composed essentially of carbonate of lime, from which both the carbonic acid and water are driven off by burning in a kiln. Another group, however, exists which we may call *plasters*, of which the base is sulphate of lime, or gypsum, usually found in combination with nearly 24 per cent. of water, and often containing carbonate of lime and clay in small proportions. On being burnt at a low temperature this mineral simply parts with its water, which it absorbs again readily, and with great rapidity, on subsequent exposure; but if a greater heat is applied it melts, and when cooled assumes a new and permanent form, not altered by wetting.

The property possessed by gypsum, of parting readily with its water of solidification, and re-absorbing it as readily, is the basis of a vast variety of uses to which this mineral is applied. When mixed with water mechanically, after being calcined, a part of the water enters into combination with the powder, and forms a true hydrous sulphate of lime, which collects into minute crystals, fitting into each other, and the mass becomes rapidly solid, although not very hard. If the solidification takes place in a mould, the most minute cavities are found to have been filled, and the result is a perfect cast, owing to the expansion that takes place while solidification goes on. Thus the calcined gypsum, mixed with water, becomes an admirable material for casting, and is greatly used for this purpose. Vast quantities of gypsum, of various degrees of purity, are found in the immediate vicinity of Paris, and thus the powder obtained after burning is generally designated *Plaster of Paris*. It is employed very extensively in constructions for various kinds of internal work. *Stucco* is a combination of the same substance, with a solution of gelatine or strong glue. This mixture dries more slowly than that made with water, but is more durable.

Sulphate of lime is the basis of all the cements known as ***Keene's***, ***Martin's***, ***Parian***, and some others, but in these the plaster in the state of fine powder is thrown into a vessel containing a saturated solution of alum, sulphate of potash, or borax. After soaking for some hours it is removed and air-dried, and subsequently rebaked at a brownish red heat. When taken out of the oven it is once more reduced to a fine powder, and carefully sifted, after which it is fit for use, but when slacked a solution of alum is employed instead of pure water. When borax is used, the plaster is called Parian, but in the other case it forms Keene's cement. The kind called Martin's cement is made with pearlash as well as alum, and is baked at a much higher heat than the rest.

The raw material for these various cements, of which the consumption is now extremely great, is obtained from Derbyshire, Nottinghamshire, and Cumberland, besides the neighbourhood of Paris. The quality differs much, but for the finer kinds of cement the most crystalline is considered the best. Vast quantities of gypsum exist in Tuscany, much of it in the crystalline form called alabaster. The English gypsum is sometimes in beds of very variable thickness, sometimes in lenticular masses, and occasionally in veins. It occurs extensively in the new red sandstone, but also in the clay deposits of the oolitic period. The harder kinds make the soundest plaster, containing generally a little lime, but the purer kinds are much whiter when burnt. In France the gypsum is burnt in open kilns, and is thus discoloured, but in England this is avoided, the fuel not being allowed to come in contact with the plaster.

A highly ornamental material, consisting of a coating of plaster mixed with alum and colour into a paste, and afterwards beaten on a prepared surface with fragments of marble, &c., has long been known under the name of *scagliola*, and is greatly used as an excellent and economical means of imitating the finer kinds of marble, the material being as hard as marble, very durable, cold to the touch, and taking a perfect polish. The name scagliola is derived from the Italian, where the process is said to have been invented more than two centuries ago, but it is now very extensively used for decorative purposes in England. The cement is prepared from the finest gypsum, broken up before calcining, and afterwards reduced to a fine powder and passed through a sieve. It is then mixed with aluminous matter, and isinglass, and also with colouring matter, and is afterwards made up with alum; and as it is generally made use of only where the more beautiful and veined marbles are to be imitated, as many different colours and shades of colour must be mixed up separately as there are in the kind of marble to be represented. Thus prepared, it is ready to be laid on to the surface intended to receive it, which has a rough coating of lime and hair already prepared.

The different colours having to be laid on and mixed by the hand, the work somewhat resembles that of the fresco painter, everything depending on the skill of the operator in imitating the style, beauty, and veining of the original. When the cement is laid on and has hardened, the surface is prepared for polishing by rubbing it with pumice-stone, and cleansing with a wet sponge. It is then polished by rubbing, first with tripoli and charcoal, then with felt dipped in tripoli and oil, and lastly with oil alone. A durable lustre is thus obtained, equal to that of marble.

With this general outline of the nature and use of the various cements and plasters in which carbonate and sulphate of lime are the essential ingredients, we pass on now to the different exhibitors in these materials. There are several in each, chiefly from our own country and Italy, so far as larger and more ornamental specimens are concerned. They show some novelty and much excellent work, and form a very interesting and important group of objects. We commence with those who chiefly exhibit the cements properly so called, and the larger groups of objects, as applied rather to construction than decoration, and shall afterwards proceed to the plasters and scagliolas.

a. Hydraulic Cements.

Messrs. ROBINS, ASPDIN, and Co. (Outside, West, 5, and Class XXVII., 103, p. 772) are exhibitors of a gigantic slab of Portland cement, measuring 20 feet by 12, and 10 inches thick, weighing 15 tons; numerous blocks of cement and concrete, proved to various pressures, up to 154 tons, showing the strength to be greater than that of Portland stone; of bricks cemented together and placed so as to give a pressure of 3 tons on the first brick; and of several other similar illustrations.

It has already been said that Portland cement is a hydraulic mortar, made of a mixture of chalk and a peculiar river silt. In working it is sometimes mixed with sand and even with broken brick, forming a kind of concrete of extraordinary strength. It receives its name from its peculiar colour, which approaches that of Portland stone, and not from being made from that stone, or in any way obtained from the Isle of Portland. Its hardness is very great, and it may be used with advantage, not only as a cement, but in many cases where ordinary stone is generally employed, and is even available for tanks and cisterns, being, when carefully manufactured, absolutely non-absorbent of water. The Jury have awarded a Prize Medal to these Exhibitors, as showing specimens on a very large scale, admirably illustrating the use, the strength, and other capabilities of the material they manufacture. In addition to the illustrations afforded by specimens sent for exhibition, Messrs. Robins and Aspdin, as well as other Exhibitors (Messrs. J. White and Co.), have tested the strength of their cements of different kinds, in the presence of some members of the Jury, and the results of these experiments will be included in an Appendix to this part of the Report.* They will be found to contain facts and results of great scientific interest and practical importance. These Exhibitors illustrate the use and comparative strength of several admixtures, consisting of different proportions of Portland cement with sand, broken brick, and other fragmentary substances, and the experiments sufficiently demonstrated the great strength of these valuable cements, and the different modifications of them.

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* See an account of experiments on the strength of Portland cement, p. 587.

Mr. J. Seeley (Nave, West, 88, p. 852, and Outside, West, 11, p. 114) is the exhibitor of a large fountain, intended for a market-place, occupying a prominent position in the West Nave, and also of a figure of Mercury in the West Enclosure outside the Building. Both of these are of artificial stone, and although the former does not exhibit the material under very favourable circumstances, the Jury are satisfied that the general reputation of Mr. Seeley, and the uniform excellence of the material he manufactures, deserve to be rewarded with a Prize Medal.

It may be well to refer here to a great want manifest in this fountain, and in many other objects manufactured of artificial stone both by the present and other Exhibitors; we mean the necessity of some adaptation, not merely to the purpose required, but also to the material to be employed, a necessity too often lost sight of by those who provide and execute designs.

Messrs. R. and W. Teagle (Outside, West, 3, p. 113) have sent a figure in Portland cement, exhibiting some merit in execution, and modelled from a figure of Lazarus in wood. It must be remarked, however, that there is a want of taste and consideration in thus copying in an imitation of stone, what was carved in and adapted for wood. The treatment and feeling of true works of art must and ought to take their tone from the material employed.

Mr. J. Board, Bridgewater (by his agent Mr. Donohue), is the exhibitor of four figures in Portland cement, two of them outside the Building in the Western Enclosure (2, p. 113), and the others in Class XXVII. (94, p. 771). These figures belong to a numerous class intended for garden decoration, and are not unpleasing in themselves, although the colour and appearance of the material are not very satisfactory. We also have Mr. F. Greaves (Class I., 99, p. 131) exhibiting several figures and other objects in cement which offer little for observation.

Mr. Furse (Outside, West, 19, pp. 114, 115) has sent specimens of an artificial stone invented by him, and manufactured since 1838, adapted for flooring damp places and other purposes. This material is of rather dark colour and considerable hardness; it may be cast in slabs of considerable size (up to 8 feet by 5), and is applicable for cisterns and drains, both pipe-drains and inverts for sewers of large dimensions. It has also been used for fortification-works, as a cement for bricks, for lining prisons, casements, &c., and for many minor uses. It is non-absorbent, and is said to stand exposure well. The price of this material in slabs is 6*d.* per square foot, up to 2 feet square, and for other works it is cheap in proportion. It was first invented in Hamburg, and is said by the manufacturer to be used on the Continent in many extensive works for drainage and fortification. The Jury have adjudged this manufacture to be worthy of Honourable Mention.

Other exhibitors of cements, more or less completely manufactured, but not strictly decorative, and not including coloured or scagliola work, are Mr. T. Smith (Class I., 177, p. 139), who shows two blocks of concrete manufactured of the Mountfield lime, Sussex, a material very well adapted for submarine work; and Messrs. Griffiths and Strong, of Whitby (Class XXVII., 67, p. 768), who also show cement stone and cement (Mulgrave's) in its application to building purposes for agricultural cottages. We may mention here, also, some blocks of Medina cement exhibited by Messrs. Francis and Son, who, having obtained a Medal for their Parian, will be more fully referred to when the scagliolas are described.

M. Agombart (France, 2, p. 1169) has received Honourable Mention from the Jury for the hydraulic cements which he exhibits, and of which he is the manufacturer. The hydraulic nature of the cement exhibited by M. Agombart is derived from the kind of puzzuolana which he uses, rather than from any natural qualities the stone possesses; but the Jury having the opportunity of seeing and comparing the various cements exhibited, find that this is somewhat light and porous. They understand that it is made of a limestone containing a certain proportion of silica.

Messrs. Regny and Co. (France, 1427, p. 1244) have obtained Honourable Mention for an hydraulic lime by a mixture of burnt and unburnt stone, so that the result is another modification of puzzuolana. The method is ingenious, and the result is said to be satisfactory, but the Jury regret that in this and several other cases before them, it is quite impossible to come to any definite conclusion, as the test of experience is the only one that is of any value, and they have no means of judging beyond the mere examination of a material exposed to no test, and exhibited on a very small scale. This remark applies to the objects exhibited by M. de Ruolz (France, 1466, p. 1246), which consist of a number of bottles filled with cement, and M. Heiligenthal (France, 259, p. 1189), who shows some very neatly finished objects in a hard mastic, beautifully and delicately constructed and adapted for architectural decoration. M. Evrot is another French Exhibitor (190, p. 1183), concerning whose performance the Jury have no remark to offer. Both these Exhibitors are Honourably Mentioned.

From Belgium there are two Exhibitors in cement, Mr. C. Soetens (424, p. 1164), and Mr. N. Follet (426, p. 1164). Neither of them admit of any detailed notice.

From Central and Southern Europe there are a few cements, the most interesting of which is sent by A. Cristofoli (Austria, 38, p. 1008), who is Honourably Mentioned for a collection of paving blocks and columns of some interest. Messrs. J. Spanna and Co. (Sardinia, 88, p. 1305) also exhibit paving blocks of artificial marble, and have received the same notice. Both these Exhibitors appear to be manufacturers of a material well adapted for the purposes for which it is intended, and no doubt of sufficiently moderate price when laid down in the country. The prices quoted to the Jury are not sufficiently different from those charged for similar results in England to require special remark on this score.

The Greek Government are exhibitors of a very fine natural cement of the nature of puzzuolana, and consisting of volcanic earth from the Island of Santorin. This material is Honourably Mentioned by the Jury as of known and excellent quality, and capable of being supplied in unlimited quantities at a very moderate price.

There are several other foreign Exhibitors of cement and similar compositions. Mr. E. Seeger, of Esslingen (Wurtemburg, 78, p. 1118) has sent mosaic asphalte tablets constructed on a new plan; and Messrs. Moosbrugger and Korbe, of Coblentz (Prussia, 428, p. 1074), some table-slabs of artificial marble inlaid with mosaic work; neither of these call for extended notice. An hydraulic lime is exhibited by Messrs. Leube Brothers, of Ulm (Wurtemburg, 5, p. 1114), which is described as a quickly-setting, hard, and valuable material, the price being 1*s.* 8*d.* English per cwt.

From Austria we have two Exhibitors of artificial pumice-stone, Messrs. B. Hardmuth and Co. (35, p. 1008), and Mr. J. Schabas (36, p. 1008), and one who sends artificial stone and marble, Mr. R. Rohlik (37, p. 1008). The artificial pumice is not without importance in the absence of an abundant and cheap supply of the natural stone, and is understood to be extensively used.

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* See p. 587.

b. Plasters and Scagliola.

The general composition of the plasters has been already explained, but as the subject is one of importance and very general interest, we may here briefly recapitulate the more essential features of distinction between them and cements. The latter (cements), whether hydraulic or otherwise, easily part with the carbonic acid and water which the cement-stone contains by the mere application of heat, and become reduced to lime, whence, by certain treatment and some admixture, either natural or artificial, but generally by a mixture of silicate of alumina, a material results which more or less rapidly takes up the water required for effecting solidification, and immediately hardens without being affected by external circumstances. The basis of such cement is carbonate of lime. On the other hand, the plasters are composed of a basis of sulphate of lime or gypsum, which being burnt, parts only with its water of solidification without being in any way decomposed. The re-admixture of water reproduces solidification, though in a somewhat altered form, but by adding some of the salts of alumina, borax, and potash in a certain stage of the process, it is found possible to increase the hardness and compactness of the newly-formed stone and modify very greatly its absorbing power. In these admixtures lies the secret and peculiarity of all the various patented plasters known as Parian, Keene's, Martin's, and others.

Messrs. J. B. White and Sons (Class I., 130, and Outside, 10, p. 134 and 114) are extensive Exhibitors of Portland cement, but have added to them samples of various other cements and plasters, some plain, and others highly decorated. They may be considered as more especially the Exhibitors of Portland and Keene's cement, having constructed a beam of bricks, in which the former is used, and the strength of which was tested in the presence of some members of the Jury. Besides these are several panels, chimney-pieces, floorings, and other decorative objects of the latter kind (Keene's). The details of the experiments above alluded to, and some others of the same kind by Messrs. Robins, Aspdin, and Co., will be found in a subsequent page,[*] and it need only be said here, that the results were highly favourable to the use of Portland cement, showing it to be of great value for strength, as compared with Roman cement.

The decorative work of Messrs. White is particularly interesting, and is that to which we here chiefly refer. It includes one large panel and a pavement of Keene's cement (gypsum twice burnt and mixed and made up with alum), of extreme hardness, coloured with earthy and metallic oxides, and worked to a high polish. In this state the cement resembles scagliola, possessing even greater brilliancy and depth of colour, but wanting something of the brecciated character which characterises that preparation. Another of the panels on the south wall is executed in French plaster, which being far more abundant and more easily quarried than the English, is much cheaper, but owing to an admixture of carbonate of lime it does not burn to so pure a white. The object of the Exhibitors has been to show that this material is, notwithstanding, quite as well adapted for the finer kinds of work, as it is for stucco on walls and other common purposes.

A number of smaller objects are shown as illustrations of various decorative uses, but it must not be forgotten that the simple and less noticed adaptations to skirtings and other parts of rooms where a very hard durable substance is required, uninjured by damp, and perfectly safe from the attacks of vermin, is a practical result much more important than any other. This is the true value of Keene's and other similar plasters obtained by the admixture of borax, alum, or some other salts of the alkaline earths, with the burnt gypsum in various degrees of purity. A Prize Medal has been awarded to the Messrs. White for their exhibition of Portland and Keene's cement.

Messrs. C. Francis and Son, of Nine Elms (Class XXVII., 47, p. 767), have constructed for the purposes of the Exhibition, a large and handsome screen of Parian cement, representing the various qualities of the material and the kind of decoration for which each different quality may be considered best adapted. This cement, like Keene's and Martin's, is very hard, and is valuable for many purposes of house decoration; it also admits of very rapid execution, one of the specimens exhibited having been painted on the same day that the cement was set. The material is very beautiful, so far as fineness of grain and perfect facility of receiving colour are concerned, and it receives a splendid polish, but the white, though pure, is dead and unpleasant in its tone.

The scagliola work in these specimens, executed by Mr. Vincent Bellman, is throughout excellent, the colours which are introduced by the scagliolist imitating verd antique, Sienna and other marbles, jasper, &c.

Besides Parian, Messrs. Francis and Sons exhibit specimens of Medina cement (a modification of Roman) made up with shingle, and producing a substance of great hardness and durability well adapted for garden pavement. The cost of this by the sea-side, where shingle can be readily had, would not exceed 6*d*. per foot, cube. A Prize Medal is awarded to these exhibitors for their different cements, which they manufacture extensively, and for which they have a high reputation.

Messrs. Stevens and Son, of 186 Drury Lane (24, p. 765), the patentees and manufacturers of *Martin's cement*, exhibit some excellent and highly-finished decorations of that material on the South Wall. Its peculiarity in relation to other gypsum cements has been already mentioned, and the advantage is considered to be great compactness and extreme hardness. The scagliola work executed upon it produces effects that are very beautiful, and the price is said to be moderate as compared with the other scagliola; but there can, of course, be little difference of cost where the composition is so nearly the same, as is the case with this and the other similar cements. The Jury have adjudged a Prize Medal to these exhibitors.

To Messrs. C. Iles and Co. (28, p. 765) a Prize Medal has been given for an ingenious and cheap imitation of marble in soft and hard cement, invented and manufactured by them. The effect is produced by the waste materials of silk works, or the short cuttings from piled fabrics, as cloth and velvet, mixed with the cement, the whole thus forming a mass having either a uniform colour or a mixture of colours throughout, while the veins are formed by silk threads drawn out to imitate such appearances as may be fancied. A great advantage in point of cheapness is thus obtained, and in some cases a polish can be produced during the laying on of the cement. The material seems adapted for halls, staircases, and other internal work in houses, churches, &c., and can be finished where polish is not required for 3½*d*. per square foot in stucco, and 4½*d*. in hard cement. For polished work 9*d*. extra would be charged; but when it is remembered that the price of scagliola of the plainest kind is 6*s*. 6*d*. per foot, the vast difference in cost will be appreciated, while the durability must be at least equal.

In true scagliola the ordinary colours introduced are apt to be affected by the moist state of the work and the use of alum, so that they often run; while on the other hand, from the nature of the material, consisting of a coat of plaster on a framework of some kind and afterwards polished, there is little means of adaptation to positions where strength is required. It is therefore that the Jury have thought it right to notice a Gothic arch of a new kind of scagliola, invented and exhibited by Denis Dolan, of Manchester (45, p. 766), to whom they award a Prize Medal. This arch includes a clustered column with base and capital cast in one piece, the artisan preparing a mould and pouring into it the outer coat, a marble composition, which is allowed to set before the coarse cement of the interior is added, the latter being so contrived as not to interfere by its expansion with the outer coat, but rather insure the union of the two. This new process of casting scagliola work, and some contrivances in polishing, are noticed by the Jury as worthy of consideration. The cost of the articles in the Exhibition would be about 20*l*.

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[*] See p. 589.

Messrs. ORSI and ARMANI (36, p. 766) are the exhibitors of a material called metallic lava, which is a plaster capable of being worked into a variety of patterns and colours, as illustrated in the Exhibition, and well adapted by its beauty, durability, and cheapness, for floorings and other decorative purposes, amongst which is a table in the Moorish style, intended for the President of the French Republic.

Two different kinds of the metallic lava are exhibited; one of which is white and ornamental, and admits of the application of mosaic work; and the other brown, and peculiarly adapted for covering roofs and terraces, lining tanks, cisterns, fish-ponds, brick walls, stables, &c., where a durable, cheap, and impervious covering is required. Both kinds have stood the test of experience, and are known to be well adapted for the object they are intended for. The composition is patented, and the method of laying down a flooring or terrace without trace of joints is both new and advantageous, insuring the perfect impermeability of the whole to moisture. A Prize Medal is awarded to these exhibitors.

To Messrs. DELLA VALLE BROTHERS, of Leghorn (Tuscany, 120, p. 1300), a Prize Medal has been awarded for a new and peculiar manufacture in scagliola, to a certain extent imitative of works in Florentine mosaic, but applied in cases which would be impossible by that process. The objects exhibited consist of two tables and a vase, all truly inlaid, and having a striking and very brilliant effect. This kind of manufacture differs from ordinary scagliola in the much greater complication of the process, and also in the greater beauty of the result, as the subjects include figures and views which at first appear hardly possible to be executed in such material, but which show great labour and skill, and some artistic knowledge in application. One of the objects, a round table, contains a central tableau, surrounded by an azure zone, with several emblematic ornaments. The table itself is of scagliola on a base of marble, each colour composing the ground, and each figure of the central tableau has been first inlaid in a single piece and then shaded. The lights also are all inlaid, and the general effect is extremely beautiful. It will be seen that the general principle involved is that of a mixture of fine inlaying with shading. It would appear, however, that the result, although beautiful, is almost too costly to be generally adopted, as the price of the round table referred to is stated at 250*l*. The rectangular table in imitation of pietra dura, and the vase, which is copied from the antique, show several difficulties incident to the process very successfully overcome. The polish in all the specimens is very good, and entirely natural, no varnish whatever being used.

Mr. L. ROMOLI (Class XXX., 351, p. 842, and Tuscany, 124, p. 1300) exhibits a scagliola candelabrum in imitation of giallo antico, designed by L. Gruner, Esq., modelled by Ant. Trentanove, and the property of His Royal Highness Prince Albert; and also a table in inlaid scagliola, shown in Tuscany. This exhibitor is Honourably Mentioned as exhibiting excellent workmanship in the elegant and costly applications of the material he employs. The candelabrum is not altogether pleasing in its effect, but the workmanship is good. The inlaid table is something in the style of those exhibited by the Messrs. Della Valle, but not at all equal either in design or execution. It appears also to have been manufactured in a somewhat different manner. A cement mosaic in imitation of wood and marble was sent from the Cape of Good Hope for exhibition.

c. Artificial Stone with Silica Base.

As constructed in a manner and on principles altogether distinct from those of both lime and gypsum cements, we must next mention an artificial stone recently introduced by Messrs. RANSOME and PARSONS, of Ipswich, and somewhat extensively exhibited in Class XXVII. (97, p. 771-2). This material is a compound consisting of grains of sand, pebbles, portions of limestone, marble or granite, clay, or indeed any other material, cemented together by a true glass obtained by dissolving flint in caustic alkali in a boiler at a high temperature, mixing up the materials with this solution into a paste of the consistence of putty, moulding this paste into any required form, and after slow air-drying, burning the articles thus manufactured in a kiln at a bright red heat maintained for some time. In the course of this process, the alkali combines with the free silica and forms a kind of glass, so that the materials become cemented together by a substance which does not admit of the smallest absorption of moisture, and is consequently absolutely unattackable by the frost. It also resists every other kind of atmospheric action and is extremely hard. It possesses besides the great advantage of not contracting sensibly during the last process of baking.

It may be well to state briefly the details of manufacture in this case. The flints are used in the rough state in which they are found in the chalk, and of large size. They are suspended in wire baskets in a high-pressure boiler, the pressure being from 60 to 100 lbs. on the square inch. For about a ton or ton and a half of flints, about a quarter of a ton of caustic soda is required (about 56 per cent. of alkali). The resulting substance, a fluid silicate of soda, is drawn off every 48 or 56 hours, the quantity being about 200 gallons, and is afterwards evaporated down to a specific gravity of 1·165, when it is fit for use. The further process is sufficiently described above.

Although this kind of artificial stone appears to offer many advantages, it is right to mention one objection to its use which has not yet been obviated, consisting of an efflorescence of some of the salts of soda, greatly disfiguring the appearance of the work.

Besides artificial stone adapted for all kinds of garden work, for paving, and for architectural decoration, it has been found easy to manufacture a porous variety for filter stones which may be made of any size, admirably answer the purposes for which they are intended, and are supplied at extremely small cost. They are cleaned with perfect ease, and may be contrived so as to be applied without a reservoir to filter water, delivered to houses by the system of constant supply. The cost of a filter passing 300 gallons per day would be 50*s*., and small filters are prepared for the use of travellers, the price of which is only 5*s*. Besides these slabs, permanent ascending filters are prepared with the same material, the price of which, complete, varies from 15*s*. to 4*l*., supplying daily from five to sixty gallons: these are especially adapted for ships and domestic purposes. Other very useful articles have been manufactured of the same kind of material, among which scythe-stones and other grindstones may be mentioned. The Jury have awarded a Prize Medal to these exhibitors for the improved material they have introduced, and the applications of it they have already made.

d. Bituminous Cements and Mastics.

Another and quite different kind of cement is made chiefly with bitumen. It is now well known both in England and on the Continent, under the name of asphalte.

The pavement laid down at the east entrance of the Exhibition by the SEYSSEL ASPHALTE COMPANY is a good sample of their material, and a Prize Medal has been awarded them for this object. The asphalte is generally obtained from natural sources, where it is combined with a large per centage of carbonate of lime, reaching even to 80 per cent. or more, and the combination is so perfect that the rock in this state long resists the action of muriatic acid. Less pure kinds contain sand, which is found to be injurious. The best kinds of asphaltic rock are converted into a plastic workable mastic in a short time, and at very little cost, merely by the addition of 6 or 8 per cent. of mineral or coal-tar and a few pebbles, the union being effected in an iron cauldron at a very moderate heat, and the viscid mass placed on a prepared flat surface. The advantages of this kind of pavement are its extreme toughness and power of resisting very considerable wear. Such a pavement absorbs no water and makes very little dust.

Mr. J. B. DUFOUR (France, 485, p. 1201) is also the exhibitor of an asphalte adapted for pavement of this kind, as well as of mosaic work of natural stones cemented by asphalte. This use of the material is fully appreciated by the Jury, and must be extremely valuable. It has, however, been long known, and indeed the application of bitumen dates very far back in the history of civilization, as we find that it was commonly employed by the ancient Egyptians, and formed a solid and durable cement in the walls of Babylon. The Jury award an Honourable Mention to Mr. Dufour for his exhibition.

e. Metallic Sponge Cement.

A very curious and ingenious contrivance for a pavement is exhibited by Mr. A. CHENOT (France, 119, p. 1177), which, if it can be manufactured at an economical rate, may be of importance under certain circumstances. It is called by the inventor "metallic sponge," and is prepared by reducing certain ores of iron (oxides) into a spongy state by the removal of their oxygen gas. In this condition they readily form into a durable cement. It may be a question whether an invention of this kind, which is not very recent, would not have been brought into active operation before now, had there been no practical difficulties hitherto insuperable; the Jury feel, however, that they are justified in conferring a Prize Medal on Mr. Chenot, in the belief that a new principle has been introduced, and that a most durable material for pavements, &c., is provided by the aid of his contrivance.

K. GLASS AND PORCELAIN MOSAICS.

The art of inlaying, when the material inlaid consists of manufactured cement, glass, or porcelain, instead of marble or gems cut into definite forms, is so extremely different in all respects that we have judged it best to describe the processes of the former kind separately, and bring together the exhibitors who have sent such results into a single group. Even this group admits of subdivision, as it includes Roman mosaics, where prisms or threads of glass of various size and shape compose the whole picture; Venetian mosaics, where the glass is a tessera or other squared shape of some size, inlaid often in a cement base: and a third kind, in which the inlaid substance consists of porcelain or burnt clay, generally also in tesseræ, and producing results admirably adapted for paving, and for house, palatial, and church decoration.

a. Roman and Venetian Mosaic.

The manufacture of true Roman mosaic has always, we believe, been confined to the city whence its name is taken, and no country has entered into competition with Rome in exhibiting specimens of it. The Reporter has received the following account of the manufacture from M. Pistrucci, Chairman of the Jury:—

"The mosaics which are made in these times are composed of pieces of glass, sometimes called *smalt* and sometimes *paste*. They are made of all kinds of colours, and every different hue, and for large pictures they take the form of small cakes. For small works they are produced in threads, varying in thickness from that of a piece of string to the finest cotton thread. Heaps of these, of all tints and colours, are prepared. A plate or slab of copper, marble, or slate is then provided, of the size and thickness required for the intended work. This slab is hollowed out so as to resemble the bottom of a box or a tray, to a depth proportioned to the work; this may vary from an inch to the eighth, or even the sixteenth of an inch, if the work is to be small. This hollow is then filled with plaster of Paris, well smoothed, on which the outline of the proposed design is very accurately traced, and an inked pen is passed over the outline to preserve it. Very few tools are required by the workmen; but for the large works, where comparatively large pieces are to be inserted, small sharp-cutting hammers are made use of for splitting the cakes and reducing them to their proper size and form. Pincers also, of different forms, are used for placing them equally. In very small works, instead of hammers, sharp-pointed pincers are made use of, like those with which diamonds are taken up, and sometimes a small tool like a *scarpello*. The heat of an oil lamp is required to enable the workman to draw out the strips of glass to the fineness he wants, even to that of a hair. When this is all ready, the first operation is to dig or scoop out, with a scarpello of the proper size, a small piece of plaster of Paris from the bottom of the box or tray, without injuring the outline. This is filled up with a kind of mastic, like that which is used to fix panes of glass in the sashes or frames of a window, and the required piece of smalt or glass is then pressed into the mastic or composition. In this way, step by step, and from day to day, repeating the operation of scooping out a small piece of plaster of Paris, and never losing sight of the outlines, they gradually fill up the whole tray. In works of considerable dimensions the workmen place the tray or plate before them as painters place the canvas on which they are painting, and have the original always close to them. For smaller works they sit at a table, as if writing, and generally keep their work flat on the table. The designs used in these mosaics are, for the most part, copied from the pictures of some artist of eminence, the designers themselves being also a separate body, working for the *mosaicisti*, who mechanically fill up the spaces as above described. It is true, however, that though these last cannot be called artists, nevertheless those who distinguish themselves in the art must be endowed with a good natural taste, a true and correct eye, and great perseverance, to enable them to copy the various tints and forms of the original without injuring the outline. I am not aware that any *mosaiciste* has ever worked from his own original design, or even that he has drawn the outline on which he works. When this operation is completed, it is passed over a stone made perfectly smooth and cleaned of every kind of dirt. But as it will always happen that interstices, however minute, will be left more or less between the several small pieces of smalt inserted in the mastic, these are to be carefully filled up with heated wax, applied with hot-iron instruments from a pallet on which it has been prepared for the purpose; and much of the good effect and finish of the work will depend on the ability and care of the workmen by whom this operation is performed."

The Exhibitors of works of Roman mosaic are six in number, and the Council of Chairmen have acceded to the recommendation of the Jury of this Class to give a Council Medal to that one amongst them who has sent the most remarkable specimen of this most beautiful and imperishable art. The artist selected for this high reward is the Cavaliere BARBERI (Rome, 15, p. 1286), and the object he exhibits is a large round table, designed and executed by him, or under his superintendence, and representing celebrated views in Italy. Without comparing this with other celebrated mosaics, not exhibited, the Jury have been exceedingly struck with the singular delicacy and beauty of the workmanship, the admirable adaptability of the material to the nature of the work and the style of design, the exquisite shading of the colours, and the brilliant though softened effect of the group of views, the atmosphere and sky of each mingling into the same ethereal tint, which relieves the eye, and allows it to rest with pleasure on the separate views.

Of the other mosaics, two of very different kind have been sent from the ROYAL MANUFACTORY AT ST. PETER'S (Rome, 23, p. 1286), one of them being a copy of a celebrated picture by Guercino (a St. John Baptist), and the other a medallion, the portrait of Pope Boniface, the Second. Both of these are of much larger pieces than the table, being intended for more distant vision, the latter especially, which appears meant for a lofty position in a church; but both are remarkably fine specimens of workmanship, and the colours and drawing are perfect. A Prize Medal is awarded to the exhibitor of these objects. (Prize Medal granted by Class XXX. also.)

To the Cavaliere LUIGI MOGLIA (Rome, 20, p. 1286), a Prize Medal is also adjudged, for a circular table, a square slab, and a picture presenting a view of Pæstum, all in Roman mosaic, and all admirably executed. The other exhibitors of similar objects, viz., BENEDETTO BOSCHETTI (Rome, 17, p. 1286), artist; DOMENICO MOGLIA (Rome, 21, p. 1286), and ANTONIO ROCCHIGIANNI (Rome, 22, p. 1286), are Honourably Mentioned, as having shown admirable specimens of the same curious art; and to the former a Prize Medal has been awarded.

It is right to mention that since the opening of the Exhibition, and indeed since the investigations of the

Jury have been completed, several objects in Roman mosaic have been added, which are chiefly of small size, but which deserve high commendation for their beauty. Several members of the Jury having left town, it has been impossible to reward in any formal manner the exhibitors of these, although they well deserve to be mentioned with the others.

A group of objects is exhibited in a new kind of glass mosaic, by Mr. G. H. **Stevens** (Class XXX., 158, p. 830), executed at about one-third the price of the ancient manufacture of this kind. These objects include a pair of spiral candelabra, made in Keene's cement, in imitation of marble, inlaid with various patterns of glass mosaic, and intended for the decoration of a hall or drawing-room. The glass is in large tesseræ. There are also glass mosaic tables, a slab containing various patterns for panels, and a specimen of heraldic decoration. The glass is stained or gilt, and the method is adapted for many purposes. The Jury have thought the method worthy of Honourable Mention.

b. Clay and Porcelain Mosaics.

No Exhibitors can at all compete with Messrs. **Minton** (86, p. 770) for the variety, beauty, and excellence of the encaustic and mosaic tiles manufactured by them by a process which involves very great mechanical ingenuity, and which has been carried to a very high pitch of perfection. Messrs. Minton have, indeed, to some extent, followed in the track of similar manufactures among the ancients, both with regard to the uses, forms, and patterns of their tiles, for paving and walls; but they have very greatly improved all the mechanical contrivances, introducing one method more especially—enormous compression to consolidate dry clay—which deserves very distinguished notice, and has been the commencement of an entirely new era in mosaic work in plastic material. To Messrs. Minton, accordingly, the Jury recommended a Council Medal, and the award was recognised by the assembled Group of Juries, and sent to the Council of Chairmen for confirmation. These Exhibitors had also received the same honour for their manufactures in porcelain generally, and there is thus a joint Council Medal given from Classes XXV. and XXVII.

The tiles exhibited by Messrs. Minton are of three kinds, viz.:—

1. *Encaustic, or Inlaid Tiles.*—These are made by pressing clay in the plastic state into an embossed plaster mould, the pattern or design on the mould being raised. When the tile is withdrawn from the mould, the outline of the pattern is indented; and the indented parts are then filled in with liquid coloured clays, according to the colours it is wished to produce. The surface is then scraped quite flat, until the pattern appears well defined. The tile is then fired, which brings out the colours to the proper tint.

2. *Venetian Tiles and Mosaics.*—These tiles are produced by the compression of powdered clays in metal dies, of any geometrical form that may be desired; the clays having been previously stained with metallic colours. Each tile or tessera is, of course, of the same colour throughout. When fired, they are arranged on a smooth platform with the face downwards, according to the design intended; after which liquid Roman or Portland cement is poured upon them, and they are thus formed into slabs of any size required.

3. *Tiles made after the manner of the Alhambra, and other Spanish Tiles.*—There is only one example of these tiles in England, and that is in the Mayor's Chapel at Bristol, supposed to have been presented to a predecessor in the civic chair by a Spanish merchant. These are made by pressing plastic clays on an embossed mould, which forms grooves or indentations. These tiles are then fired, and come out of the oven with the pattern formed. The indentations are then filled in with enamels of various colours, and fired again, which produces a brilliant effect, and renders the tiles suitable either for floors or casing walls.

To Messrs. **Alfred Singer** and Co., of the Vauxhall Pottery (88, p. 770), a Prize Medal has been awarded for a mosaic pavement composed of tesseræ of vitrified clay of several colours and shapes, all produced by machinery with great rapidity and facility, and without the necessity of chipping any of the tesseræ. The machine is patented by the Exhibitors; and, besides making tesseræ of the usual form and size, is capable of subdividing them in such a way that, with comparatively few shapes, an endless variety of patterns can be executed, the joints being preserved in straight lines throughout the whole pavement.

The mode of working is as follows:—The clay being prepared in the usual way, by washing and sifting, and stained with various metallic oxides, is formed by a machine into long thin ribbands, about ¾ inch thick, and 3 or 4 feet long. Out of these ribbands the tesseræ are cut by the patented machine with great rapidity, and when dry are baked in saggers in the usual way.

The pavement slabs are made by laying these tesseræ face downwards on a perfectly flat slate, the pattern being of course reversed, and covering their backs with a layer of Portland cement and two layers of rough thin tiles, carefully embedded in the cement. In this way strong slabs are formed, of about 1¾ or 2 inches thick, which are almost perfectly impervious to moisture or rising damp, and can be laid down by any mason.

The exhibitors consider that they may fairly claim merit for the introduction of the method, and the flatness and durability of the surface, as well as its impermeability. The work can be produced at from 2*s.* 6*d.* to 5*s.* per square foot, according to the size of the pavement and that of the tesseræ. The specimen in the Exhibition is valued at 3*s.* 6*d.* per square foot.

Messrs. **Marchesi** and **Ossoli** (Rome, 13, p. 1285) are exhibitors of a number of slabs of cement, of very good quality, prepared for pavement, and imitative of marble mosaic. They have received Honourable Mention for these objects.

Group 4.—Manufactures in Clay.

The number of objects exhibited belonging to this group is considerable, and of great importance. The number of exhibitors is not, however, very large, amounting only to between eighty and ninety, of whom nearly forty are foreigners.

Of the English exhibitors there are some remarkable for excellence of various kinds, but especially in fire-clay goods, terra-cotta, salt-glazed ware, tiles, drainage-pipes and bricks. Of each of these there are several.

France has as many as twelve exhibitors sending terra cottas of great beauty, and some fire-clay goods.

Belgium has only four, and all of fire-clay goods, consisting of retorts and crucibles. Of the various States of the Zollverein there are four from Saxony, and one from Bavaria, almost all of chemical apparatus; besides four from other countries, of brick and terra-cotta. Austria has only one, but a very important exhibitor in bricks. Italy has also only one, who sends a clay mosaic pavement. From the Peninsula there are four; two of them sending samples of the large jars for which Spain and Portugal have long been famous. From India are several specimens of bricks and terra-cotta; and from the United States are a few objects of some interest.

L. Bricks and Tiles.

Among the materials used for construction none are more really important than bricks, these articles being manufactured of a substance almost universally attainable, worked into a form convenient for use, hardened and rendered more or less impervious to moisture by a partial burning, and when used, cemented together with mortar, or some of those substances described in the first group of plastic materials. Bricks have been employed from the earliest period, and are still as necessary, if not more so, than ever; and, whether in the form of common stock bricks, or any modification for building purposes, or as flat or other bricks for roofing or paving; or lastly, as gutters or pipes for drainage, the number used is so large, and the interest concerned so universal, that even the smallest improvement, either in the mixture of material, the method of burning, the method of uniting, or indeed any other matter, is of really national importance.

The facts with regard to bricks have reference to the kind of clay used; the admixture of clay with other material; the size, shape, and proportions of the brick, tile, or pipe; the mode and extent of burning; the production of any glaze or other peculiar surface; and lastly, the mode of using them and attaching them together. It will be found that several contrivances, more or less ingenious, and more or less complete and efficacious, have been submitted for exhibition, and have come under the consideration of the Jury, and the Reporter regrets that this subject, the interest and extent of which he fully recognises, should have been left to him to describe and dilate upon, sensible as he is that the want of professional and practical acquaintance with the arts of construction must seriously interfere with the due execution of his task.

In speaking of the exhibitors of these articles, it will be convenient to consider them grouped, as far as possible, in regular order. We propose to treat them as follows, although it may sometimes be necessary to depart from this plan on account of single exhibitors sending objects of different kinds:—

1. General improvements in building contrivances, such as hollow bricks, glazed bricks, &c.
2. New and peculiar forms of bricks and ornamental bricks.
3. Common, waterproof, and white bricks.
4. Roofing and paving tiles.
5. Drain-pipes, &c.
6. Bath or scouring bricks.

We have mentioned in the commencement of this Report that a Council Medal had been awarded to the Society for Improving the Condition of the Labouring Classes (pp. 774-5), for their improvements in the arts of construction as applied to dwelling-houses, and especially to those of the lower classes. Those only who have visited the dwellings of the labouring population, as at present constructed in large towns, are at all aware of the overwhelming necessity for some great and rapid improvement, and of the vast alteration that might be effected in the moral condition as well as the health of the poor, if the decencies of life were attended to in their habitations. By introducing a system of construction remarkable at once for strength, cleanliness, warmth, ventilation, dryness, rapidity of completion, safety from fire, and economy, this Society have established claims deserving of the highest acknowledgment, and have insured the gratitude of multitudes who have not yet learned the advantages they will derive. The contrivances include a peculiar form of brick, made tubular; moulded articles in clay for window-sills, mullions, &c., soil and other drains, earthenware water-closets, &c., besides kitchen-ranges, iron bedsteads, &c., which do not come under the consideration of the Jury. Many of these are illustrated, not only in the Exhibition (Class XXVII., 124, pp. 774-5), but in the lodging-houses constructed by H.R.H. the Prince Albert, opposite the Exhibition Building in Hyde Park; but it is well to state that the cost of these cottages need not by any means be taken as a model for similar constructions elsewhere, and that, on the contrary, the houses that have been actually erected show a sufficient return for the capital invested, and even at very moderate rents promise to prove profitable in a strictly commercial sense.

Of all these contrivances the Society appear to put forward the principle of tubular bricks as of first importance. It is true that the idea is by no means modern, similar materials having been employed by the Romans when lightness was needed, as in large vaultings, and being described as of common use at this day in Tunis, and other parts of North Africa, where they have indeed been employed for many ages. Bricks of this kind, of somewhat peculiar construction, have been patented by H. Roberts, Esq., F.S.A., the Honorary Architect of the Society, and have been illustrated by the Society in the Exhibition, the one kind made wedge-shaped (the value of which form is doubtful), and bonded longitudinally over each other, so that two cavities run parallel through every course, giving a double security against moisture, and much facility for ventilation. We quote the following from a paper published by the Society, and distributed by them:—

The dimensions being unlimited, a size has been chosen which, with the omission of the headers, reduces, by about one-third, the number of joints, and greatly improves the appearance of the work, giving it more boldness of effect and resemblance to stone than that of ordinary brickwork. This size is twelve inches long, and three courses rise one foot in height; a size equally convenient for the workmen in the manufacture, and in the use of the bricks, for, whilst less liable to damage in moving than those of larger size, their form admits of ready handling and stowage for transport.

Nine patent hollow bricks of the size before described will do as much walling as sixteen of the common sort, whilst the weight of the former but little exceeds that of the latter, an important consideration in reference to carriage as well as the labour in using.

When passing through the machine, or in the process of drying, any number may be readily splayed at the ends for gables, or marked for closures, and broken off as required in use; or they may be perforated for the purpose of ventilation. If nicked with a sharp-pointed hammer, they will break off at any desired line; and the angles may be taken off with a trowel as readily as those of the common make.

A sufficient proportion of good facing bricks may be selected from an ordinary burning, and in laying them a much better bond will be obtained than is usually given in common brickwork.

The bricks for the quoins and jambs may be made either solid or perforated, and with perpendicular holes, either circular, square, or octagonal: those in the quoins may be so arranged as to serve for ventilating shafts. Stone will be found equally applicable for the quoins and jambs, and the appearance of the work be thereby improved.

Hollow bricks may be made with any good tile machine, in the same manner as ordinary draining pipes, and at about the same cost, in proportion to the quantity of clay contained in them. They are more compressed, require less drying, and with much less fuel are better burned than ordinary bricks, even when only waste heat, or that in the upper part of the kiln, is used.

The saving in brickwork effected by the use of the patent bricks, when made at a fair price, will be from 25 to 30 per cent. on their cost, with a reduction of 25 per cent. on the quantity of mortar, and a similar saving on the labour, when done by accustomed workmen. The process of drying is much more rapid than in common brickwork, and the smoothness of the internal surface of walls built with the patent bonded bricks renders plastering, in many instances, quite unnecessary, whereby a further saving is effected, not only in the first cost, but also in the subsequent maintenance. If glazed on the outer face, as may be done with many clays, a superior finished surface is obtainable without plaster.

Statement showing the Comparative Cost of a Rod of Reduced Brickwork, built with ordinary Bricks of the common size, and a Rod built with Patent Bonded Hollow Bricks:—

	£.	s.	d.
4,300 ordinary bricks to a rod, at . . .	4	6	0
2,450 Patent Bonded H. Bricks, „ 25s. . .	3	1	3
Saving in bricks per rod . . .	£1	4	9
4,300 ordinary bricks to a rod, at 24s. . .	5	3	3
2,450 Patent Bonded H. Bricks, „ 30s. . .	3	13	6
Saving in bricks per rod . . .	£1	9	9
4,300 ordinary bricks to a rod, at 28s. . .	6	0	5
2,450 Patent Bonded H. Bricks, „ 35s. . .	4	5	9
Saving in bricks per rod . . .	£1	14	8

This shows an advantage of 29 per cent. in favour of the patent bonded hollow bricks, in addition to a considerable diminution in the cost of cartage or transport, and of 25 per cent. on the mortar and the labour.

The relative prices given above may be taken as the fair average selling prices, depending on the cost of fuel, labour in preparing the clay, &c.; and the result of inquiries of parties who have made these bricks in Huntingdonshire, Wiltshire, and Lancashire fully confirms the statement that 30*s.* per 1000 may be considered as a fair average selling price. Owing to their larger dimensions, this corresponds to 16*s.* 10½*d.* for the common sort, or if sold at 32*s.* this is equivalent to common bricks at 18*s.* The extra cost for glaze is not stated.

In concluding this notice of the contrivance here referred to, the Jury are desirous to place it distinctly on record, that the Council Medal is awarded to the Society for their exhibition generally, as exemplifying their efforts in various ways to improve the dwellings of the labouring classes, and not for any particular part of it.

A very ingenious machine exhibited by Messrs. **BORIE BROTHERS** (France, 417, p. 1198) is well adapted for the manufacture of tubular bricks of the best quality, with considerable rapidity, and of perfectly uniform dimensions. In this machine the clay is greatly compressed, and when burnt the bricks are extremely hard and strong. It is said to be capable of making 4000 of ordinary size per day; but the size exhibited is very large, and there are as many as nine small tubes running longitudinally through each. The bricks can thus be made extremely light, the saving in weight being estimated at 50 per cent., but capable of reaching 70, while the saving in expense is stated at from 10 to 30 per cent. A Prize Medal is awarded to the exhibitor.

Other hollow bricks, manufactured in the ordinary way, and without statement of price, are exhibited by the North Devon Pottery Company (Class I., 127, p. 133), but these do not offer any marked peculiarity.

Bricks of rhomboidal form are exhibited by Mr. J. C. **HADDAN** (Class XXVII., 114, p. 773), and have been considered by the Jury as worthy of Honourable Mention. They are considered to offer a means of producing a better bond than can be obtained with the ordinary shape, but it will doubtless be very long before the form and proportions which have so long been used in the manufacture of bricks will be changed, or in any way modified for ordinary purposes. It may, however, happen that for special purposes a change will become advisable, and any ingenious attempt which possesses the great qualifications of cheapness and comparative simplicity is worthy of notice.

Other bricks of new form are shown by Mr. A. **MILCH** (Prussia, 9, p. 1048), who is considered worthy of Honourable Mention, and by Mr. R. **BESWICK** (Class XXVII., 106, p. 772).

Moulded bricks are exhibited by Mr. L. **THOMPSON** (100, p. 772), and Mr. E. S. **KEY** (126, p. 776). The latter are adapted for window frames of cottages, school-rooms, &c., not being liable to decay, and being perfectly fire-proof. They are also cheap, the cost per foot super. being stated at 1*s.* for red, and 1*s.* 4*d.* for white brick, including whole panes of sheet glass, but exclusive of carriage.

A number of specimens of ornamental bricks are exhibited from England, some of them worthy of special notice. Among these Lord **LOVELACE** is Honourably Mentioned for a stack of three chimneys, constructed for and exhibited by him (87, p. 770). The form and style of these chimneys are better than the execution.

Mr. J. **LUFF** (111, p. 772) has received Honourable Mention for moulded bricks, both plain and ornamental, besides red and white paving tiles, and kiln tiles for malting. The ornamental bricks are described as very economical, the number required for a chimney 10 feet high from the base costing not more than 30*s.*, made to any pattern. The plain tiles and pantiles are capable of resisting the weather, and form a cheap and durable covering for cottages. The collection exhibited is small, but very creditable.

Mr. J. **AMBROSE** (128, p. 776), is the exhibitor of a white ornamental chimney, also adjudged worthy of Honourable Mention. The form and construction of the bricks employed are very creditable to the exhibitor.

We come now to the consideration of good common bricks, and the Jury have to mention, as occupying the first place amongst these, the series exhibited by Mr. **MIESBACH** (Austria, 610, p. 1038), of Vienna, the founder and proprietor of one of the largest and most remarkable establishments for brick-making that exists in the whole world. A Prize Medal is awarded to this exhibitor.

As some illustration of the magnitude of this establishment and the good quality of the bricks, we may state that it formed a part of the contract for the great tunnel through the Sömmering, on the Austrian railway, that 20,000,000 of bricks required this year (1851) should be supplied from Mr. Miesbach's works, and that another contract for 40,000,000 for public works at Vienna is also supplied from the same works during the same year. These are all additions to the ordinary make, and the fact is certified by a member of the Jury, an architect of Vienna. The subjoined statement of the nature of their establishment has been forwarded by the exhibitors to the Jury, and is given here as interesting and instructive.

The privileged brick and tile factory on the Wiener-Berg stands on a space of ground of 264¼ English acres, while an area of 680 English acres afford a supply of excellent material for brick-making, sufficient for several centuries to come, and consist of four sections, which are separated into ten subdivisions. There are 24,930 feet in length of drying sheds for the manufacture of ordinary bricks, and 8,304 feet of moulding sheds for the manufacture of tiles, and facing and ornamental bricks, besides 43 kilns calculated to burn 45,000 to 110,000 bricks per kiln, or to burn at one time 3,500,000. There are further in this establishment, infant schools for 120 children, a hospital with 52 beds, besides a tool workshop, a wheelwright's and carpenter's shop, and the great watering

NAME OF THE WORKS.	Number of Moulding Benches.	Annual Production of Bricks and Tiles.	Persons employed.			Total Number of Persons.
			Officials.	Overseers and Superintendents.	Workmen and Carmen.	
In the Province of Austria below the Enns.						
1. Inzersdorf on the Wiener-Berg (the largest brick manufactory in the world) – – – – –	446	65,500,000	13	19	2,620	2,890
2. Ober Laa on the Laaer-Berg – – – – –	61	8,500,000	2	3	310	495
3. Biedermannsdorf – – – – – – – –	36	4,000,000	2	2	150	180
4. Vösendorf – – – – – – – – –	40	5,000,000	2	2	180	220
5. Guntramsdorf – – – – – – – –	60	8,000,000	2	3	270	315
6. Zillingdorf near Wiener-Neustadt – – –	6	900,000	1	1	30	40
Total – – –	649	91,900,000	22	30	3,560	4,140
Hungary.						
7. Râkos near Pesth – – – – – – – –	115	15,250,000	5	6	600	740
Together – –	764	107,150,000	27	36	4,160	4,880

and kneading pits for red and white ornamental bricks. On all the sections there are the requisite dwellings for the officials and workmen, besides stabling for about 300 horses. The six other factories are provided in the same proportion, and the amount of money turned over in the business amounts to about 1,800,000 florins c. m. (180,000*l.* sterling), the capital employed being 600,000 florins c. m. (60,000*l.*)

The ordinary dimensions of the bricks constructed by these exhibitors are double the usual size, measuring 11·3 by 5·9 and 2·8 inches, instead of 9 inches by 4½ and 2½, and they are said to be generally cheaper than stock bricks of the best quality in other countries, notwithstanding the high cost of fuel. They are burnt partly with coal and partly with lignite, obtained from numerous and extensive mines in various districts belonging to the same proprietors.

There are one or two exhibitors of improved common bricks, and some others who have sent similar articles chiefly as illustrations of raw material. Of these we only mention (as being exhibited in Class XXVII.) Messrs. Fordham and Sons (118, p. 773), and Mr. F. Fisher (Class I., 119, p. 133), the former of whom send improved, and the latter white bricks.

Excellent bricks of the common kind used in the country are amongst the objects exhibited from India, but they offer nothing peculiar that requires notice here.

A Prize Medal has been awarded to Mr. J. Workman (116, p. 773) for an ingenious and apparently effectual method of rendering common bricks perfectly waterproof, at a cost of about 6*s.* per thousand. The machine by which the process is effected is sufficient to turn out from 30,000 to 50,000 per day, and the waterproofing takes place either during the first process of manufacture, or after the brick is completed. No extra cost of carriage is needed to complete the work under any circumstances.

It is unnecessary to point out all the advantages that would result from taking advantage of this method, but the Reporter would not omit to notice its peculiar importance in the case of cottages and small houses, and for vaults and foundations. It is in these applications that the very great absorbency of common bricks (which will take up on an average nearly a quart of water each) is so ruinous not only to the property exposed under their shelter, but to the health of the inhabitants, who are often very ill supplied with the means of removing the evil. The inventor believes that the total extra cost of using his bricks would not exceed 4*l.* in the construction of a small cottage.

The manufacture of paving tiles, roofing tiles, and draining tiles, including also drain pipes and pantiles, is so far distinct from that of bricks in the ordinary acceptation of the term, that they admit of separate reference in this place, and many of them are more properly considered amongst agricultural implements. We have, however, a few remarks to offer concerning some few of the various exhibitors who have sent articles of this kind.

To Mr. Thomas Peake, of Tunstall, Staffordshire (123, p. 774), a Prize Medal is awarded for a large and interesting series of articles manufactured in a peculiar preparation of clay, and with a peculiar burning, and called by him *Terro-metallic*. To produce this material several clays are mixed, and some of them being hard they are pulverised by rollers, and tempered in improved pugmills, the whole being worked by no less than five steam-engines (one of them 50-horse power), and machinery of various kinds in several large factories. At the present time about 30 ovens are employed, and as much as 50 acres of land are in connection with the tileries. The establishment of this exhibitor is of very long standing in Staffordshire, and the prices at which the goods are supplied have been of late years very much reduced. The colour as well as quality of the terro-metallic is extremely good for many purposes, some of it being almost like cast-iron, and very strong testimonials have been given by many practical men in favour of the excellence and durability of the manufactured articles. It is stated that the heat at which the material is fired is so considerable as to insure in every case perfect hardness and soundness, and it also produces a natural glaze of considerable value.

Messrs. H. and R. Haywood, of the Brownhills Tileries, near Burslem, in Staffordshire (127, p. 776), are exhibitors of tiles of all kinds, quarries, stoneware pipes, closet-pans, traps, and other objects of very fine quality, and are considered worthy of a Prize Medal. Messrs. Haywood not only exhibit a very extensive series of these articles, which are largely supplied and much esteemed in the trade, but they have also added chimney shafts and pavements of the same material. Their clay is of excellent quality, and very well and perfetly worked, and the firing seems to have been effected at a high temperature.

To Mr. Robert Brown, of Surbiton Hill, Surrey (117, p. 773), a Prize Medal is awarded for improved Italian tiles, and grooved ridge tiles, invented and exhibited by him.

Until this exhibitor introduced his modification of Italian tiles, those made in England, as well as those brought from the Continent, were ill adapted to the English climate, and therefore little used, but by the alteration he made in the form, the exact appearance of the Italian tile is preserved, while the roof is perfectly water-tight. The lower tile being slightly curved, and a horizontal indentation made across its face, about one inch from the top, besides a button being placed instead of the nail-holes used in the old Italian tile, the needful alterations are made, and the tile is complete. The tiles are coloured grey, the colour being burnt in. The cost of these tiles is more moderate than that of any other Italian tiles used in England.

The grooved-ridge tile is so contrived that the vertical ornaments can be made separately, at low cost, and with great accuracy, and can be replaced if broken. The Jury consider both this and the former modification as of great merit, and have reason to believe that they are fully sanctioned by experience under various circumstances of exposure.

A Prize Medal has been awarded to Mr. Amuller (France, 405, p. 1197) for a new kind of tile introduced by him, exhibiting much ingenuity of design, besides great neatness and excellence of execution. Mr. Fox (France, 1232, p. 1236) is adjudged worthy of Honourable Mention for other tiles, of brick, clay, and glass, exhibited by him. The tiles of the former exhibitor are apparently well adapted for general use, unless their cost should be more considerable than that of the more common kinds, nearly equal to them in decoration and durability.

Mr. Sealy, of Bridgwater (130, p. 776), an exhibitor of roofing-tiles and Bath bricks, is Honourably Mentioned, chiefly for the latter articles. The scouring bricks, so called, were first brought into general notice by the house which he now represents, and he is still the principal manufacturer and exporter of the article, which is of great use for various purposes in the arts. The following account of the Bath bricks will be found to possess some interest, and is supplied by this exhibitor. It is probable that the finest silicious particles are derived from the destruction of infusorial animalcules at the meeting of the tide with the fresh water of the river, and it is not unlikely that a somewhat similar if not identical product might be obtained from the mud accumulating at the mouth of the Elbe and other rivers where such causes are known to act.

"The material used for cleaning and polishing metal goods, &c., known by the name of *Bath brick*, is manufactured at Bridgwater from the tidal deposit of the river Parret; and although many attempts have been made to produce a similar article, we believe they have all hitherto failed. This material is a peculiar mixture of fine silicious sand and clay brought up by the tide, which is very strong in the Parret, and is deposited on the sides of the river's banks as the water becomes still, just before the time of its ebbing, and some little time afterwards."

There are several exhibitors of draining-pipes and tiles, some of whom, sending also terra-cotta and glazed stoneware, will be referred to afterwards in this Report; others, sending them rather as illustrations of machines than manufactures, do not properly enter into competition, and others again, already noticed, have been more remarkable for other more prominent, although perhaps not more really important objects. We must, however, refer here to one exhibitor who has been adjudged worthy of Honourable Mention by the Jury, and whose products are extremely remarkable for the unusual beauty and purity of the material of which the pipes and tiles are manufactured. We allude to the Earl of **Enniskillen** (Class I., 116, p. 133, and Class IX., 232, p. 395), and quote the following account of the Florence Court Tile and Pottery Works as forwarded to the Reporter:—

"The raw material, of which these objects are manufactured, consists of a patch of about 20 Irish acres, and is only a portion of a very extensive seam of clay, bounded on three sides by a very large extent of excellent peat, or turf bog, producing an incalculable supply of fuel to the works at a cheap rate. The depth of the clay bed averages about 13 feet, of which the upper strata burning *red* measures about four feet, and is workable to within a few inches of the surface, the other nine feet improves in pureness, and burns whiter as it reaches the bottom.

"The qualities of this clay were partly discovered in 1847, and the manufacture of tiles commenced in 1848. In 1850 it was found necessary to increase the works, and erect two new kilns on a larger scale, to enable the manager to turn out a fresh weekly supply of pipes.

"The drying shed is 180 feet long, by 20 wide in the clear, and capable of containing in its drying compartments 50,000 two-inch pipes, with two wooden tramways running the whole length to accommodate the machines to the shelves, with a wide crossing in centre, close to the rear of which the pug-mill, worked by two horses, is situated. Another range of drying sheds is now being laid out for erection, and the demand from this manufactory extends from Cork to Belfast. A pottery on a moderate scale has been established here a few months, and promises fairly for flower-pots, milk-pans, butter-crocks, jars, black and brown tea-pots, &c."

It may be well to observe, that there is no other fuel than peat used in any portion of this manufacture.

Mr. C. **Phillips**, of Weston-super-Mare (Outside, West, 63, p. 117), has sent for exhibition a collection of flower-pots, of very admirable manufacture, and remarkable both for colour, smoothness, and style. The Jury have considered Mr. Phillips worthy of Honourable Mention for these articles.

M. Terra-Cottas.

The manufacture of terra-cotta is an important and interesting modification of common moulded brickwork, requiring a clay of great purity, resembling that used for pipe-making and potter's-ware, containing but little iron, and made up with a quantity of crushed pottery and calcined flints, the whole being well mixed and burnt to a very high heat. It thus approaches in its nature to what is called stoneware, but the fusion of the materials is not effected. There are several exhibitors of terra-cotta of very high merit, and we proceed to enumerate them. It should be observed that the true terra-cotta of the ancients was a less baked and much less durable material than the modern kind, being, in fact, little more than sun-baked clay of considerable purity.

Of English exhibitors of terra-cotta, the most remarkable in respect to the magnitude of the objects exhibited are Messrs. E. P. **Willock** and Co., of the Ladyshore Terra-cotta Works, Manchester (8, p. 764, and Nave, West, 223, p. 853), to whom a Prize Medal has been awarded. A complete model of a decorated Gothic church, executed entirely in Ladyshore terra-cotta (the whole of the church as well as the model being of this material), forms a very interesting and prominent portion of the Exhibition, and besides this are shown a Corinthian capital, a chimney-piece painted in imitation of oak, with the slab in stone, a flower-stand, a piece of Gothic tracery, and other smaller articles, all illustrating the uses and advantages of the material.

It is stated by the exhibitors that these objects are supplied at a reduction of from 50 to 75 per cent. on the price of carved stone or oak. The quality of the material is good, and the style of manufacture careful and praiseworthy. The Jury recognise the importance of introducing a material so useful and so economical in many cases, especially where the absence of durable stone interferes with the construction of public buildings. A well-made terra-cotta may be regarded as almost indestructible by ordinary exposure, and although in colour it is generally inferior to good stone, and the parts are liable to warp in burning, yet for some kinds of ornament, and for many practical purposes, the result is everything that is needed.

A Prize Medal has also been awarded to Mr. **Blanchard**, of King Edward Street, Westminster Road, London (92, p. 771), for several objects in terra-cotta, exhibited by him, including part of a Gothic pinnacle, a capital, and some small articles. These are of very excellent colour, and the details of construction are admirable. The material is described as a composition of the best white pipe-clay, crushed pottery ware, calcined flint, flour-glass, and white sand, all well amalgamated and burnt at a high temperature. The tint is exactly that of the material as it leaves the kiln, without artificial colour, wash, paint, or stopping, and is extremely uniform. It does not alter on exposure, and the works of this establishment have stood the test of time.

Mr. **Pulham**, of Broxbourne (108, p. 772, and Class XXX., 216, p. 833), is the exhibitor of several objects in red terra-cotta, some adapted for construction and others entirely ornamental. As far as material is concerned these are considered by the Jury to be worthy of a Prize Medal, while the artistic merit of the more ornamental articles is equally noticeable. The colour of some of this terra-cotta is very dark rich red.

Messrs. **Doulton** and **Watts**, of Lambeth, are exhibitors of sundry objects in terra-cotta and fire-clay, some of them of considerable beauty, and they exhibit, together with Messrs. **Henry Doulton** and Co., also of Lambeth, a number of excellent articles in stoneware (23, p. 765, and 95, p. 771). Both these parties are proprietors of extensive works at Lambeth, where they carry on the manufacture of stoneware on a large scale, to which they have recently added that of terra-cotta, of which alone we speak in the present notice. The terra-cottas they exhibit include vases of large size, trusses, window-heads, and Ward's cases, the latter very beautifully and delicately constructed, though of small size. They also include a full-sized figure of Time (by Messrs. Doulton and Watts), made in one single piece of clay and fired entire without joint of any kind. The chief expense of such figures is incurred in the first moulding, and should there be a demand they could afterwards be repeated at small cost, not exceeding in this case 10*l*. or 12*l*. They are absolutely imperishable by weather. A Prize Medal has been awarded to Messrs. Doulton and Co., and Messrs. Doulton and Watts, jointly, for their combined exhibition of terra-cotta and stoneware, the latter of which will be referred to subsequently.

To Messrs. **Ferguson**, **Miller**, and Co. (93, p. 771), a Prize Medal has been awarded for sundry goods in terra-cotta, manufactured by them of fire-clay, and burnt at a high heat. The fire-clays found in various parts of the coal measures are now much used for different purposes where refractory clay is required, and amongst the rest for ornamental vases, and figures for outside decoration in gardens, for which they form a good artificial stone, much superior to common stone. The contraction that takes place in firing renders it somewhat difficult to model them with sufficient accuracy to insure a satisfactory result, and this is especially the case where the form required is complicated and cut up into detail. The present exhibitors have prepared some vases expressly for the Exhibition, and they have shown ingenuity in adapting the design to the material.

The Grangemouth Coal Company (99, p. 772) exhibit a somewhat similar series to those just described. All the articles forwarded were manufactured from a fire-clay of remarkable purity, consisting of about 64 per cent. silica, and 34½ per cent. alumina, with less than 1½ per cent. of iron, lime, and phosphates. The analysis of the clays used by these exhibitors, as given by them to the

Reporter, rather shows a different combination from that of the Stourbridge clay, but the extremely small per centage of such impurities as render the clay fusible must be regarded as an important peculiarity. The vases, pedestals, and chimney cans exhibited are all of the natural colour of the clay when burnt, none of them having been painted or otherwise coloured. The exhibitors are adjudged worthy of Honourable Mention.

The following is an analysis of the clays of two different kinds used by the exhibitors. The analyses were made by Dr. Penny, of the Andersonian University, Glasgow:

	No. 1.	No. 2.
Silica - - - -	65·20	62·85
Alumina - - - -	33·41	35·65
Lime - - - - -	·32	·45
Magnesia - - - -	·13	·15
Oxide of iron - - -	·49	·59
Phosphates - - -	·45	·31
	100·00	100·00

A very beautiful vase in terra-cotta, exhibited by Mr. Betts in the West Nave, but designed by Mr. J. Thomas (22, p. 765), is considered worthy of Honourable Mention for the excellence of its form, the colour and quality of the material, and the finish of the work. Some other objects in terra-cotta are shown by Mr. Betts, of less ornamental character, but of equally good material.

An elegant but small vase, of dark red terra-cotta is exhibited in Class I. (106, p. 132) by Mr. Burnett, and is Honourably Noticed by the Jury for the smoothness of its texture and the uniformity of its tint, as well as for its form.

There are several other English exhibitors of terra-cottas and fire-clays. Of these we may first mention the Garnkirk Company (98, p. 772), who have sent a fountain and several vases in fire-clay, besides some samples of salt-glazed ware. The material appears to be of fair quality and carefully worked. Messrs. J. Bell and Co. (96, p. 771), have sent vases manufactured of their excellent fire-clay, which, though not very remarkable in other respects, show the quality of the material to great advantage. In Class I. (105, p. 132) are a statue and some small objects in terra-cotta, exhibited by Mr. Grimsley, of Oxford, the designs being deserving of notice; and in the same Class, exhibited on the South Wall (86, p. 130), is a small group in relief, manufactured of fire-clay, and sent by the Bank Park Pyropolite Works. Some other objects in terra-cotta are exhibited from England, but they are of comparatively small importance, or are sent rather as illustrations of material than as mineral manufactures.

From France there have been sent several objects in terra-cotta, some of them extremely remarkable, not only for beauty of material, but for taste and elegance of design, and an amount of skill in manufacture which does the highest credit to every one concerned. Of the various exhibitors the Jury have felt no difficulty in awarding a Prize Medal to Messrs. Virebent Brothers, of Toulouse (France 732, p. 1215), who have forwarded a large and most interesting series of objects of a kind of terra-cotta, originally intended for architectural decoration in restoring old ecclesiastical edifices. The colour of this artificial stone is naturally a yellowish white, but for certain objects it is produced of an Etruscan red or black. It takes all colours and gilds perfectly well, and has been long and extensively used in France, where it is not only employed for the construction and restoration of buildings, but also for statues and vases, and even for pulpits, altars, piscinas, and other decorative work in the interior of churches. The chief object exhibited is a chimney-piece of great beauty in the renaissance style, but there is also a large series of objects adapted to church architecture. These exhibitors have received testimonials from engineers and architects of eminence.

Mr. Debay, of Paris (France, 45, p. 1173), an artist who has contributed some objects of beauty and excellence, manufactured in a kind of terra-cotta, is considered by the Jury to be worthy of Honourable Mention. Among the works of this artist are two figures which show considerable skill in design and treatment, as well as in the nature of the material.

Honourable Mention is made also of Mr. Holstein (France, 876, p. 1221), an exhibitor of terra-cotta mouldings; of Mr. Garnaud, jun. (France, 233, p. 1187), who shows various specimens of white terra-cotta of considerable hardness, adapted to external work for houses, and also for sculpture; and of Mr. C. de Boissimon (France, 427, p. 1199), for ornamental vases and fire-bricks. The material in all these French terra-cottas is of singularly fine quality and even texture, and the tint is remarkably delicate and uniform. The articles manufactured are in a bold free style, well modelled and well burnt, and do great credit to the several exhibitors; but the Reporter regrets that he has no special or detailed information as to the nature of the raw material, the localities in which it is found, the mixtures of the clay, sand, and broken pottery employed, or the heat of firing. It may be remarked that in all of them the colour is pale, showing an absence of iron in the clays.

There are some German exhibitors of terra-cotta, whom it is necessary to allude to. Messrs. Stair Wasserott, of Ravensburg (Wurtemburg, 69, p. 1118), are distinguished by the Jury with Honourable Mention as manufacturers of some very well-constructed architectural objects of a good kind of terra-cotta of red colour. These include only part of a large series of such objects, to be procured at the manufactory of the exhibitors, who have forwarded a volume exhibiting drawings of their different products, including pavements, draining and other tiles, and a large variety of mouldings, windows, and other architectural contrivances; considerable taste in the application of the material is manifest in the designs in this volume.

Mr. Ernest March, of Berlin (Prussia, 240, p. 1061), has sent an extensive series of dark red and pale terra-cottas, showing great merit in design, and moulded of the dust of the high road near Berlin; much ingenuity is shown in rendering available this peculiar material, and the exhibitor is Honourably Mentioned for these terra-cottas, besides which, he has sent some chemical utensils. Other objects of similar material exhibited amongst the Zollverein goods, and appearing in their Catalogue, are a group of considerable elegance sent by the Government engineers at Wiesbaden, and affording good illustrations of the excellent clay of the Duchy of Nassau. There are also some imitations of freestone in clay, and other smaller objects, which we need not here particularise.

A few excellent and useful works in terra-cotta are exhibited from other countries, of which the Jury have noticed some from Switzerland worked into good designs, and others from Tuscany. The former include a font, showing much elaborateness and considerable skill, exhibited by J. Ziegler Pellis (260, p. 1283), (awarded Honourable Mention in Class XXV.), the latter, a stove in terra-cotta exhibited by L. Cantagalli, of Florence (Tuscany, 88, p. 1297), adapted to the country, but not likely to be valued in England. The colour of the former of these objects is an extremely dark red, and it well deserves Honourable Mention.

From Spain and Portugal respectively, there have been sent for exhibition specimens of the large earthern jars used in those countries for preserving oil, wine, and other products. These jars are often made very much larger than the specimens exhibited, containing sometimes many times the quantity that these would do, but they are remarkable and interesting examples of a manufacture of great antiquity, much ingenuity, and considerable importance. The large jar (*Tinaja*) exhibited by Mr. M. Ysasi (Spain, 51, p. 1332), is from Toboso (Mancha), and is Honourably Mentioned by the Jury. Such jars are buried in the earth in a kind of cement, and preserved in this way for an indefinite period. They are made by hand without the wheel, and are fired in an oven constructed on purpose, the interior being made use of to receive a number of small objects fired at the same time. The most celebrated and largest manufactory of these jars is at Toboso. The inside is sometimes varnished to receive spirits.

There is a Portuguese jar from Alemtejo, accompanied by two earthen pots used in cooking, remarkable for their extreme durability and thinness, considering the uses to which they are applied. The material is apparently a very silicious clay containing some mica.

N. Gas-retorts, Fire-bricks, &c., and Chemical Utensils.

We have already mentioned the use of fire-clay (obtained generally in this country from beneath certain seams of coal), and its value in the manufacture of terra-cotta, where being burnt at a high heat, the clay requires to be of such a nature as to resist fusion, or in other words, to have the property understood by the term *refractory*. Many other specimens of manufactured fire-clay have been sent, adapted to special and most important purposes, and we proceed now to enumerate the exhibitors, and the nature and degree of excellence of the objects exhibited. It is to be regretted that there are not more exhibitors to compete with each other in this department, but some of those to whom we shall allude have sent specimens which are highly creditable.

The Reporter has had the advantage of an opinion and report communicated by George Lowe, Esq., C.E., F.R.S., one of the Associate Jurors in this matter, whose judgment has assisted in guiding the Jury in their awards.

Messrs. **Joseph Cowen** and Co., of Blaydon Burn, Newcastle-on-Tyne (112, p. 772), are exhibitors of samples of fire-clay, fire-bricks, and patent fire-clay gas retorts, which are all of admirable quality, and bear the highest reputation. The Jury have, therefore, awarded a Prize Medal to them.

The use of fire-clay is not of very ancient date, and has greatly increased within the last few years. It is found in England almost exclusively in the coal measures, and from different districts the quality is found to differ considerably. The so-called "Stourbridge clay" is the best known, and will be alluded to presently; but other kinds are almost, if not quite, as well adapted for the higher purposes of manufacture, being equally free from alkaline earths and iron, the presence of which renders the clay fusible when the heat is intense. The proportions of silica and alumina in these clays vary considerably; the former amounting sometimes to little more than 50 per cent., while in others it reaches beyond 70; the miscellaneous ingredients ranging from less than 1½ to upwards of 7 per cent.

The works of Messrs. Cowen and Co. are among the most extensive in England, and they obtain their raw material from no less than nine different seams, admitting of great and useful mixture of clay for various purposes. After being removed from the mine, the clay is tempered by exposure to the weather, in some cases for years, and is then prepared with extreme care. The objects chiefly made are fire-bricks and gas retorts; the latter being now much used and preferred to iron for durability. These retorts were first made by the present exhibitors in ten pieces (this being twenty years ago), and since then the number of pieces has been reduced successively to four, three, and two pieces, till, in 1844, they were enabled to patent a process for making them in one piece; and, at the present time, they are thus manufactured of dimensions as much as 10 feet long by 3 feet wide in the inside, which is, however, more than double the size of the largest exhibited by them.

The following extract from the Report with which Mr. Lowe has favoured the Jury, will be read with interest. He says,—

"I recommend this exhibitor from my own knowledge as connected with the extensive furnace work of the Chartered Gas Company during the last thirty years, at which period we were buying Stourbridge goods from 8*l.* to 10*l.* per thousand, when a fair trial of Mr. Cowen's bricks, at just one-half the price, convinced us then, and have ever since proved to us their excellency. One especial feature in these bricks and retorts visible to the eye, and so essential to their withstanding high heats, is their freedom from iron, which acts the part of a flux, destroying the otherwise good properties of many fire-clays. This he arrives at by following the Chinese practice of submitting his clay for years exposed to all weathers, turning it frequently over, whilst young hands pick out the fossiliferous fragments, generally pyritous, which this disintegrating process lays open to observation. The clay contains a high per centage of silica. Add to these points great care in the manufactory, in which every appliance is to be seen, and we have nearly the secret of Mr. Cowen's fame. He has testimonials from all quarters, one from Rouen, stating thirty-eight months as the durability of some of his retorts, being four times that of iron ones."

The fire-bricks exhibited by Messrs. Cowen are sold at from 40*s.* to 50*s.* per 1,000 on board at Newcastle, the price varying with the size. The same articles are delivered in London at from 50*s.* to 70*s.* The retorts are from 60*s.* to 80*s.* each at Newcastle, and in London from 5*s.* to 10*s.* more.

Messrs. **Harper** and **Moore**, of Stourbridge (119, p. 773), are exhibitors of fire-clay bricks remarkable for their hardness; and they also send a glass pot. All these objects are well made, of good colour, and free from iron; and are considered worthy of Honourable Mention. The large pots are used in the manufacture of plate, crown, and sheet glass; and those of smaller size in the manufacture of flint glass: the pots remaining in the furnace till worn out or broken, and lasting sometimes for two years. One of the vessels with an open top (called a curvett) is used to convey the melted glass from the interior of the furnace to the casting-table for plate glass, a test, perhaps, the most severe that a fire-clay vessel can be put to, but which some of those made by these Exhibitors have stood 180 times without breaking. The purest fire-clay, in which iron is entirely absent, is needed for such purposes. The wholesale price of the curvetts is 40*s.* each.

The crucibles shown by Messrs. Harper and Moore are made by hand, and are extensively used for brass, iron, steel, silver, gold, and other metals. The bricks used for lining the inside of glass-house and other furnaces, where long-continued and intense heat is applied, are also of good quality.

Glass-house pots are also exhibited by Messrs. **Squires** and **Sons**, of Stourbridge (Class I., 117, p. 133), and Messrs. **Hartley**, of Sunderland.

The celebrated fire-clay used by these and other Exhibitors, and so widely celebrated as Stourbridge clay, lies about 15 feet beneath the lowest of three workable seams of coal (each averaging 6 feet thick), worked at Stourbridge in the lower coal measures in the south-western extremity of the Dudley coal-field. The bed of clay is four feet thick; and the following is the composition, according to Berthier, quoted in Dufrésnoy's "Mineralogie," vol. iii., p. 259:—

Silica - - -	63·70
Alumina - -	22·70
Oxide of iron - -	2·00
Water - - -	10·30
	100·00

Other British Exhibitors of similar objects are Messrs. **King**, of Stourbridge (Class I., 91, pp. 130, 131), well known for their manufactures of fire-clay goods from this celebrated district, and the Exhibitors of a large and interesting series, including the raw material unburnt and finished articles of manufacture, and a small model of a glass-house. Owing to some cause, the goods here shown are not altogether such as to do credit to the maker. The best objects from Messrs. King are the crucibles, and the greatest interest attaching to their group arises from the fact that the raw or unburnt pots, &c., are shown as well as those which are burnt.

Gas retorts of very fair quality are shown by Mr. **Ramsay**, of Newcastle, who has also succeeded extremely well in the manufacture of fire-bricks, chimney-pots, and other goods. The retorts show a little more iron than is desirable, but the Exhibitor has been considered worthy of Honourable Mention. Retorts of less creditable appearance are exhibited by Messrs. **Hickman** and Co., of

Stourbridge (Class XXVII., 107, p. 772), and Mr. A. POTTER, of Newcastle (Class XXVII., 115, p. 773). The surface of both these retorts is cracked and undulating. When we consider the high and long-continued temperature to which these objects are exposed, the absolute necessity of attending to every detail in mixing the clay and moulding the retort will be at once recognised; and the apparently slight defects of some of those sent for exhibition, require to be noticed as of real importance. Mr. J. PEASE (Class I., 122, p. 133) is Honourably Mentioned for some fire-bricks of excellent quality exhibited by him.

Next to England, the finest specimens of fire-clay goods, on a large scale, are from Belgium, from which country there are three exhibitors of gas retorts. The Jury have awarded a Prize Medal to one of these, Mr. T. BOUCHER, of Baudour (399, p. 1163), who has sent a well-made retort, extremely thin, of good structure, and free from surface iron and cracks. The Jury have awarded the Medal to this Exhibitor on account of the undoubted superiority which it presents over other similar objects from the Continent, and do not enter on any question of priority of manufacture that may arise, or identity of methods adopted by this and other Exhibitors.

The Jury have awarded Honourable Mention to Mr. A. SMAL-WERPIN, of Huy, Liège (398, p. 1163), for a neatly-made retort of rather indifferent colour; and also to Messrs. B. PASTOR and Co., of Ardennes, Namur (395, p. 1163), (granted by Class I. likewise), whose retort is extremely thin and well made (thickness only 2¼ inches), but faulty in colour, the foxy appearance indicating the presence of iron, which cannot fail to act as a flux. Besides the retort, these Exhibitors have sent fire-bricks and lumps, having the same fault in colour, but very beautiful in point of manipulation.

France has sent only one specimen of fire-clay gas retorts, and that not remarkable for excellence. The Exhibitor is Mr. PAUWELS, of Paris (1382, p. 1242), who exhibits also an ingenious gas moderator, which does not come before the present Jury for consideration. Fire-bricks and vases are sent by Mr. DE BOISSIMON, of Langeais (427, p. 1199), an eminent manufacturer on the Loire, who has been already referred to, and has received Honourable Mention.

Refractory bricks are sent by two Exhibitors from Portugal and one from Spain. Of the former, some (275 to 278, p. 1311) from the MANUFACTORY at BULHOENS, promise well, but there is no proof of their excellence beyond the appearance of the brick. They are, however, Honourably Mentioned, and the Jury also mention in the same way Mr. JOSE FERREIRA PINTO BASTO (Prize Medal in Class XXV.), of Vista Alegre (279, p. 1311), who exhibits refractory bricks. The Jury are informed that these bricks are made of a clay also used for earthenware, and certainly admirably adapted for the finer works of this kind, and that the Exhibitor is the discoverer of this bed, which has been used for more than a quarter of a century in the porcelain works at Vista Alegre, now very extensive. Great credit appears to be due to Mr. Pinto for the persevering industry with which he has struggled against numerous difficulties, and succeeded in introducing into his country a most useful and important manufacture. The bricks exhibited are neat, and appear of good quality. They contain much of what is technically called "grog" (coarse fragments mixed with fine paste), which renders them capable of standing a sudden application of heat without cracking, but the small extent of the exhibit does not justify the Jury in giving more than Honourable Mention.

The bricks sent by the AULENCIA COMPANY at Madrid (53, p. 1332) are light and of open texture. The colour is very white, and the raw material, which has only been brought into use very lately, appears to be of remarkably fine quality. As there happens to be a considerable demand in Spain for various articles of fine pottery, the more extensive working out of this deposit appears to be a very important matter.

From the Zollverein we find one exhibitor of fire-clay and brick crucibles. Mr. VON MULMAN, of Siegburg on the Rhine (West Prussia, 319, p. 1068), who also sends chemical utensils. This manufacturer makes fire-bricks for blast furnaces and puddling furnaces at a very moderate cost.

Besides the objects in refractory clay already considered, there are some others, chiefly chemical utensils, which, from their condition, magnitude, and other circumstances, are referred to Class XXVII., and which, therefore, it becomes our duty here to report upon. For this purpose the Jury called in the aid of an Associate Juror, T. H. Henry, Esq., F.R.S., and have perfect confidence in the results they have been enabled to arrive at.

The largest and most important exhibitor of crucibles manufactured of an admixture of fire-clay and plumbago, and required for purposes where an intense heat is employed, as for the melting of steel and reducing the precious metals, is Mr. H. W. RUEL, of London (Class I., 435, p. 161), to whom a Prize Medal has been granted. The crucibles in question are described, both in this and other countries, as if made of plumbago, but consist, in fact, of an admixture of that mineral, in variable proportions, with the finest and purest fire-clay. The introduction of the plumbago, is, however, a very important modification, and acts by preventing the injurious effects of contraction and expansion during change of temperature. Besides plumbago, other forms of carbon are sometimes used, especially pounded coke. The best crucibles for the purposes that require the greatest resistance, are either made of one-half of a finely-ground cement or paste, consisting of old crucibles and fire-clay and one-half coke and graphite, or of larger proportions of clay; but those used for the assay of the precious metals are sometimes made of two-thirds graphite.

The crucibles of Mr. Ruel are of the very best quality, and the Associate Juror, Mr. Henry, thus reports on them:—"Mr. Ruel has so improved the black-lead or plumbago crucibles, as to drive the foreigners out of the English market, and his articles are preferred abroad. I have repeatedly tried them and have found them excellent. Messrs. Brown and Wingrove, the gold smelters, use them exclusively, I understand, and in order to make sure I have asked them for a written opinion.* Ruel's *assay* crucibles resist the action of fused oxide of lead much better than any others I have tried. Mr. Ruel is, I believe, the oldest crucible maker in this way, and I think his great merit lies in working steadily for a considerable time to improve the English manufacture, and gradually vanquish the strong prejudice in favour of a foreign article by the superiority of his own production."

To Messrs. LORENZ, KAPELLER, and SON, of Hafnerszell, near Passau (Bavaria, 28, p. 1099), a Prize Medal has also been awarded for black-lead crucibles, which are described as of more refractory character than usual, and which appear to justify this account. The specimens sent include one of very unusual dimensions, measuring 2 feet high and 20 inches in diameter. They are very well made. These manufacturers have long enjoyed a very high reputation in the European market, and their crucibles are extensively sold, having been generally regarded as the nearest rivals to those made of Stourbridge clay.

Mr. F. COSTE, of Tilleur, Liège (Belgium, 397, p. 1163), is an exhibitor of plumbago crucibles of good quality, and is considered worthy of Honourable Mention. Those he exhibits are of two kinds, one of them not containing plumbago, but the former, adapted for melting steel, are so contrived as not to require removal for a fresh charge, and thus present a novelty of construction.

Other plumbago crucibles are sent by Mr. G. B. ATWOOD, of Massachusetts (United States, 426, p. 1463), but they are understood to be really English, made from

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* The written opinion thus requested has been submitted to the Jury, and establishes the fact that this exhibitor's crucibles are of the very best quality for all the most important purposes for which such utensils are required.

American plumbago, and are not in other respects remarkable.

To Messrs. C. E. and F. **Arnoldi**, of Elgersburg, in the Duchy of Saxe Gotha (Prussia, 778, p. 1093), Honourable Mention is awarded for a considerable variety of chemical apparatus in earthenware exhibited by them, and of very good quality. The principal objects here to be noticed are the crucibles, which are of four sorts, but there are also retorts, alembics, and distilling apparatus, besides other articles.

Mr. E. **March**, of Berlin (Prussia, 240, p. 1061), has been already mentioned for his terra-cottas, but he is also an Exhibitor of chemical apparatus of good quality, the principal articles being two large and fine jars for distilling acid. In France we have Mr. **Bonnet**, jun. (1096, p.1230), exhibiting a muffle and various chemical apparatus, considered deserving of Honourable Mention, the muffles being constructed in parts to avoid fracture by heating; and there are also some very neatly-constructed crucibles, and other apparatus, exhibited by Mr. **Deyeux** (France, 476, p. 1200), which appear to be of very good quality.

We find exhibited in Class I. (118, p. 133), a number of melting-pots made for casting brass, and other metals, by Mr. S. **Anstey**. These have been in use for some time, and are made by a patented process. They are recognised as of good quality in all respects.

O. Glazed Fire-clay Goods.

There are several Exhibitors of glazed fire-clay goods, some of them nearly approximating the manufacture of porcelain, but the articles are considered to belong to the present division of clay manufactures. One of the chief of these is the firm of Messrs. S. **Green** and Co. (125, pp. 775-6), to whom a Prize Medal has been awarded in another Class (Class XXV.), but whose salt-glazed ware demands notice here.

This ware is of various qualities, according to the purpose for which it is required, some objects, as ginger-beer bottles, jars, &c., being comparatively coarse, while for chemical utensils it is impossible that too much care can be taken, or too much labour and ingenuity devoted to insure accuracy of form and uniformity of texture. For the principal part of the manufacture the clay is mixed, moulded, and dried, as for other pottery ware, but it is burnt in a room which admits of a degree of heat being applied which would melt any clays, unless of the finest natural quality, or very carefully prepared. In addition also to this high degree of firing, the glaze, instead of being applied by dipping, as is usual with earthenware, is produced by throwing into the furnace, at a certain stage of the process, a quantity of coarse salt, which is instantly vapourised by the intense heat, and this vapour, penetrating to every part of the kiln, produces decomposition where it touches the vessels that are being baked; a film of glass being formed by the combination of a portion of the silica of the clay surface with the soda, while any iron that exists is brought to the surface, becomes oxidized, and gives a tint of colour apparently also adding to the strength of the glaze.

Among the objects thus produced, the exhibitors to whom we have already referred, Messrs. S. Green and Co., have manufactured some of the finest and largest that have been brought into the market; but Messrs. **Doulton** and Co., and **Doulton** and **Watts**, have also sent admirable specimens of great practical utility. Numerous examples are exhibited, both in Class XXVII. and outside the Building, in the North Western Enclosure. The Jury have especially noticed a group of objects by Messrs. Doulton and Co., including pipes of unusual size, and chemical vessels also of large size and extremely perfect; besides a series exhibited by Messrs. **Singer**, remarkable for being glazed inside only, the body vitrified as usual, and the surface of the ware being dry or unglazed. The advantage of the latter condition is considered to be the less probability of cracking, on the application of heat from the outer surface expanding more readily than if salt-glazed in the usual way. All the exhibitors hitherto mentioned have been distinguished by Prize Medals; and although the manufactures in this kind of material are in no degree less important than others already described in some detail, we can only here refer to them without announcing any further reward. It may, however, safely be said, that the objects exhibited on the English side in glazed stoneware, are worthy of great commendation for their excellence, and not less so for their great utility.*

Mr. **Rufford** (89, p. 770) has received Honourable Mention for an ingenious porcelain bath in one piece, two wash-tubs, and several glazed bricks, the former presenting a white glaze upon fire-clay, and being remarkable for its novelty and cheapness. The present exhibitor invented his process for making such baths at the instance of the Society of Arts in the season of 1846-7. The following account has been forwarded to the Reporter:—

"The stone materials for this purpose, viz., fire-clay, China clay, and the glaze, are so assimilated that the two clays are of the same porosity, bear the same heat, expand and contract alike, and the glaze will melt only when the fire-clay is sufficiently burnt. They undergo seventy-two hours of white heat, are not sufficiently fired until cold-blast cast-iron will melt, and they are produced in the glazed finished state at one burning."

In this state they can be cut with a chisel, are perfectly non-absorbent, and are not affected by heat, cold, or damp. The full-sized adult bath costs, if perfectly free from blemish, 7*l*. First class, such as exhibited, 5*l*. 10*s*., or 5*s*. extra if marbled. Second class, colours not clear but body sound, 35*s*. to 60*s*. The glazed white bricks are 13*s*. 6*d*. per hundred, and are found to stand well.

Mr. E. **Ungerer**, of Hirschberg, in Silesia (Prussia, 241, p. 1061), exhibits a set of water-pipes in glazed stoneware of very excellent quality, and is Honourably Mentioned by the Jury.

Messrs. **Salt** and **Mear**, of East Liverpool, Ohio (United States, 203, p. 1450), exhibit a water-vase of somewhat remarkable appearance and good material, and are also Honourably Mentioned.

Miscellanea.

There are two exhibitors in a material which, as it consists of porcelain, might be referred to Class XXV., but which, being widely disconnected in its application from the ordinary uses of that material, and being included in Class XXVII., have been considered by this Jury. One of them presents an adaptation of porcelain for architectural decoration, and the other for street labels, and we can say only a few words concerning each of them.

To Messrs. **Bowers**, **Chalsinor**, and **Wooliscroft**, of Tunstall, in the Staffordshire Potteries (104, p. 772), a Prize Medal has been awarded for a newly-patented application of coloured and moulded porcelain for architectural decoration, capable of being carried out to a great extent, and especially adapted for door-cases and arches, window-cases and arches, string courses, bricks, and cornices for shop-fronts, &c. The material is cheap, brilliant in colour, sharp, and perfectly durable. Some of the decorations exhibited are very elegant, but they admit of great improvement, for which the material is well adapted.

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* Although by the decision of the constituted authorities the Medal which had been awarded to Messrs. S. Green and Co., in Class XXVII., has been withdrawn in favour of the similar honour awarded by the Jury of Class XXV., the author of the present report cannot pass on to other exhibitors without giving some account of the objects which chiefly attracted the attention of his Jury. These are, the large jar, the condensers, the air-tight stoppers, and the acid pump exhibited within the Building, and the whole apparatus of the retort placed outside.

Of these the jar is stated to have a capacity of 420 gallons; and although not without flaws near the base, is yet so perfect in its essential characters, and so much larger than those usually produced, as to be an extremely remarkable and interesting object. The condensers are not only large, but perfect; and the spherical stopper and valve are so ground as to be perfectly air-tight, and must be regarded as an admirable and most useful contrivance. The jar is, perhaps, the largest piece ever manufactured in this ware; and it must be recollected that the degree of heat required to admit of the salt-glaze is extremely different from that used for the large jars from Spain and Portugal. In addition to the articles mentioned, is a triangular worm of a still, which is perfectly air-tight, but admits of being readily and perfectly cleaned in every part. The Jury noticed with great commendation the care and attention bestowed by these exhibitors on chemical and other apparatus.

A Prize Medal has also been awarded to Messrs. SKINNER and WHALLEY (121, p. 774) for a vitreous marble paste in a kind of porcelain, extremely hard and durable, and better adapted for street labels than anything hitherto introduced.

Mr. J. BRANNAM (131, p. 776) has exhibited a small collection of jugs, pitchers, &c., in stone-ware, which, although placed in Class XXVII., more properly belong to Class XXV.; and this is the case also with Messrs. WESTWOOD and MOORE (Class XXVII., 113, p. 773), who send some articles of stone-ware and others of glass, which we can here only mention.

A porcelain stove is exhibited from Frankfort (16, p. 1122), by Mr. J. HOFFMAN, and other similar objects are elsewhere in the Building. Some articles in porcelain of more miscellaneous character have been considered by the Jury of Class XXV. Such are those sent by Mr. GILLE (France, 848, p. 1220), Messrs. MINTON (p. 770), and Mr. J. G. DOWSON (Class XXII., 476, p. 648), all of whom are exhibitors of chimneypieces constructed of porcelain. The two former are noticed in Class XXV.

Messrs. MAYO and Co., of Cheapside, London, are exhibitors of a new kind of joint patented by them, and intended to connect glass pipes conveying gases or fluids (Class I., 18, p. 122), and also of patent siphon vases for containing aërated mineral waters (Class XXVII., 7, p. 764). Both these contrivances are useful and ingenious, and the Jury have awarded a Prize Medal to the exhibitors. The two inventions are combinations of metal with glass or pottery, and are already sanctioned by experience.

To Mr. E. J. COATES, of Bread Street (Class XXVII., 18, 19, p. 765), a Prize Medal is awarded for a cheap and useful combination of iron and glass in the construction of mantelpieces. These are very inexpensive, have a good effect, and are extremely durable, and are said to have been extensively introduced in the United States, although new in England.

A new style of glazing greenhouses and other constructions in glass has been exhibited by Mr. KENT, of Chichester (Outside West, 62, and Class XXVII., 122, p. 774), and is Honourably Mentioned by the Jury. In this method vulcanized Indian rubber is introduced, and the glass is fastened without putty.

Another construction has been exhibited by Mr. DENCH (Outside West, 61, p. 117), of something of the same kind, and is also Honourably Mentioned.

Mr. LIPSCOMBE (Class XXVII., 49, p. 767) is the exhibitor of several small drawing-room fountains, showing some ingenuity and elegance. There is, however, nothing very new introduced in the construction.

Mr. W. BLAKE, of New York (America, 233, p. 1451), exhibits a kind of earthy fire-proof cement or paint, said to form a very compact and strong film resembling slate, and quite impervious to moisture. It is described as occurring in a stratum of rock at Ohio, and is apparently a kind of clay of black colour, and readily reduced to a fine powder. Mixed with linseed oil it forms a pigment of slate or chocolate colour, which hardens on exposure, but does not crack or peel, and is adapted for outside painting, or for damp walls, decks of ships, &c.

APPENDIX.

EXPERIMENTS ON THE STRENGTH OF PORTLAND CEMENT.

Two exhibitors of Portland cement on a large scale, Messrs. J. B. WHITE and SONS, of Millbank, and Messrs. ROBINS, ASPDIN, and Co., of Great Scotland Yard, to both of whom Prize Medals have been awarded, intimated to the Jury their wish to illustrate the strength of their cement as compared with other kinds, and accordingly such members of the Jury as were in town and were able to attend, were present at a series of experiments for this purpose, on the 20th, 22nd, and 23rd September. An account of these experiments is here appended, and some further experiments were performed on the 24th September in the presence of Sir C. Pasley and some other gentlemen, an account of which, attested by them, will also be given.

The first experiments were performed by Messrs. White and Co., and were intended to show the relative strength of Portland and Roman cements. The weights used throughout were iron pigs, estimated at 100 lbs. each.

1. A block of neat Portland cement, 16 inches long, and having a sectional area of 16 inches (4 inches square,) was suspended from each end, and the weight applied exactly in the centre. The block had been made four months. It broke at 1,580 lbs., including the weight of the scale (estimated at 80 lbs.). The fracture was perpendicular, even, and good.

2. An exactly similar block of neat Roman cement, made from Harwich stone, and seven weeks old, broke at 380 lbs. This must have been a bad sample of the material.

3. A similar block of neat Sheppey cement, made in the month of May, broke at 980 lbs.

4. A block of neat Portland cement, having a sectional area, measuring 2¾ inches by 2 inches, made 31st March, was pulled asunder with the fracture as shown at the top, at 2,280 lbs.

5. A block of Portland stone, having the same sectional area, and in all respects resembling the above, broke at 1,480 lbs. The fracture showed no flaw in the stone, which was of even grain and good quality.

6. Two blocks of Portland stone, being 6-inch cubes, had been cemented with about one-eighth of an inch thick of Portland cement, about four months before the experiment. The upper stone being held by iron clippers, the weights were suspended from the lower one, the depth of the holes for the clippers being five-eighths of an inch. When the weight amounted to 3,780 lbs., the former broke. The square holes for the clippers being made deeper in another part of the stone, and the scale being once more loaded, the iron hook by which the scale was suspended broke at 4,580 lbs., the cement still remaining perfectly sound. In this experiment, therefore, the strength of the cement was not absolutely tested.

7. Two similar blocks of Portland stone joined together with Roman cement, the thickness of the joint being a quarter of an inch, and the age five months, were separated by 2,780 lbs. The cement in this case left the stone partly on the upper, and partly on the lower surface, showing, that the adhesive force of the cement was greater than the cohesion. It was estimated that Roman cement, under such circumstances, would separate at under 1,000 lbs.

8. Five hard stock bricks were taken, cemented together with a mixture consisting of one-half Portland cement and one-half sand. They were suspended from the upper brick, and the scale was attached to the lower. The fracture took place at 2,580 lbs. at the top brick.

9. The principal experiment of Messrs. White consisted in breaking down a beam constructed of ten courses of hollow bricks cemented together, the upper part having three courses on edge and four flatwise, and the lower part two courses on edge and one flatwise. They were fastened with Portland cement, and strengthened by lengths of hoop iron, a number of which, amounting to

fifteen, were inserted. The iron measured 1½ inch by 1/16th nearly. The following are the dimensions of the beam:—

	Ft.	In.
Total length - - - - -	24	4
Length between bearings -	21	4
Depth - - - - - -	4	6
Thickness at bottom - -	2	3
" top - - -	1	6

	lbs.
It was built of 1,200 hollow bricks, weighing	10,750
32 bushels cement " 32 " sand "	6,400
Total weight of beam - -	17,150
Weight of stone at the top of the beam - -	672
" attached scale - - - - - -	1,792
" suspended portion of beam - -	15,000
Total suspended weight -	17,464

It may be well to state, that if built of common bricks and fastened with Roman cement and sand, the net weight of the beam, including scale and stone, would have been 21,207 lbs., being a difference of 3,743 lbs. resulting from the use of hollow bricks.

On the other hand it appears that the actual area of cemented surface is only 700 square inches instead of 1,060, which it would have been if solid bricks had been employed; for it appears that the actual sectional area of the bricks is 5¾ by 4¼ inches, the rims or sides being ⅜ths inch, so that the hollow part may be estimated at 9 square inches. There are in all forty vacuities, and we thus have—

	Inches.	Sq. Inches.
Six uppermost courses, measuring in sectional area - - - -	36×17·25 =	621
Three lower courses, measuring in sectional area - - - - -	16×26·6 =	439
		1,060
Deduct spaces = 40 × 9 - - -	=	360
Total sectional area cemented -		700

The depth of the beam being 52½ inches, we thus have, as a measure of the strength of the beam, 700 × 52½ = 36,750.

One object in the peculiar form and proportions of this beam was to institute a comparison between the strength of Roman and Portland cement, a similar beam having been constructed in 1837 at Nine Elms, by Messrs. Francis and White, at the suggestion of Mr. Brunel, the bricks in which were, however, common stock bricks, bonded in the usual manner, and bedded and grouted with a mixture of equal parts of the best Roman cement and clean Thames sand. In this beam there were nineteen courses, the thirteen uppermost being two bricks thick, and the six lower ones two and a-half; the sectional area being 1,107 superficial inches, and there were inserted fifteen lengths of hoop iron 1½ inch by 1/16th. The beam was borne on two pieces, leaving a clear bearing of 21 feet 4 inches; and after it had been built about three months it was loaded with 11,200 lbs. of pig-iron, placed on a platform suspended from the central part of the beam. At the end of another three months the weight was increased to 24,000 lbs. After twelve months it was broken down by increasing the weight to 50,622 lbs.

The depth of this beam being 57 inches, the measure of its strength compared with that of the other is 1,107 × 57 = 63,099; and since 63,099 : 36,750 :: 50,652 : 29,500, it is considered by the exhibitors that the breaking weight of their beam, if in Portland cement, ought to have been 29,300 lbs.

The beam, as originally constructed on the south side of the Enclosure outside the western extremity of the Exhibition, was completed in April last, and has since been left unsupported, carrying 17,464 lbs., as before explained, consisting of the full weight of the beam itself, the stone, and the scale, until the 20th September. On that day it was loaded in the centre part with 15,000 lbs. weight of pig-iron, and in this state was left till Monday, when it was carefully examined, and found free from any flaw. The loading was then continued until it was weighted with 40,000 lbs., when a deflection of nearly one-eighth of an inch was observed. Shortly afterwards, at 41,600 lbs., two cracks were detected, commencing on each side at the fourth brick from the centre, and before long a third crack exactly in the centre. One of these cracks commenced with the fracture of a brick, but the other two at the contact of the cement with bricks. When another 10,000 lbs. had been added, the iron hoop was heard to crack, and the piers were slightly affected, as was proved by the breaking of a string that had been stretched from one end to the other to measure the deflection. With this weight also the cracks extended through the six lower courses, and the deflection was about five-sixteenths of an inch. Additional weight being still put on up to 62,800 lbs., this weight was borne for a short time, but the fissures all widened manifestly; the central one extended vertically through bricks and cement indifferently, and the beam at length separated into two parts, thrusting the piers considerably out of the upright.

After the conclusion of the experiment it was found, that of the iron hoop there were only thirteen pieces traceable, and of these ten were torn asunder at the principal central crack; the other three were doubtless broken also, but at the side fissures. The important part played by the iron in this case must not be overlooked, but cannot very easily be estimated. As a practical proof, however, of the use of brick beams and their strength, this experiment is of considerable value in itself, besides affording an additional proof of the value of Portland cement.

The true comparative strength of Roman and Portland cement is, perhaps, not so well tested as if the bricks had been of the same kind in the two experiments; but estimating as nearly as circumstances will admit, it appears that the Portland bears to the Roman a ratio of 2¼ to 1 very nearly. It must, however, be remembered that the Roman cement beam had been built seventeen months, and the Portland only five, a fact greatly in favour of the former material.

The experiments of Messrs. Robins and Aspdin were of somewhat similar nature, but cannot be regarded either as identical or parallel. They were made on various mixtures of Portland cement, some of them joining together bricks and stone, and others formed into slabs of various dimensions. There was no experiment on so large a scale as the brick beam of Messrs. White, but the other specimens were, on the whole, larger, and the illustrations were of great interest. We proceed to enumerate them.

1. A block of the shape of that shown in Experiment 4, of Messrs. White, but consisting of three parts of sand and one of Portland cement, and having a sectional area of 4 inches by 2⅛ inches (= 8·5 square inches) was suspended from a clip, and held a scale weighing about 1 cwt. The block had been made about one month. It broke at 2,400 lbs., including scale, the fracture resembling that in the other case, but a part of the cement being broken off by the clip.

2. A similar block, having a sectional area of 3½ by 2½ inches, and made with four parts sand and one part Portland cement, broke with 2,600 lbs., including scale. The fracture was clean, and at the lower part of the neck. The texture of the cement was even.

3. A beam of sixteen common stock bricks, joined by very thick intervals of real Portland cement, was held at the extremities, and broke by a weight of 500 lbs. suspended from the middle. In this case the part broken was the brick only. The beam had been made one month.

4. A similar beam of the same magnitude, but having one end only supported, and projecting 3 feet 2½ inches from the bearing point, was weighted, and broke with 256 lbs., exclusive of the scale suspended from the free extremity. In this case the fracture took place at the eleventh brick from the fixed extremity, and both brick and cement were fractured.

5. Another beam of twenty-two bricks, also fixed at one extremity (only the number free being reckoned),

was broken by 1½ cwt., in addition to the scale. The length of this beam was 51 inches.

6. A solid step, constructed of two parts Portland cement and one part broken brick, and weighing 3¾ cwt., was fixed at one extremity, leaving 6 feet 4½ inches projecting. It supported its own weight, and broke off close to the bearing point, when the third weight of 56 lbs. (making a total of 168 lbs.), was placed on the extreme end.

7. Two blocks of neat cement, 1 foot 5½ inches long, 9 inches wide, and 4½ inches thick, cemented together with neat cement, broke at 6,000 lbs. The lower part of the block gave way.

8. Twenty stock bricks in courses, united with cement, composed of one of cement and one of sand, 3 feet 6½ inches bearing, the ends supported by iron clamps, and the weight applied to the centre. The bricks broke at a weight of 1,200 lbs.

9. Six fire-bricks in courses, joints all cement. The upper brick broke at 2,836 lbs.

10. The five fire-bricks from the last trial were again tested, the iron being inserted in the second brick from each end. The upper brick broke, carrying with it also a part of the lower weight, 4,600 lbs.

11. Two pieces of Portland stone, 2 feet by 11½ inches, 7¾ inches thick, neat cement joints. The lower stone broke, carrying away a very small portion of the cement joint; weight 7,272 lbs.

The last five experiments (Nos. 7 to 11) were performed on the 23rd September, in the presence of General Sir Charles Pasley, C.B., Professor Wappler, of Vienna, and other scientific gentlemen, by the two former of whom the above statement is attested.

The Jury have great satisfaction in placing these experiments on record as among the results of the Exhibition. They cannot fail to be regarded with much interest by every one connected with engineering and the arts of construction, and, combined with what was before known on the subject, they fully prove the value of the peculiar material known as Portland cement, and its great advantage over the Roman or Parker's cement. There can be little doubt that the mud of many rivers running over soft calcareous rock, and containing also a large per centage of clay, might be used with advantage, as well as the mud of the Medway; but it yet remains to determine the true chemical cause of the great difference observable in similar proportions of calcareous and argillaceous matter for the purposes of cement, and till this is done, it can hardly be expected that artificial cements will exactly replace those which occur naturally, and whose value has been proved by experience.

Although it did not form one of the subjects of the experiments instituted before the Jury to prove the resistance of Portland cement to crushing weights, it may not be out of place to add here the results of experiments on this subject.

A block of neat Portland cement, manufactured by Messrs. Robins, Aspdin, and Co., thirty days old, measuring 18 inches × 9 × 9, was tested by a Bramah's hydrostatic press, and is said to have withstood a pressure of 41 tons for upwards of a minute, when it broke up with a report.

A similar block, of one part cement and one sand, twenty-eight days old, crushed at 108 tons. Another, four sand and one cement, at 45 tons; and another, nine sand and one cement, crushed at 4½ tons.

A small piece of neat Portland cement, exposing a surface of 1½ inch by 1 inch, and six months old, withstood a pressure of 40,320 lbs., while a piece of Portland stone of the same size crushed at 2,576 lbs.

D. T. ANSTED, Reporter.

London, October 1851.

CLASS XXVIII.

REPORT ON MANUFACTURES FROM ANIMAL AND VEGETABLE SUBSTANCES, NOT BEING WOVEN, FELTED, OR INCLUDED IN OTHER SECTIONS.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers, and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

DON JOAQUIN ALFONSO, *Chairman*, Spain; Director of the Conservatory of Arts, Madrid.
J. E. GRAY, F.R.S., P.B.S., *Deputy Chairman*, British Museum; Keeper of the Zoological Department, British Museum.
REV. GORHAM D. ABBOTT, United States; Spingler Institute, New York City.
A. J. BALARD, France; Member of Institute.
DR. E. LANKESTER, F.R.S., *Reporter*, 22 Old Burlington Street; Secretary to the Ray Society.
T. J. MILLER, 7 Millbank Street; Merchant.
G. PETERSON, Russia; Member of the Scientific Committee for the Administration of the Domains of the Empire.
T. A. WISE, M.D., 9 Prince's Gate, Hyde Park; Hon. East India Company.

Associate.

NATALIS RONDOT, 1 Rue Fontaine, St. George's, Paris; Late of the Embassy to China, &c., &c. (Juror, Class XXVI.)

IN commencing their labours, the Jury thought it advisable to divide themselves into Sub-Committees for the purpose of examining the various objects submitted to their attention. The subdivisions of the Class enabled them to do this with facility, and the following Sub-Juries were formed:—

The Chairman, Don JOAQUIN ALFONSO, M. BALARD, and Dr. LANKESTER for Sections A and B, including gutta percha and caoutchouc manufactures.

Messrs. GRAY, ABBOTT, and WISE for Sections B and C, including manufactures from various animal substances, as ivory, tortoiseshell, horn, &c.; and from vegetable substances, as wood, vegetable ivory, cork, &c.

Messrs. MILLER and PETERSON for Sections E and F, embracing manufactures of straw, and of a miscellaneous kind from various animal and vegetable substances.

Dr. LANKESTER and Dr. WISE were appointed to draw up the present Report. The avocations of the latter gentleman having called him from town, the drawing up of the Report devolved on Dr. Lankester. Each of the Sub-Juries was requested to furnish the Reporter with remarks upon the various objects in their Sections; and the Reporter is indebted for a large proportion of the general remarks on the manufactures in caoutchouc and gutta percha to M. BALARD.

The constitution of this Class is somewhat peculiar and exceptional. The necessity for its existence was felt in the fact that a large number of articles manufactured from vegetable and animal substances could not properly be included in the Classes which embraced either woven or felted materials. This was especially the case with the very numerous applications of caoutchouc and gutta percha to the production of articles of constant and increasing use. What is true generally of these substances was felt in relation to many things manufactured from such animal substances as horn, ivory, whalebone, &c., and the vegetable substances—cork, vegetable ivory, and cocoa-nut fibres. At the same time the Jury experienced some difficulty in defining what articles rightly belonged to their Class without trenching upon the domain of others. This difficulty had evidently been felt in the disposal in the Building of many of the objects exhibited, and one of their first tasks was to send to other Classes objects which had been placed in Class XXVIII., and which had appeared under this head in the Official Catalogue. They had also to examine other Classes for the purpose of bringing objects into their own Class, which otherwise might have been overlooked. With all the other precautions taken by the Jury, it is to be feared that some objects properly belonging to their Class, from being placed in other Classes, or from not being in the Catalogue, have not received the attention they deserved. Especially have they felt that many articles exhibited in the Foreign Department, from being sent to the Exhibition after the awards were made, may have escaped the notice which their merits would otherwise have demanded.

In presenting this Report, the Reporter has adopted the plan laid down in the scheme of "Heads for Juries," published by the Royal Commission, each Section of the Class, where necessary, being treated of under the following heads:—1. General Remarks. 2. Council Medals. 3. Prize Medals. 4. Honourable Mentions. 5. Remaining Exhibitors.

SECTION A.—MANUFACTURES FROM CAOUTCHOUC.

§ 1. *General Remarks.*

The existence of a milky juice in many plants, which flows from them when their tissues are wounded, is a fact that has been familiarly known from time immemorial. It is, however, only a matter of recent discovery that this milky juice characterizes certain families of plants. Although the great majority of plants which yield this juice in abundance are tropical, yet they are not without their European representatives. The spurges, dandelion, and celandine of our road-sides are instances. The families of plants which furnish this milky juice in the greatest abundance are *Moraceæ*, *Euphorbiaceæ*, *Artocarpeæ*, *Apocynaceæ*, *Cichoraceæ*, *Papaveraceæ*, *Campanulaceæ*, and *Lobeliaceæ*.

This juice, which is called by botanists "the milky juice," because it has an appearance similar to milk, has also the physical constitution of that fluid. It is an aqueous liquid, charged with soluble matter, in which float globules of a substance insoluble in water, and which are by their tenuity held in suspension in the liquid, but for which they have no affinity, in the same manner as butter is held in suspension by milk. From the difference of the refractive powers of these two substances, each of which, taken separately, would be colourless or transparent, arise the opacity and white colour of the two; hence the compound is properly called a "milky juice."

The analogies which this juice exhibits with the milk of animals and vegetable emulsions are seen in the manner in which it acts when left to itself. Run out into the air, received and preserved in close vessels, it separates itself into two layers, as milk itself would do. The watery part very soon has an insoluble part floating upon it, which collects together, and swims at the top as cream swims upon milk, and which forms nearly the half of the entire mass.

But with these physical resemblances the analogies cease. That which in milk and in emulsions produced from seeds collects on the surface of the aqueous liquor, is, properly speaking, a fatty body, containing oxygen in its composition, as they all do; while the kind of cream which swims upon the milky juice of the plants when left to itself, is one of the compounds of carbon and hydrogen which are found so frequently in organic bodies. The latter, when obtained for commercial purposes, bears the Indian name of *caoutchouc*.

This substance has long been known to the natives of both the Old and New World, in Hindostan and South America. It was not, however, till the expedition of the French Academicians to South America in 1735, that its properties and nature were made known in Europe by a memoir upon it by M. de la Condamine. This notice excited little attention; and subsequently notices of this substance were sent to the French Academy in 1751 by M. Fresnau, and in 1768 by M. Macquer. At the latter end of the last century and the beginning of the present it was brought into this country in small quantities, where, on account of its being used for rubbing out black-lead pencil marks, it acquired the name of India-rubber.

Although, after its application to the water-proofing of garments, its consumption gradually increased, the importation into the United Kingdom in 1830 appears not to have been more than 50,000 pounds. In 1842 the import of this article had increased to between 700,000 and 800,000 pounds. Up to the present time the consumption of India-rubber has prodigiously increased; and one port alone in South America is said now to send to Great Britain nearly 4,000 cwts. annually. To the large consumption in the United Kingdom we must add that of America, where the application of caoutchouc has been much more general and successful than even in our own country.

The particular species of plants which are employed for procuring India-rubber are very numerous, and it is probable that many yield it which are not yet known to botanists. The tree which supplies most in Continental India is the *Ficus elastica*, a tree belonging to the order *Moraceæ*; it is exceedingly abundant in Assam. All the species of ficus yield caoutchouc to a greater or less extent in their juices, and even the common fig (*Ficus carica*) of Europe contains it. Species of ficus produce the caoutchouc brought from Java, and *F. radula*, *F. elliptica*, and *F. prinoides* are amongst those mentioned as affording a portion of that brought from America. Next to the *Moraceæ*, the order *Euphorbiaceæ* yields the largest quantity of caoutchouc. The *Siphonia elastica*, a plant found in Guiana, Brazil, and extending over a large district of Central America, yields the best kinds of India-rubber that are brought into the markets of Europe and America. To another order, *Apocynaceæ*, we are indebted for the caoutchouc which is brought from the islands of the Indian Archipelago. The plant which is the source of this substance in those districts is the *Urceola elastica*, a climbing plant of very rapid growth and gigantic dimensions. A single tree is said to yield, by tapping, from 50 to 60 lbs. annually. Many other plants of this order yield caoutchouc, and of those given on good authority we may mention *Collophora utilis* and *Cameraria latifolia*, plants of South America; *Vahea gummifera*, in Madagascar; and *Willughbeia edulis* in the East Indies. To this order belongs the cow-tree, or Hya hya (*Tabernæmontana utilis*), of tropical America, which yields a milky juice that is drunk by the natives of the district in which it grows.

The caoutchouc, whilst it is in the tissues of the plant, is evidently in a fluid condition, but after its separation from the other fluid parts, its consistence becomes changed, and it forms a solid mass similiar, in its external characters, to vegetable albumen. In this state it is dense and hard, but may be separated and rolled out so as to form a sheet resembling leather. It has many interesting and peculiar properties. Insoluble in water and in alcohol, it dissolves in ether, in the sulphuret of carbon, the fat oils, and the liquid carburets of hydrogen.

It is soft and elastic at the ordinary temperature, but at the temperature of 2° above the freezing point it acquires the hardness of wood. A temperature of 100° softens it without altering its form. It then unites with itself with the greatest facility, and two pieces recently cut apart reunite so as to render it impossible to discover where the junction has taken place. But a higher temperature, approaching 150°, changes it into an adhesive substance, which, on cooling, does not recover the primitive properties of caoutchouc.

In this state of recent coagulation, and while still in a pulpy condition, caoutchouc possesses a degree of plasticity which admits of its receiving, by means of moulds, the most varied forms.

The greater part of the caoutchouc of commerce is obtained by the natives of the countries in which it is produced, in the form of shapeless masses, collected at the foot of the tree which has been incised or cut, for the purpose of extracting the juice from it, or solidified in a trench made in the earth, and coagulated in this rude mould in voluminous masses, which often resemble the trunk of a large tree. A part of it, however, possesses other forms, which the rude art of the natives attempts to communicate to it. They model, with plastic clay, figures of animals, imitations of the human foot, and pear-shaped bodies, and then dipping these moulds in the thickened caoutchouc, and renewing the connexion when the first coat is solidified by exposure to the air, they obtain, by breaking the mould and getting it out in fragments through an opening properly arranged, hollow flasks, figures of animals, rough slippers, &c. They thus make caoutchouc serve for the manufacture of objects for which we ourselves employ animal membranes and leather.

Caoutchouc is obtained from both the Old and New World. The East Indies furnish caoutchouc, of which numerous specimens have been exhibited in the Crystal Palace by the East India Company. This caoutchouc, which comes principally from Java, is often glutinous, and is less esteemed in commerce than that furnished by the equatorial regions of America. Great quantities of caoutchouc are imported into Europe from Mexico, from South America, and especially from the province of Para, in Brazil. That which comes in the shape of bottles is generally preferred, and when it is pure, and the different coats which comprise it are well united, it may be employed immediately for many purposes. But it often happens that the coats which form the pear-shaped masses are badly united. It then becomes necessary, in order to make use of them, to work it up by a process of kneading, so as to obtain it in a coherent or homogeneous mass. This operation becomes especially indispensable when, as most commonly happens, the caoutchouc is in large impure masses, and mixed with sand and the *débris* of vegetable matter. These impurities do not entirely proceed from the moulds made in the earth, into which the juice has been allowed to exude, and in which it has been left to thicken and solidify, but their quantity and their presence between the coats of the pyriform masses show that the impurity is mainly to be attributed to fraud. The caoutchouc thus obtained is not applicable to any use until it has undergone a previous purification.

The purification of the caoutchouc is accomplished by submitting the impure caoutchouc to the action of cylinders furnished with teeth turning in opposite directions and with unequal velocities, which cause it to undergo a kind of mastication. If the matter which renders the caoutchouc impure adheres very closely when dry, this property is lost when it is moistened. From this it happens that, by causing a small jet of water to flow into the apparatus, these foreign matters, crushed by the mill, are carried off by degrees, and the purified portions of caoutchouc unite the one with the other. By the subsequent exposure of these masses of purified caoutchouc to a second mastication, but performed dry, they are softened by the heat evolved during the forcible compression to which they are then submitted. In this treatment the caoutchouc becomes softened without being liquified, and a homogeneous mass is formed which is cut in the form of rectangular blocks.

These are again placed in casting moulds, in which they are powerfully compressed, until they are completely cooled, when it is found that the pressure has freed them from cavities, air-bubbles, &c. By submitting them to the action of knives moved very rapidly by a mechanical action, and the edges of which are constantly kept wet by a thin jet of water, the caoutchouc is cut into sheets of various thicknesses, which, subdivided in their turn, constitute those small parallelopipedons used by draughtsmen to rub out the marks of black-lead pencils.

This use of caoutchouc was, in England, for a long time the only one to which it was applied; but this limited use was far from indicating the extent to which caoutchouc has been employed in the last thirty years, or the multiplicity of services it has been called upon to perform for sanatory and industrial purposes. To rub out pencil marks, to form the rude slippers which seemed well adapted to the Indian toilet, but to which a form acceptable in Europe had not been imparted, were, in fact, the only uses to which caoutchouc was applied up to 1820. In England was discovered the art of stretching it into thin sheets, and thus making it available for the production of waterproof fabrics. In France was discovered the art of drawing it out into delicate threads for the manufacture of elastic tissues. We are indebted to Messrs. Mackintosh and Hancock for the application of caoutchouc to the rendering tissues waterproof, and for the manufacture of those garments which throughout the world have rendered unquestioned service to the cause of health, and have made the name of one of their inventors so justly popular.

The garments called Mackintoshes are well known. They are formed of fabrics covered on one side with caoutchouc, or two fabrics are united by the caoutchouc between. They are thus rendered impermeable to water, but at the same time they possess a flexibility such as it had never been possible to obtain by the employment of other varnishes. For the purpose of obtaining the sheet of caoutchouc sufficiently thin for this purpose, it is dissolved. The solid carburets of hydrogen are soluble in the liquid carburets, and for this purpose spirits of turpentine and the volatile products of coal tar were first employed. But after having obtained this solution, it was necessary to evaporate a great quantity of it for the purpose of obtaining a coating of caoutchouc, which at first occupying a great space, should be reduced to a small one when the drying was complete. For the purpose, however, of economising the solvent, a method is employed of kneading the caoutchouc, by means of powerful machines, with the spirit of turpentine or naphtha, and impregnating it with the menstrua without dissolving it, and softening it without making it a liquid; the caoutchouc rendered pulpy, is then spread upon the cloths by means of a flattening mill, and the process of evaporation is thus dispensed with. Waterproof garments were thus rendered cheap and available for the use of every class. This description of garment, nevertheless, presented a notable fault which was not avoided until a later period, and which arose out of the properties inherent in the caoutchouc itself. This substance, which in ordinary circumstances possesses very great elasticity, such as to justify the name by which it is designated in France, *gomme élastique* (elastic gum), loses this elasticity when exposed to a temperature near the freezing point of water, and this suppleness, which might almost cause a sheet of caoutchouc to be mistaken for an animal membrane, gives place all at once to the rigidity exhibited by the same membrane when dried. This property, which in cold weather was a real defect, when applied to fabrics rendered waterproof by caoutchouc, has been found very useful in the making of garters, braces, and other articles in which the elasticity of the caoutchouc has been brought to supersede that which had, until then, been obtained by the employment of spiral metallic springs. In order to obtain the threads which are used for the manufacture of elastic tissues, either the flasks of caoutchouc in its natural state, cut in half and flattened by pressure, or else those masses of purified caoutchouc which are sold in continuous sheets, cut by knives, wetted by a small jet of water, are employed. These sheets are divided into thongs; the latter are afterwards subdivided into very narrow bands, which serve in their turn to produce the threads employed for the manufacture of the tissues. If by a slight elevation of temperature the natural elasticity of the caoutchouc is increased, these narrow bands can then be stretched into threads of great length by drawing them out and rolling them upon bobbins. But it may be well conceived that the management and weaving of the threads would be very difficult if they retained their elasticity. Fortunately the particles of the caoutchouc eventually accommodate themselves to the forced position which they have been made to assume, and the exposure to a low temperature materially hastens this result. The threads having thus lost their elasticity can then be introduced like common threads into the fabrication of stuffs; they can be covered with a different thread, by winding spirally round them cotton, silk, &c., and this compound thread may be in its turn introduced into the composition of new tissues. In all these operations the caoutchouc has retained all its rigidity, but that elasticity of which it has been deprived by a long distension and a low temperature, can be restored to it by means of a proper degree of heat. The stuff thus woven is exposed to a temperature of from 140° to 160° Fahrenheit by the passage of a hot iron, when each thread resumes with its primitive length the diameter which it first possessed. The fabric diminishes in length without increasing in width. The tissue is thus compressed, and the caoutchouc, which has regained its elasticity, communicates it in a permanent manner to these tissues. The manufacture of these threads of caoutchouc constitutes at present a distinct branch of industry from that which, making use of them either in an uncovered state, or covered with silk and cotton, combines them with ordinary threads in the way of weaving; and, like the manufacturers of linen or cotton fabrics, the makers of the elastic tissues buy the threads of caoutchouc in bobbins of different numbers. When the limited lengths of the narrow bands from which these threads are manufactured is borne in mind, the necessity is foreseen of being able to unite them end to end for the purpose of making continuous threads. A remarkable property of caoutchouc renders this easy. It unites with itself with the greatest readiness if it be the least warm; and two surfaces recently cut with a very sharp instrument, may be made to adhere together by means of pressure, with a cohesion equal to that which unites the other parts of the same thread. But although in this case this property is made useful, in other instances the limited elasticity, and the rigidity communicated to it by a low temperature, are great drawbacks.

However, all these properties inimical to its use disappear in that combination of sulphur with caoutchouc called vulcanized India-rubber, which exhibits such special properties as to form in some degree a new substance. This transformation of caoutchouc was first applied to practical purposes in America.

While in England the employment of caoutchouc was being developed principally in regard to the rendering of cloths waterproof, and in France its elasticity was being made available for the manufacture of certain tissues, it was turned to account in America for waterproof shoes, by making use of the processes discovered by Mr. Charles Goodyear, who, since 1836, had been engaged in the discovery of means for making use of caoutchouc, with a skill and perseverance which have borne the most happy fruits. It is not that attempts at fashioning according to the European taste, and thus rendering useful the Indian shoe made of caoutchouc, had not been frequently made in Europe, but these attempts had hardly been successful in giving them acceptable forms, and the stiffening by cold rendered them very inconvenient. However, Mr. Goodyear at last succeeded in making shoes of raw India-rubber purified, and perfectly free from objection, thus completing by the manufacture of waterproof shoes the service which Mackintosh had begun by the invention of the garments which bear his name. Since 1842, Mr. Goodyear has imported into Europe shoes which possess an unlimited and permanent elasticity, and which resist cold; two of their surfaces may be pressed against each other without the least adhesion taking place. These are precisely the remarkable qualities which characterize that caoutchouc which is called in the present day vulcanized India-rubber. Impressed, perhaps, with the idea, too often moreover a just one, that the specification of a patent is sometimes nothing more than the occasion of attracting the attention of imitators, Mr. Goodyear took no patent for this article, but he endeavoured in Europe to take advantage of his discovery, by communicating it as a process of which he alone possessed the secret, which might be lost to mankind and disappear with its sole possessor, when Mr. Thomas Hancock, of Stoke Newington, who had been engaged in Europe in the working of caoutchouc with no less perseverance and success than Mr. Goodyear in America, discovered anew the process of the vulcanization of India-rubber, and secured it by a patent, which Mr. Goodyear afterwards demanded for the same subject. Mr. Thomas Hancock discovered that a band of caoutchouc dipped into melted sulphur, and impregnated with this substance, without losing any of its properties, only required to be afterwards exposed to a temperature of about 300° Fahrenheit, to acquire properties entirely novel, which were precisely those possessed by the material employed by Mr. Goodyear for the waterproof shoes.

This was, as may be seen, a new discovery of a fact already known—a novel solution of a problem which was known to be soluble, since it had been already solved. This discovery must, however, have presented its difficulties, and required also the fortuitous co-operation of favourable circumstances. For though analysis might have pointed out to Mr. Hancock the existence of sulphur in the productions of Mr. Goodyear, and have also disclosed the presence of the salts of lead which the latter had deemed indispensable, it could not in any manner give him a clue to the discovery of the essential condition of this transformation, that is to say, the employment of a given temperature which alone was able to impart to the mixture of caoutchouc and sulphur, the new properties which appeared to make of it an entirely new body.

Whatever may be the share of merit assigned to Mr. Goodyear and to Mr. Hancock in this important invention, the latter has not the less exclusive merit of having discovered that sulphur was the sole cause of the vulcanization of India-rubber. On seeing Mr. Charles Goodyear introducing the different salts of lead into the specification of the patent which he subsequently took out, it is felt that he regarded their intervention as indispensable, while it is now demonstrated that sulphur alone is sufficient; if other substances are employed in certain cases, it is not so much to aid in the vulcanization of the caoutchouc as to add to its weight and solidity.

The vulcanization of India-rubber is an easy process. The India-rubber, softened by the heat evolved when it is being kneaded by strong machines, is mixed with the sulphur in the masticating apparatus already alluded to. This mixture retains all the solubility of the caoutchouc in the different menstrua,—the property of becoming hard at a low temperature as well as that of uniting with itself; but as soon as it is exposed to a temperature of 300° Fahrenheit,—a temperature which would have sufficed to change the pure caoutchouc,—the matter acquires new properties. It is no longer soluble in the menstrua which dissolve caoutchouc, but is impregnated with them by contact, and swells out like an animal membrane that is moistened with water; resuming its primitive properties on being dried. It no longer becomes rigid when exposed to cold, nor does it unite with itself, and it resists without any alteration a temperature which would have sufficed to transform the ordinary caoutchouc into a sticky matter; it is, in short, vulcanized India-rubber. This absence of the tendency to adhesion is so decided, that in actual manufacture no use whatever can be made of the shavings of the caoutchouc thus modified, and the means of separating the sulphur and reproducing the pure caoutchouc presents at the present day an important problem to solve. If this action of heat which modifies the caoutchouc is exercised upon a mixture enclosed and compressed in a mould, the material then acquires a form which the indefinite and permanent elasticity of the vulcanized India-rubber causes it to retain.

This sulphurization of the India-rubber, instead of being produced with free sulphur, may be obtained with sulphur in a state of combination, as with the chloride of sulphur. If articles of common caoutchouc are immersed for one or two minutes in chloride of sulphur, diluted in 50 or 60 times its weight of sulphuret of carbon, they acquire by exposure to a proper temperature, all the properties of vulcanized India-rubber. In commerce this caoutchouc is designated by the name of *converted* caoutchouc.

From the moment in which the vulcanization of India-rubber was known, all the inconveniences which ordinary caoutchouc presented having disappeared, its employment received an extension which is continually increasing, and each year sees new applications of this product spring into use. The enumeration of the objects exhibited by the two manufacturers to whom this branch of manufacture is the most indebted, Mr. Goodyear, in America, and the firm of Mackintosh, in Europe, will tend to show how widely spread, and how varied the use of this material has already become.

§ 2. *Council Medals.*

1. **Charles Mackintosh** and Co., 73 Aldermanbury (76, pp. 782, 783). The firm of Charles Mackintosh and Co. comprises the names of the men who in Europe have made the most useful discoveries in the art of applying caoutchouc to the most varied uses:—the late Mr. Mackintosh, who gave his own name to the waterproof garments, and Mr. Thomas Hancock, whose share of merit in the discovery of the vulcanization of India-rubber we have already mentioned. In going through the collection of articles exhibited by this firm, the importance of the uses to which the substance is capable of being applied, especially since the discovery of the process of vulcanization, can be readily appreciated.

The kinds of fabrics with which the garments called Mackintoshes are manufactured have always remained the same, but the garments themselves have acquired more lightness and less smell, and the substitution of vulcanized for common caoutchouc insures to them at the present day a permanent suppleness.

The other services which these fabrics are called upon to perform, have been greatly multiplied. Their price having become less, they are capable of being applied in lieu of tarpaulings for covering waggons, carriages, &c. The property which they possess of serving to contain water, and which had at first been made available for a well-known therapeutic use, has allowed of their being made into portable baths, which can be rolled up like an ordinary cloth when not in use. The shoes exhibited by Messrs. Mackintosh and Co. are made with much care, and with a degree of elegance which shows that in Europe these articles are but little used except by the more opulent classes.

It is not only in the making of shoes that India-rubber has been called in to supersede leather; the articles exhibited by Messrs. Mackintosh and Co. show the use that can be made of it to form pistons of pumps, and how conical valves of India-rubber can be advantageously substituted for leather or metal ones. Sheets of caoutchouc of different colours, either smooth or worked in relief, are brought in to supersede moulded ornaments in the manufacture of furniture, of ottomans, and in the binding of books.

The use of vulcanized India-rubber to form the piston-valves in steam-engines on the screw principle, has greatly contributed to the employment of these novel motive powers, which are destined in some degree to effect a change in navigation by allowing steam to come in solely as an auxiliary to the wind. The exhibition of Messrs. Mackintosh and Co. comprises a valve of this description, which after six months' use has undergone so little alteration that it may be foreseen that these articles possess an almost unlimited durability. The rendering available the impermeability of their fabrics to air and gas has likewise been extended. To the air-cushions which have been long used are now added the air-mattresses, so well adapted as beds for travellers and invalids; boats inflated with air, at once portable and incapable of sinking, and which for life-boat uses and in inland voyages are capable of rendering great service. The collection of Messrs. Mackintosh presents some specimens of this kind of great interest. Lieut. Halkett, of the Royal Navy, by making them in several closed compartments in such a manner that the stuff being pierced through at one point cannot lead as a necessary consequence to the sinking of the boat, has rendered more certain the services which these machines are called upon to perform. The applications of the elasticity of caoutchouc have also been greatly increased. The wheels of carriages have been surrounded by it in such a manner as to prevent the disagreeable noise which they make upon the pavement. Rollers for inking printing types and lithographic stones have been made from it; it is employed for the making of cushions for billiard tables, and to supersede the use of sacking-cords in bedsteads. Advantage has been taken of the elasticity of an India-rubber band, which has a tendency to return to its primitive length when the action of opening a door has elongated it, for the purpose of forming door-springs, the use of which is beginning to spread widely.

The force with which caoutchouc untwists itself, when it has been twisted, has caused it to be employed in the mechanism of window-blinds.

A thin tube of India-rubber, of tolerably large diameter, but flattened at the bottom, so that it terminates in two flat edges, which the elasticity keeps in juxtaposition, constitutes an apparatus of extreme simplicity which perfectly supersedes ordinary hydraulic valves. The edges which are in contact below open by the pressure of any liquid passing through the tube, and close when the liquid has run out, thus preventing any fœtid gas escaping from below. The elasticity of India-rubber has made a ring of it applicable for uniting cast-iron or earthen tubes used for the conveyance of water. This indestructible and moveable tube, which admits of widening and allows the pipes to slide one within another, presents a method of fitting which seems destined to render notable service in the conveyance of water in large towns.

A thin hollow sphere of India-rubber, terminating in an appendage in the form of a tube, introduced in a flaccid state into an opening accidentally made in gas or water-pipes, may by means of being expanded by inflation, be used to press upon the sides of these pipes, and thus present a method of occlusion of great simplicity, which will allow these pipes, which it has become necessary to replace, to be removed without inconvenience.

Mr. Richard Edward Hodges has lately proposed to make use of cords of vulcanized India-rubber as a means of rendering its elasticity serviceable in raising weights, and has offered by the use of different cords, which are to be stretched successively, and then released all at once, a method of throwing projectiles, and especially harpoons, with increased force. This invention is as yet too new for any one to be able to judge of it by experiments on a large scale. The source of power in this application of India-rubber presents a curious physical problem, as it is evidently not at once reducible to the other powers of mechanical force.

The substitution of vulcanized India-rubber for metallic springs in the buffers of locomotive-engines, is one of great service. The masses of vulcanized India-rubber deaden the shocks with an ease which may cause this employment of caoutchouc to be considered as one of the most useful to which it has been applied up to the present day.

A certain number of the novel applications are due to Messrs. Charles Mackintosh and Co. The ability which they have displayed in the manufacture of caoutchouc has afforded to other inventors of these new applications the means of putting their ideas into practice. Without the discovery of vulcanized India-rubber they could, moreover, never have been carried out. The Jury, therefore, in order to recompense the considerable services rendered in the employment of caoutchouc by Messrs. Mackintosh, Hancock, and their other partners, have awarded a Council Medal to the firm of Charles Mackintosh and Co.

2. Charles Goodyear, Newhaven, Connecticut, United States (378, p. 1461). Mr. Charles Goodyear, of Newhaven, Connecticut, exhibits a very remarkable collection of productions in caoutchouc, manufactured in the United States in numerous manufactories by processes which are his own, and for which he has patents in his own country. The eighteen to twenty licenses granted by Mr. Goodyear for the use of his processes, and a capital of more than 2,000,000*l*. expended in the establishment of his manufactories, attest the importance which this branch of manufacture has attained in America. Mr. Goodyear exhibits in his collection a number of articles of the same kind as those manufactured in Europe, whether with vulcanized India-rubber alone, as springs for waggons, elastic maps, balloons, sponge-bags, tobacco-pouches, or with India-rubber covered upon one or both sides with stuffs of various natures, or uniting together two fabrics by a coating of waterproof material, according to the processes originally employed by Mr. Mackintosh. In the manufacture of air-cushions and mattresses, and especially in that of waterproof garments, more strength and greater thickness are to be remarked than in the articles manufactured in Europe, but with less finish in the workmanship and less elegance in the forms. It may be thus clearly seen that these articles, which are as yet only used in Europe as objects of luxury or of more refined comfort, have already in America entered into general consumption, and become, by their price, within the reach of the least opulent classes, to the tastes and wants of which the manufacturer has been compelled to accommodate himself. Providence has given us in caoutchouc a species of natural leather, plastic and impermeable to water, and which is especially adapted to increase the well-being of that class of workmen, the nature of whose occupations compels them to encounter the inclemency of the atmosphere. In the manufacture of these articles it is, therefore, of importance that the resources and requirements of individuals of this class should be kept in view. Besides these articles common to the manufactures of America and of Europe, Mr. Charles Goodyear exhibits a series of productions which have interested the Jury in a high degree by their novelty, and which promise to become the object of numerous and novel applications.

The ordinary cloths covered with India-rubber present a great resistance when they are pulled in the direction of the fibres, but they tear with great facility if they are made to undergo a traction tending to separate the threads united by the weaving. This is an inconvenience which might stand in the way of some of their uses, and against which Mr. Goodyear has succeeded in providing by the fabrication of a species of stuff or felt, which he manufactures by machines of his own invention. This stuff, formed in successive layers and in variable numbers of threads crossed in different directions, constitutes a species of regular felt obtained by mechanical means, which can be produced at a low price, and is capable of supporting a traction in any direction.

By covering these stuffs, formed of three, four, and even five and six coats of entangled threads, with a thin coat of India-rubber in a pulpy state, which, penetrating into the interstices of the fibres, still further increases their adhesion, Mr. Goodyear is enabled to obtain extended surfaces of a species of resisting and waterproof paper—a real vegetable parchment of which he has been able to make excellent use in most advantageously superseding paper itself as a material for covering damp walls; as a material, moreover, very well adapted for printing upon, and therefore to the making of large maps for walls, also of the globes and celestial spheres of large dimensions which are employed in teaching cosmography or geography. By covering with this waterproof fabric a species of woollen wadding, he has been enabled to produce garments at once warm and waterproof, remarkable for their lowness of price, and especially for their lightness, which much surpasses that of the ordinary Mackintosh. By covering this same stuff, rendered adhesive, with cotton fabrics, he has been able to employ it in making table-covers. Made to adhere to a thick woollen down it can be employed to cover the ground in such a manner as to keep off cold and moisture, and constituting a new species of carpet which is beginning to be substituted in the United States for the floor coverings of oil-cloth used in low and damp places. Mr. Goodyear, by covering with two layers of a felt of this description the two sides of rough canvas, has been able to unite in this combination the advantages of impermeability with those of greater resistance to mechanical action, and thus economically to obtain cloths adapted to the manufacture of sails, and to the coverings of carriages and merchandize.

With this kind of complex stuff are made, at the present day in the United States, the apparatus for life-boats, the insubmersible boats, as well as those pontoons inflated with air, which were first constructed by Mr. Armstrong, of New York, and which, by simplifying certain equipages which the armies were compelled to carry with them, have already rendered service to the United States in their war with Mexico.

It is well known that the application of India-rubber to the manufacture of shoes was in a more especial manner the object of the first researches of Mr. Goodyear. These shoes are of three sorts. Those of one sort are formed of a layer of caoutchouc, covering a woven and non-elastic fabric; these common shoes appear to be universally employed in the United States. Others, produced by a layer of caoutchouc spread upon a knitted, and therefore an elastic fabric, are more commodious in use, their elegant shapes leaving nothing to be desired. This kind of fabric has also been made use of for the manufacture of gloves, which, proof against water, lyes, &c., allows the mistress of the house in humble families and her children to apply themselves to the most lowly household cares without giving up a certain degree of elegance, and without destroying the whiteness of the hands.

Mr. Goodyear has, in addition to these, exhibited a few specimens of a third species of shoe, of entirely new invention, which is made with a sheet of caoutchouc pierced through with an infinity of very small holes. These shoes, which by reason of the resistance of the India-rubber to moisture, and of the extreme smallness of the holes, are impermeable to water, but pervious to gases, possess the double advantage of being waterproof in regard to external moisture, while they nevertheless admit of the dissipation of the moisture arising from perspiration. This condensation of the moisture of perspiration is a serious inconvenience inherent at the present day in the wear of India-rubber shoes, and of the ordinary Mackintoshes. These inconveniences may be entirely removed, without the advantages being diminished, by the employment of the thin pierced sheets of India-rubber exhibited by Mr. Goodyear.

In the multiplicity of objects to which caoutchouc has been lately applied, it was proper that childhood should have its share. Mr. Charles Goodyear has conceived the happy idea of fashioning the mixture of sulphur and caoutchouc, constituting vulcanized India-rubber, by heating it in moulds. He is thus enabled to produce dolls' heads, different figures of animals—in a word, toys of every description, which are indestructible by falls, shocks, and moisture, and which, while contributing to the pleasures of childhood, only deprive it of that of destroying.

It has been already seen how Mr. Charles Goodyear had in America, since the year 1842, worked in caoutchouc, to which the addition of sulphur and carbonate of lead had imparted the greater elasticity. By combining caoutchouc with sulphur and magnesia he has latterly succeeded in imparting to it the rigidity and hardness of wood, but of a plastic wood, and therefore susceptible of being produced from moulds in the most varied forms. This material, like India-rubber itself, is capable of receiving different tints; and by partially mixing the differently coloured masses, he has been able to produce shaded specimens, which are beginning to be substituted for horn in the manufacture of buttons, and of handles for penknives and table-knives, and which rolled out into thin sheets are adapted to take the place of wood in the veneering of furniture. Although this invention is as yet a recent one, there is good reason to suppose that it will very soon bear its fruits. By varying the preparations of sulphur and magnesia combined with the caoutchouc, it has already been made to attain different degrees of consistence; and probably in a short time industry will be able to discover in this substance, so indestructible, all the degrees of cohesion that solid matter exhibits in its most varied states. This enumeration of the articles shown by Mr. Goodyear at the Great Exhibition, incomplete though it is, nevertheless suffices to indicate the extent of the services which he has rendered to the art of applying India-rubber to the most diversified uses, and justifies the high distinction he has obtained, as well as the award which the Jury make to him of a Council Medal.

§ 3. *Prize Medals.*

1. THE HAYWARD RUBBER COMPANY, Colchester, Connecticut, United States (294, U. S. p. 1453). The manufacture of waterproof boots and shoes is one of the principal uses of India-rubber in the United States. The manufacturers who make them supply a consumption of from three to four million pairs every year. One single establishment, that of the Hayward Rubber Company, manufacture as many as 3,000 pairs a-day: they employ in it the process invented by Mr. Goodyear. These boots and shoes have attracted the attention of the Jury. They possess the double merit of being well made and of elegant appearance. The considerable number in which they are made must have a tendency to lower their price. The Jury award a Prize Medal to the Hayward Rubber Company.

2. J. WANSBOROUGH, 52 Little Britain, London (75, p. 782). Mr. Wansborough has exhibited a new description of waterproof fabric, produced by a method which calls to mind the manufacture of the stained papers called velvet papers. By covering an ordinary fabric of thread or cotton with a coat of glutinous caoutchouc, and then causing to adhere to it the wool powder coloured in different shades, which is so abundantly obtained in the shearing of cloth, he has been enabled to produce a fabric resembling velvet, which is strong and waterproof, and which, for the manufacture of travelling hats, curtains, travelling bags, &c., is capable of receiving numerous applications. The Jury have rewarded Mr. Wansborough's invention with a Prize Medal.

3. S. C. MOULTON, New York (534). Mr. Moulton exhibits some articles in India-rubber prepared in England, principally by Mr. Goodyear's processes, and which have appeared to the Jury to be well made. They have particularly noticed some waterproof fabrics which Mr. Moulton exhibits as having been produced by machinery and without dissolving the caoutchouc, a method, the result of which is to obtain waterproof fabrics entirely free from the disagreeable smell which they often possess. Amongst the very numerous objects comprised in Mr. Moulton's collection, the Jury have especially noticed some half clogs, the same as those shown in the American Exhibition, but made with greater elegance, and which, being easy to put on with a common shoe, easy to take off, and of a tolerably low price, seem to exhibit the form in which these articles (the utility of which is every day better appreciated) may be best extended in Europe, and more generally employed there. The Jury have also noticed some articles of saddlery which exhibit a new application of vulcanized India-rubber, in superseding the leather usually employed in their manufacture. The Jury award a Prize Medal to the *ensemble* of Mr. Moulton's manufactures.

4. GROSSMANN and WAGNER, 11 Rue de Renard St. Sauveur, Paris (France, 856, p. 1221). India-rubber, which so much resembles leather in its properties, nevertheless lacks an essential quality which is one of the characteristics of leather, its tenacity. It will be understood,

therefore, what great advantage would arise in uniting together two substances, the qualities which should in some degree complete each other. Amongst the different articles of Messrs. Grossmann and Wagner's manufacture which have attracted the notice of the Jury, they have remarked some shoes in which these manufacturers have realized this union. These shoes, the soles of which are of leather, possess greater durability than those which are entirely made of India-rubber, and have not the defect of slipping upon the pavement. The Jury have rewarded the manufacture of Messrs. Grossmann and Wagner, and especially the perfection to which they have brought India-rubber shoes, with a Prize Medal.

5. Thomas Forster, Streatham, Surrey (178, p. 787). Mr. Forster exhibits some waterproof garments of good make. These garments, in which the especial object has been to render them more accessible to the less opulent classes, are produced by means of the combination of ordinary caoutchouc with certain resinous substances, which are moreover added in suitable quantities so as not to interfere with the suppleness or the flexibility of the fabric. Mr. Forster produces articles in the coloured paste of India-rubber, which he was the first to bring into use. The good quality of these fabrics made by Mr. Forster has been proved by long use. The Jury award him a Prize Medal.

6. Christopher Nickels and Co., 13 Goldsmith Street, Cheapside, London (78, p. 783). The manufacture of elastic tissues constitutes one of the most important uses of India-rubber. Messrs. C. Nickels and Co. devote themselves with much success to this special manufacture. They exhibit a collection of articles of this description proceeding from their factories, which show of how great a variety this species of weaving is susceptible. The elastic tissue serves no longer solely for the manufacture of garters, braces, and belts; it is applied to the manufacture of gloves, sandals, elastic cords, and other articles of the same kind, of which Messrs. C. Nickels and Co.'s exhibition contains a complete collection. The Jury award them a Prize Medal.

7. M. Leunenschloss, Rouen (313, p. 1192). The manufacture of elastic tissues, which had its birth in France, has received in that country a great degree of development. It comprises the numerous fabrics of this description of productions, a few of which are represented at the Great Exhibition. The Jury have especially noticed the productions of this nature which are exhibited by M. Leunenschloss, and which are worthy of the reputation which this manufacturer has deservedly obtained. He is moreover the author of several ingenious inventions, which have rendered this manufacture more easy and regular. The productions which he exhibits in braces and laces for tailors' and ladies' use, are remarkable for their good quality and their elegance. The Jury award a Prize Medal to M. Leunenschloss.

8. Messrs. Höltring and Höffken, Barmen (1 Zollv. 662, p. 1086). The collection of braces exhibited by this firm presents a series of articles, in which the threads of elastic tissue are employed for one of their most useful applications. The workmanship and appearance of these articles also entitle them to commendation.

§ 4. *Honourable Mention.*

1. Messrs. Bunn and Co. (77, p. 783). A very extensive and interesting collection of specimens of the various descriptions of India-rubber, more especially from Para. Also specimens of gutta percha, and examples of the processes to which these substances are submitted in their preparation for application in the arts.

2. W. H. Burke (Class IV., 115, p. 204*). Specimens of India-rubber web manufactures of various kinds. These consist of tissues of alpaca, mohair, and Genappe braids, covered with caoutchouc on one side, and having a peculiarly light and elegant character. The exhibition comprises also specimens of "mineralized India-rubber," having the same properties as vulcanized India-rubber, and prepared with the object of avoiding the smell of the sulphur used in its preparation.

3. Messrs. Church and Chittenden, United States (382, p. 1461). A collection of shoes made of India-rubber, in a style which enabled the makers to sell them at a low cost. This is one of the establishments in America registered under Mr. Goodyear's patent.

4. J. C. Cording, United Kingdom (82, p. 783). A variety of articles of dress made of various fabrics, and rendered waterproof by caoutchouc. The articles included coats which might be worn with either side outwards, also ladies' capes and hoods.

5. R. E. Hodges, United Kingdom (72, p. 782). Various applications of the elastic property of vulcanized India-rubber, as in mechanical purchases, guns, bows, &c.

The Reporter would also call attention to the caoutchouc manufactures exhibited by Mr. J. Horsey, of London, 188, p. 787, which contained several very elegant specimens of goods manufactured from vulcanized India-rubber, as also fabrics coated with caoutchouc of various colours, in which the colours were mixed with the caoutchouc and not subsequently applied, so as to prevent their being removed by wear or the application of moisture.

The ladies' and children's boots and shoes exhibited by Mrs. Tallerman (70, p. 782) afford an instance of a new and useful application of caoutchouc.

§ 5. *Remaining Exhibitors.*

Under this head the Reporter has endeavoured to give a list of the names of exhibitors of various articles made of caoutchouc, or into which it enters, whether exhibited in Class XXVIII., or belonging to some other.

J. Sanders, 11 Fore Street, Cripplegate (73, p. 782). India-rubber waterproof umbrella tent.

J. L. Hancock, Goswell Mews, Goswell Road (83, p. 783). Portable India-rubber shower-bath, hose-reel, and inflated air-tight bed chair.

S. Matthews, 58 Charing Cross (81, p. 783). Large-sized India-rubber portable boat, and India-rubber cloak boat, designed by Lieut. Halkett, R.N. India-rubber portable bath.

C. Joubert, 8 Maddox Street, Hanover Square (Class XX., 40, p. 579). Self-adjusting white watered corset. Elastic corset belt for invalids. India-rubber tissue, of French manufacture.

J. S. Hall, 308 Regent Street (Class XXVIII., 184, p. 787). Improved elastic over-shoes, with leather soles and plush heels, to prevent slipping.

S. Turner, Orchard Place, East India Docks (223, p. 142). Coal and its products. Products from caoutchouc and wood.

J. Outridge (29, p. 980). Caoutchouc from River Demerara, near the Falls. Milk from the cow-tree, from River Demerara.

W. Huet, Rouen (Seine-Inférieure), and 12 and 14 Rue du Cimetière, St. Nicholas, Paris (270, p. 1189). India-rubber articles, braces, and twists.

J. D. Leblond, Carver, 5 Rue St. Louis (au Marais), Paris (1301, p. 1239). Patent India-rubber male and female figures for artists.

C. L. Ducourtioux, Caoutchouc Stocking Manufacturer, 4 Rue Fontaine au Roi, Paris (1199, p. 1235). Machine-made caoutchouc stockings and belts.

Briquet and Perrier, Tissue Manufacturers, 22 Rue Jean Robert, Paris (1116, p. 1232). Elastic caoutchouc tissues for braces, garters, &c., and specimens of that manufacture.

— Rabourdin, Manufacturer, 88 Rue des Marais St. Martin, Paris (1416, p. 1244). Braces; garters; silk and India-rubber fabric.

— Lerhe, St. Petersburg (Russia, 311, p. 1376). Clogs in India-rubber, for ladies and gentlemen. Waterproof morocco pillow.

H. H. Day, New York (308, p. 1453). India-rubber manufactures.

J. J. Rompler, Erfurt (781, p. 1094). India-rubber elastic braces and watch-guards. Silk and half-silk shoe stuffs, mixed with India-rubber; shoes made of the same material.

Rooyackers and Son, Rotterdam, Makers (52, p. 1145). Boots; varnished boots, the leg without seam. A Chinese boot. Boots of vulcanized caoutchouc.

LOUISA PIECE, Geneva (233, p. 1281). Caoutchouc knit stockings for invalids.

J. VIE, Caoutchouc Manufacturer, 161 Rue St. Jacques, Paris (726, p. 1213). Caoutchouc tissues, elastic stockings, belts, knee-caps, &c.

SECTION B.—MANUFACTURES FROM GUTTA PERCHA.

§ 1. *General Remarks.*

The substance designated by the name of gutta percha (pronounced *pertsha*), is, like caoutchouc, a carburet of hydrogen, and isomeric with that substance, and possesses a great number of the properties which characterize India-rubber, but exhibits certain special properties which admit of its being applied to particular uses to which caoutchouc is not adapted. Gutta percha possesses as great an indestructibility by means of chemical agents as caoutchouc. It has an intermediate consistence between that of leather and wood; it is capable of being softened by heat, and of regaining its primitive consistence on cooling. It is, therefore, at the same time capable of taking and of retaining the most delicate impressions. The important uses to which it has been latterly applied are only the forerunners of those to which it will be adapted hereafter, provided the lack of this precious material (which unfortunately is produced in much less quantities than India-rubber, and in localities much more circumscribed) does not present an obstacle to it.

Whilst the plants which furnish caoutchouc abound in the whole of the territorial zone which extends between the tropics, the *Isonandra gutta*, belonging to the natural order *Sapotaceæ*, is the only tree which yields gutta percha. It grows scarcely anywhere except in certain parts of the Malayan Archipelago, and up to the present time has been almost exclusively obtained from Singapore. It was brought for the first time into England, in the days of Tradescant, as a curious product, under the name of *Mazer wood*, and subsequently it was frequently brought from China and other parts of the East, under the name of India-rubber, in the form of elastic whips, sticks, &c. In 1843, Doctors D'Almeida and W. Montgomery drew particular attention to it, together with its various singular properties, its easy manipulation, and the uses for which the Malays employed it. The most common employment of it was for whips: and it was by the introduction of a horse-whip made of this substance that its existence was for the first time known in Europe. The exhibition of the products of the East Indies, shown by the Honourable East India Company, proves that the natives of the country in which the *Isonandra gutta* grows, knew also how to appropriate it to the manufacture of different kinds of vases, and that European industry has little more to do than to imitate their processes.

The importation of gutta percha into England, where the employment of this substance first drew attention, was in 1845 only 20,600 lbs.; but in 1848 it had increased to above 3,000,000 lbs.; and during the last three years the importation has amounted to a much larger quantity, and one which begins to cause some apprehension as to the possibility of the supply sufficing for the requirements of the novel uses in store for it in the future. It is true that during its use gutta percha is but little consumed, and the waste from the articles in this material, submitted to a proper softening, can be made to serve new uses; nevertheless its constantly increasing consumption, added to the barbarous manner in which the product has hitherto been extracted, may well justify some apprehension.

During the first few years of the employment of gutta percha, it was the custom to cut down the tree for the purpose of obtaining the juice, which, left to itself, very soon allowed the gutta percha to separate and coagulate of its own accord. There is reason to hope that European industry will soon be embarked in the cultivation of this product, and that the *Niato* (which is the name that the Malays give to the tree which produces gutta percha), multiplied by means of a regular culture, naturalized in other countries than those to which it is indigenous, and worked by regular incisions, which will only take from the tree a portion of its juice without hindering its development, will be the means of furnishing at a low price a substance which is destined to render notable services to industrial and domestic economy.

The gutta percha, which arrives in Europe in the form of lumps of some pounds weight, is far from being pure. The natives of the Malayan Archipelago make no scruple of introducing into it stones, earth, &c.; the presence of which in the interior of these blocks renders a purification indispensable, which purification, however, is capable of being attained without much manipulation.

Ever since its first introduction into Europe, gutta percha has, in fact, found everything provided for the purpose of cleansing it, and has been found capable of being worked by the processes and instruments which are employed in the purification of India-rubber. At the present day the block of gutta percha, cut into slices by a strong machine, is softened by means of hot water, divided and torn into shreds by the same machine that is used for India-rubber, which serves to knead the gutta percha in such a manner that the crushed stones and earth may be separated from it on being diluted in the water; it is then dried, and submitted, by means of a powerful machine, to a mastication similar to that which India-rubber is made to undergo; and when, after some hours of kneading, the mass has become homogeneous and sufficiently softened, it is drawn by the drawing-mill into cylindrical cords, into tubes of various diameters, or it is spread out by means of the flattening machine (as is done with lead) into sheets of various thicknesses, which are finally divided into bands, from which are cut out with a nipping tool the pieces which are required to be employed in different uses.

Whatever difficulty manufacturers may have had in procuring gutta percha fit to be made use of, they have at least been able to concentrate their efforts upon the discovery of uses to which it is adapted; and in the space of a few years have discovered numerous and important ones, as may be witnessed in the beautiful exhibition made by the Gutta Percha Company. One of the first and principal uses of gutta percha was to supersede the leather bands employed in machinery for the transmission of movements. This is very nearly the only use to which it has hitherto been applied in France. It seems, moreover, that latterly in England some inconveniences have been found to result from this employment of gutta percha; but should its use for that purpose diminish, every day others are found for it.

Indestructible by water, and at the same time a bad conductor of electricity, gutta percha has been found available for enclosing the metallic wires employed in the electric telegraph; and the use of this substance may certainly claim its share in the success of the submarine telegraph, which has just brought London and Paris within a few minutes of each other.

It may be conceived to what a variety of forms a substance can be turned which, becoming soft without adhering at the temperature of boiling water, regains at the ordinary temperature the slight elasticity and the consistence of leather. Thus agriculturists and manufacturers have turned it to account for the fabrication of buckets of all kinds, light, indestructible, and capable of being mended by a slight degree of heat and pressure when they are worn out.

It is especially in the manufacture of articles for maritime use that gutta percha, resisting as it does the action of water, and especially of salt water, appears to be the best adapted. Buoys of every description for anchors, nets, &c., have been made of it; sailors' hats, speaking-trumpets, &c. There is no doubt that it will be brought to perform a useful part in waterproof garments, as well as in the construction of life-boat apparatus. If India-rubber has been advantageously combined with leather, it may be conceived that the combination of gutta percha with wood, of which Mr. Forster has shown a specimen at the Exhibition, may in certain cases offer peculiar advantages.

The decorative art has also taken advantage of the plastic properties of gutta percha. All those different articles of furniture, the prices of which are so much enhanced by carving, are capable of being reproduced by means of pressure, and thus multiplied at a low price.

Writing-tables, work-baskets, &c., can be produced in gutta percha, and thus be made to combine the threefold advantage of lowness of price, elegance of form, and absence of fragility. In the large manufactory which is more especially devoted to the employment of gutta percha, are made every day a great quantity of mouldings, friezes, panels, leaves, &c., and of articles of every description. These, combined by the decorator, covered with gilding (which gutta percha takes in perfection), are, in the manufacture of picture-frames, and in the decoration of furniture, capable of superseding the carving upon wood, which is so costly, or papier-maché and carton-pierre, which present the defect of great fragility. On going through the Exhibition of Messrs. Thom and Co., as well as that of the Gutta Percha Company, we may judge of the extent which the employment of this substance promises to the decorative art by the imitation of carving upon oak, rosewood, &c. Bronze articles have also been reproduced in a felicitous manner; and the clearness of the edges and the purity of the forms make it easy to understand how gutta percha has been found capable of being used for making galvano-plastic moulds, and how some experiments have begun to be tried for the purpose of substituting this material in the process of stereotyping, for the metal with which at the present day the pages of our illustrated books are multiplied. This employment of gutta percha for the reproduction, by pressure, of objects for interior decoration cannot but be widely extended, enabling the many to enjoy those graceful and elegant forms which, as long as they could not be reproduced in a material indestructible by water and free from fragility, could only be brought within the reach of the few.

Quite recently, by the exertions of Mr. Truman, a lump of coloured gutta percha, moulded into the form of a jaw-bone, has been found capable of holding together artificial teeth, and thus advantageously superseding those settings in gold, which were so costly, and the absolute rigidity of which, moreover, presented much inconvenience. The slight but sensible elasticity possessed by gutta percha renders it, on the contrary, very well adapted to this use.

There is another use to which the exertions of H. Mapple have rendered gutta percha applicable. Soles of this substance, glued on to the upper leathers by means of gutta percha dissolved in gas-tar, constitute shoes which are not affected by water, which will last a long time, are very simple and economical in their make, the soles of which are easily mended, and easily put on again when they come off, and can be made to serve anew by means of a fresh kneading up when they have become unfit for use; thus constituting a description of shoes, the use of which cannot fail to become extended in such a general manner as to render notable service to health. Gutta percha soles have also been found capable of being affixed with much advantage upon leather soles.

This solution of gutta percha in the oil of tar, like that of caoutchouc, which, by its evaporation, leaves the caoutchouc uninjured, can be made use of to obtain sheets of gutta percha of extreme thinness, which have already begun to be used in surgery, as well as in the preparation of waterproof papers and cloths.

It is more especially to the manufacture of chemical utensils for the preservation and conveyance of acids, that gutta percha seems destined to render the greatest services. Latterly pumps for hydrochloric acid have been made of it, pipes for conveying this acid, bottles in which to send it away; large wooden vessels have been lined with gutta percha, in which to preserve the acid; gasometers are being constructed, which will be capable of collecting the sulphuric acid disengaged in certain chemical actions, and which would have corroded metallic vessels.

§ 2. *Council Medal.*

The Gutta Percha Company, Wharf Road, City Road (85, pp. 783, 784). A great number of the novel applications of this substance have been invented by the Gutta Percha Company; and the great development which this Company has given to this branch of industry has realized all that could be hoped from the employment of this substance. The exhibition also of specimens was very complete and extensive. The Jury, therefore, recommended that one of its great rewards should record their sense of exertions which have in a few years shown in so striking a manner the extent to which this new substance may be made available for the benefit of man, as well as the means by which it may be successfully employed. The Jury have, therefore, awarded a Council Medal to the Gutta Percha Company, as having, in the highest degree, contributed to these important results.

§ 3. *Prize Medal.*

The West Ham Gutta Percha Company (90, p. 784). In the distribution of the awards of which gutta percha is the object, the West Ham Gutta Percha Company cannot be overlooked. They have also submitted to the judgment of the Jury the most varied objects manufactured in gutta percha, in which they have made use of certain processes peculiar to Mr. Charles Hancock.

A beautiful group, representing a boar hunt, covered with a metallic coating in imitation of bronze, displays in a very high degree the success with which gutta percha may be employed in the decorative and even fine arts. The exhibitor has succeeded in combining gutta percha with sulphur and the metallic sulphurets, to which the name "metallo-thianised" gutta percha has been employed. The gutta percha thus treated is as hard as ebony, and can be used for most purposes to which wood and ivory are generally applied.

§ 4. *Honourable Mention.*

J. Martin Cabirol, Paris (France, 786, p. 1218). The Jury think it right to record their sense of the merit of M. Cabirol's application of gutta percha to the manufacture of surgical instruments and apparatus, although the consideration of the merit of the particular object belongs to another Class.

§ 5. *Other Contributors.*

F. Whishaw, 9 John Street, Adelphi, Designer and Inventor (Class X., 419, p. 454). Telekerephona, or speaking telegraph. Gutta percha telephone. Railway trains communicator. Gutta percha tube and lathe-band, as first made at the Society of Arts in 1845. Subaqueous insulated electric telegraph conductors. Battery protector.

Mary O'Donnell, 69 London Street, Reading, Designer (Class XIX., 53, p. 561). Ornamental leather. Hand-screens in stamped gutta percha, preserved real flowers and embroidery, &c.

The Gutta Percha Company, Pat., 18 Wharf Road, City Road (Class XXVI., 21, p. 731). Table and pier glass in gutta percha ornament, in the natural colour.

F. Thompson, Westfield Terrace, Sheffield, Inventor and Manufacturer (Class XXII., 808, p. 670). Patent gutta percha skates of various colours and combinations.

Thorn and Co., 98 New Bond Street, Designer and Manufacturer (Class XXVI., 1, p. 730). Gutta percha manufacture. Decorations; girandole; various specimens and patterns of frames, brackets, mouldings, &c.

T. Walker, 1 Conduit Street, Regent Street, Inventor and Manufacturer (Class XXVIII., 87, p. 784). Gutta percha hat-bodies. Ventilated velvet hats, &c. Hat-case, answering for a life-buoy float, foot-bath, &c.

Miss Moorson, Kensington (Class XXIX., 253, p. 802). Gutta percha models.

W. T. Iliff, Newington (Class XXIX., 253a, p. 802). "London Street Scenes," "May Day," &c., modelled (by the hand) from gutta percha, by Miss E. Moorson, of Kensington, aged 13.

F. Dinzi, Vienna, Manufacturer (348, p. 1024). Gutta percha articles, including sticks, riding-whips, snuff-boxes, goblets, flower-pots, &c.

T. Wheeler, Toronto (353, p. 969). Medallion in gutta percha of the Earl of Elgin, Governor-General of Canada.

Section C.—Manufacture from Ivory, Tortoiseshell, Shells, Bone, Whalebone, Horn, Bristles, &c., Cork, Cocoa-Nut Fibre, Vegetable Ivory, &c.

The articles manufactured from the above substances, and not included in other sections, are not numerous, but are of a very miscellaneous character; it is therefore, almost impossible to give any connected account of them. Many of these materials were exhibited as raw products in Class IV., as ivory, whalebone, cork, &c., and to the Report on this section the reader is referred for their natural history. Such substances as ivory, bone, and horn, enter into the manufacture of many articles of use which have been referred to in the Reports on previous sections. The articles exhibited in this section will be referred to under each separate substance mentioned, and as near as possible under the heads before employed.

I. Animal Substances included in Section C.

1. *Ivory.*

This substance, obtained chiefly from the tusks of the elephant, of which a great variety were exhibited in Class IV., formed a conspicuous object in many parts of the Exhibition. Many of the articles formed of ivory which were exhibited displayed those qualities of taste and design which, although some were intended for use, removed them from the class which contemplated objects of utility, and placed them for examination under the Jury of the Fine Arts. Such were many of the specimens of ivory carving exhibited by the Hon. East India Company. The grotesque carvings of the Chinese, as well as busts and statues in ivory, were all thus placed beyond the jurisdiction of the Jury of Class XXVIII. The principal applications in ivory brought before this Class were delicate veneers, combs, and work inlaid with ivory.

Prize Medals.

Thomas Staight, 12 Walbrook, Manufacturer (Class IV., 109, p. 203*). Specimens of turning and carving in ivory. Many of the objects exhibited were beautifully executed. A set of ivory chessmen, representing Crusaders, was especially deserving of notice. There were also specimens of carving in pearl deserving of commendation.

Staight, D. and **Sons** (Class XXIX., 252, p. 802). Specimens of ivory veneering and other manufactures in ivory of a useful kind.

J. **Pratt** and Co., Meriden, Connecticut, United States, Inventor (567, p. 1469). This Company exhibited specimens of ivory veneer cut by machinery. These veneers were exceedingly delicate, one piece alone, 12 inches in width and 40 feet in length, having been sawn from a single tusk. The machine by which this veneer was produced was an invention of the exhibitors.

John Fenn, New York, United States, Manufacturer (111, p. 1440). An exhibition of several articles manufactured from ivory. The workmanship was very superior. The comb exhibited contained 150 teeth in the inch.

Noel, sen., 33 Rue de Lancry, Manufacturer (France, 666, p. 1210). A large collection of well-manufactured ivory combs with hollow round teeth.

August Habenicht (Vienna, 376, p. 1029). Amongst a number of articles for fitting up dressing-cases and for the toilet-table were some beautiful ivory combs.

Ludwig Geismar and Co., Weisbaden, Nassau (13, p. 1132). A cup in ivory, with figures in alto and basso relievo, the subject being Christ blessing the Children; also brooches and bracelets in ivory, carved with much taste.

Louis Joseph Massue, 3 Rue Aumaire, Paris, Manufacturer (615, p. 1207). A large assortment of well-manufactured ivory combs.

— **Wolf**, 2 Rue St. Appoline, Paris (744, p. 1216). Specimens of ivory carved in various forms.

Holtzappfel and Co., 64 Charing Cross, and 127 Long Acre, Manufacturers (Class VI., 232, p. 295). The Jury had their attention called to the beautiful specimens of ivory turning exhibited by this Company in the department devoted to the exhibition of machinery, where they were exhibiting their turning apparatus. They were specimens of plain and ornamental turning, but some of a very superior kind.

H. **Williams**, Dublin, Inventor (163, p. 787). Eccentric ivory turning without eccentric chuck.

C. **Shaw**, Mount Street, Dublin, Producer (164, p. 787). Specimens of mechanical sculpture in ivory.

John Maunder, Launceston, Cornwall (28, p. 780). A miniature dessert set turned in ivory.

In determining on the prizes in ivory work the Jury had some difficulty in ascertaining whether particular specimens belonged to their department, especially in the case of carving, in which case so many of the objects came under the Class of Fine Arts. Other exhibitors in ivory in Class XXVIII., to whom prizes were not awarded, were as follows:—

Peter Johnson, Wigan, Manufacturer (15, p. 779). A collection of fancy articles, many of which are turned in ivory.

E. **Crummack**, York, Proprietor and Manufacturer (18, p. 779). A collection of ivory combs made by hand.

Walter Truefitt, 1 New Bond Street (65, p. 782). Carved ivory brushes and combs.

Oscar Smith, 21 King Street, Covent Garden, Manufacturer (95, p. 784). Specimens of ivory turning and carving.

G. **Garrett**, 1 Victoria Terrace, Woodbridge Road, Ipswich, Manufacturer (141, p. 786). Ornamental snuff-boxes turned in ivory.

W. D. **Hemphill**, Clonmel, Ireland, Designer and Manufacturer (158, p. 786). A variety of specimens of turned and carved ivory.

John Francis Kain, 27 Brownlow Road, Dalston, Inventor and Manufacturer (45, p. 780). A full-sized bird cage made principally of ivory.

2. *British Ivory.*

This substance was exhibited by Mr. **Henry Brown**, of 187 Whitechapel Road (49, p. 780), and on account of its being likely to turn out an important and valuable discovery, and in many cases calculated to supersede real ivory, the Jury awarded a Prize Medal to the inventor.

3. *Tortoiseshell and Horn.*

Tortoiseshell, which is obtained from several species of the reptilian order *Testudinata*, but the best specimens more especially from the hawkbill turtle (*Testudo imbricata*), enters into the composition of many articles found in other classes of the Exhibition. It is employed in the manufacture of workboxes, clock-cases, tea-caddies, cabinets, card-cases, spectacle-frames, and other things. It is also employed in the manufacture of combs, and these articles of use were exhibited in Class XXVIII. For whatever purposes employed, the tortoiseshell is prepared in the same way. The part of the tortoise called the shell exists as a layer of cellular gelatinous matter on the surface of the external skeleton. This substance is separated from the osseous foundation on which it rests, by the application of heat. For this purpose the whole shell of the tortoise is exposed to the action of heat till the epidermal plates start from the bone beneath, and the final separation is effected by a long knife. The tortoiseshell, which is represented by the epidermis in other animals, is mainly composed of a substance resembling gelatine in its chemical character, and a small quantity of inorganic matter. On examination under the microscope it is found to consist of cells, which are naturally compressed, but may be made to assume a spherical form under the influence of a solution of potash and heat. On the application of heat the tortoiseshell becomes softened, and in this state may be compressed into any form required for manufacture. Sheets are thus prepared which, when cooled and cleansed, are submitted to machinery, by which they are cut into combs or other articles of use. No new or remarkable application of this substance came under the notice of the Jury. The collection of objects, however, exhibited by **Richard Peters** and **Son**, of Birmingham

(131, p. 786), and referred to another class, afforded several instances of the uses of tortoiseshell.

Horn is employed for all the purposes of tortoiseshell, and its much greater cheapness gives it a more extended application. Knife-handles, buttons, umbrella-handles, whip-tops, bell-pulls, drawer-knobs, sides of lanterns, besides all kinds of combs, are some of the purposes to which this useful substance is applied. In manufactures from horn that substance is chiefly obtained from the ox, although the tips, and even the whole horns of other animals, as of the ram, the antelope, the buffalo, the deer, are employed for special purposes. Among the imports into Liverpool in 1850 were the following:—

	Tons.
Deer horns - - - -	280
Buffalo horns - - -	200
Buffalo tips - - - -	120
Ox and cow horns - -	700

The latter were brought principally from South America, where they are obtained from the wild oxen of the Pampas. Horn, like tortoiseshell, is composed of a gelatinous matter with inorganic salts. Under the microscope it is seen to be composed of cells, which indicate its epidermal character, in common with the matter of which the nails, claws, hoofs, and hair of animals is composed. The horn which is used is developed around a vascular substance, which projects into the interior of the horn, and which is removed by steeping in water. In its preparation for manufacture, horn is exposed first to the action of boiling water, then of heat, under which it becomes softened, and may in proper moulds be made to assume almost any form. One of the best collections of articles in horn-work exhibited in the Crystal Palace was that sent by the Sultan of Turkey, and the Jury accordingly awarded to his Highness a Prize Medal.

The following Prize Medals were also awarded for combs and articles of ornament manufactured in both tortoiseshell and horn.

E. Crummack, York, Proprietor and Manufacturer (18, p. 779). Tortoiseshell and horn dressing-combs.

Fauvelle-Delabarre, 10 Boulevard Bonne Nouvelle, Paris (France, 202, p. 1183). Tortoiseshell and buffalo-horn combs.

Philip, Passage Choiseul, Paris (France, 680, p. 1211). Bracelets, brooches, and ornaments in tortoiseshell.

Poinsignon, —, 23 Rue Neuve St. Martin, Paris (France, 1397, p. 1243). Imitation tortoiseshell combs.

J. and J. Stevenson, Sheffield, and 9 Cripplegate Buildings, Wood Street, London (152, p. 786). Ornamental, dress, and other combs, of ox and buffalo horns.

A. A. Trancart, 12 Rue Neuve St. Denis, Paris (France, 393). Tortoiseshell combs.

4. *Mother-of-Pearl.*

An extensive assortment of mother-of-pearl ornaments, consisting of medallions, pen-holders, needle-cases, thimbles, &c., exhibited by J. Schwarz, of Vienna (684, p. 1042), and a collection of black and white pearl buttons by J. Chatwin and Sons (Class XXII., 286, pp. 625, 626), of Birmingham, were the only articles brought under the notice of the Jury of this Class, and Prize Medals were awarded to each for the superior workmanship they exhibited.

5. *Shells.*

But few examples of the use of shells for cameos were seen in the Exhibition. A Prize was awarded to a collection exhibited by N. Julin, of Belgium (383, p. 1163).

Shells are frequently worked into the form of baskets, vases, &c., and are made to imitate flowers. This kind of work forms a considerable branch of industry in the West India Islands, in the Channel Islands, and in the Mauritius. Prizes were awarded for this kind of industry to the following:—

Messrs. Balkfield and Co. (Mauritius, 5, p. 956).
The Misses Greig (Bahamas, p. 976).
Grey, The Countess of (Mauritius, 1, p. 956).
Miss Nicolls (Bahamas, p. 976).

In the collection of the Honourable East India Company were interesting specimens of bracelets and necklaces from Dacca. The construction of these ornamental objects employs a large number of persons. They are made from transverse slices of the *Turbinellus scolinus*, and are often ornamented with metallic studs, or carved with various devices.

6. *Whalebone.*

This substance is extensively employed in the arts, and was exhibited in its raw state in Class IV., and in various other Classes. Its manufacture for the purpose of covering whips, telescopes, and other instruments, and in thin strips for plait used in making bonnets and other articles of dress and use, came before the Jury of Class XXVIII., and the following Exhibitors were awarded Prize Medals:—

H. Horan (Class IV., 103, pp. 201*, 202*).
Westall and Co. (Class IV., 104, p. 202*).

7. *Bristles.*

Brushes of all kinds made from bristles were rewarded in the collections by the following Exhibitors:—

Prize Medals.

H. M. Engeler and Son (Prussia, 242, p. 1061). Painting brushes.
J. Fino (Sardinia, 77, p. 1305).
G. Foese (Prussia, 813, p. 1095). Hall brushes instead of mats.
F. A. Frinneby (181, p. 787).
E. Laurencot (France, 1296, p. 1238).
C. L. Loncke-Haeze (Belgium, 430, p. 1164).
K. G. Patta (Austria, 350, p. 1024).
A. Smith (55a, p. 784). Painting brushes.
H. Somzé (Belgium, 265, p. 1159).

Honourable Mention.

A. Dow (29, p. 780).
L. F. Fauquier (France, 502, p. 1201).
J. G. Hinde (196, p. 788).
P. Paillette (France, 1377, p. 1242).

8. *Hair.*

Besides the uses to which the hair of animals is applied, and which are noticed by other Classes, the Jury have had brought before them a collection of bowls, dishes, plates, &c., formed of the hair of the rabbit, hare, and other animals, which are felted, and afterwards varnished. These utensils have the appearance of papier maché, or varnished leather, and possess the properties of being strong, durable, and very light. This manufacture is carried on principally in Russia, and a Prize Medal has been awarded to T. Bardoffsky (Russia, 265, p. 1375) for a collection of those articles.

9. *Porcupine Quills.*

Allied in their production to bristles and hair are the quills of the porcupine. In the Canadian collection were several examples of articles of clothing and furniture ornamented with these quills, obtained from the North American porcupine. The quills are dyed, and the colours appear to be durable; and this use of them seems to be new and worthy of imitation in Europe. A chair and other articles, thus ornamented, were exhibited by Mr. W. Dunn, of Quebec (Canada, 119, p. 965), and by Mr. R. Marshall, to whom Prize Medals were awarded. Several articles of dress, ornamented in this manner, were exhibited.

10. *Quills of Birds.*

Goose and other birds' quills are found in other Classes, but two applications of this material came before the Jury. In the first instance, E. R. Rigby (58, p. 782) exhibited a collection of brushes made from split quills, which seemed to possess the qualities of cheapness and durability. The next instance was the application of the split quill to the making of children's caps and bonnets, and other articles of dress, also baskets, by J. C. F. Badin (France, 1063, p. 1229). Both these exhibitors were deemed worthy of a Prize Medal.

11. *Silk-worm Gut.*

This substance, used by the angler, and generally supposed to come from China, is manufactured in Spain, and the specimens exibited from the province of Murcia, in the Spanish collection (199, p. 1342) were deemed worthy a Prize Medal. (Awarded a Prize Medal by the Jury of Class IV.)

II. Vegetable Substances included in Section C.

1. *Cork.*

Specimens of this substance in a raw condition, the produce of the cork oak (*Quercus suber*), were exhibited in Class IV. Many of the applications of cork found a place in this Class. The most interesting of these was that exhibited by Messrs. Esdailes and Margrave (125, p. 785), in which various uses were made of cork which had been veneered or cut into fibres. The following is the description of the specimens of this article exhibited, and which the Jury have deemed worthy a Prize Medal:—

Case No. 1.—1. Specimens of finished hats, made of cork, with the vendors' names, and the respective weights.

2. Specimens of cork-hat bodies, or foundations, made solely of cork.

3. Specimen of a cork-hat body, or foundation, strengthened by muslin, as generally made and used by the trade.

4. Specimens of cork plates, cut by steam machinery, varying from 50 to 120 plates in the inch, in the state in which they are supplied to the hat-body makers.

5. Specimens of cork-tip pieces, of the like nature, in the state in which they are supplied to the hat-body makers.

6. Specimens of cork-hat cylinders, partly prepared and made up, in the state in which they are supplied to the hat manufacturers.

7. Specimens of cork-hat brim plates, in the state in which they are supplied to the hat-body makers.

8. Specimens of cork-hat brims, partly prepared and made up, as supplied to the hat manufacturers.

9. Specimens of printing on cork plates, with type and engraved blocks, exhibited by Mr. A. J. Mayer, inventor of the steam machinery employed at the City Saw Mills in this trade.

Case No. 2.—Fibre cut from cork by steam machinery, in its prepared condition, for the stuffing of ships' mattresses and boat cushions, to be used at sea for the preservation of life.

Case No. 3.—1. Specimen of a sea mattress, partially stuffed with cork fibre.

2. Specimen of the same, finished.

3. Specimen of a circular bolster, similarly stuffed.

4. Specimen of the application of cork fibre, applied as a packing to the stuffing-boxes of steam-engine piston-rods, and which is said to require no lubricating material.

Case No. 4.—Floating models, illustrative of the mode of using the cork fibre mattresses and bolsters as life-preservers at sea.

To the following exhibitors Prize Medals were awarded for general manufactures in cork, as well as the excellence of the manufacture of cork for the ordinary use of stopping bottles, casks, and other vessels:—

Duprat and Co. (France, 492, p. 1201).

Gerona, The Province of (Spain, 189, p. 1341).

J. Guinart (Spain, 188, p. 1341).

2. *Vegetable Ivory.*

This substance is the albumen (perisperm) of the seed of a small species of palm growing in the valleys of the Andes, whence it is now imported in very considerable quantities into this country. Humboldt first drew attention to its hardness and whiteness, and the uses to which it is employed by the natives of the districts in which it grows. It is called the "niggers'-head tree," on account of the form and size of the large black drupaceous fruit in which the seeds are contained. The fruit consists of several cells, in each of which is contained four seeds. The seeds are covered by a tough fibrous testa, which, on being removed, exposes the albumen, which represents the soft meat of the cocoa-nut and the seeds of other palms. At one end of the seed is a little cell, in which is enclosed the embryo, which seems to germinate without effecting any change in the condition of the hard mass by which it is surrounded. This is not the only palm whose seeds are hard enough for the uses of the turner, although the only one which is employed extensively for this purpose. The botanical name of the plant yielding these seeds is *Phytelephas macrocarpa*, and the order to which it belongs is that of *Palmeæ*. It is a good substitute for ivory, where appearance and durability are not principal objects. Its whiteness soon becomes tarnished, and it wears when used for articles where much friction is required. The only articles made from this substance, exhibited in Class XXVIII., were those of Mr. Benjamin Taylor (47, p. 780), which consisted of a variety of objects turned with great skill, and for which a Prize Medal was awarded.

3. *Cocoa-nut Fibres.*

The seeds of the cocoa-nut palm (*Cocos nucifera*), so well known by the name of "cocoa-nuts," are contained in a large fruit or husk, which is composed of long solid woody fibres. The natives of Ceylon and India have long made use of these fibres for weaving various coarse fabrics; but although cocoa-nuts were brought to this country enclosed in this shell, it has not been till recently that they have been manufactured in Great Britain. They are now used for cordage, matting, brushes, and other purposes, to which the woody fibres of other plants, and even the bristles of animals, have been applied.

Prize Medals were awarded to the two following exhibitors:—

T. Treloar (39, p. 780). Samples of matting made of cocoa-nut fibre (patterns provisionally registered). The same, with an admixture of Manilla hemp. Door-mats of cocoa-nut fibre. Hearth-rug of the same. Mattress of patent curled cocoa-nut fibre. Brushes and brooms, various, all filled with the fibre. Specimens of cocoa-nut-fibre plait. Bonnet and hat made of the plait. Specimens of seating, or fine cloth of cocoa-nut fibre.

Wildey and Co. (40, p. 780). Specimen of manufactures from the fibre of the outer husk of the cocoa-nut, consisting of floor-mattings, plain and coloured; door-mats; netting for sheep-folds and other uses; hassocks; nose-bags for horses. Cocoa-nut husk; fibre from the same; fibre prepared for brushes, substitute for bristles; fibre curled, substitute for horse-hair mattresses; fibre dyed; yarn spun from fibre; cordage, from fibre; curling and spinning by machinery, and patent preparation of fibre from the husk.

The use of cocoa-nut fibre for bedding presents many advantages; it does not become knotty or hard, it does not harbour vermin, and it is not affected by variation of climate; it is also recommended by the great cheapness at which it can be produced.

4. *Palm Leaves.*

In their uses to the inhabitants of the tropics the family of palms represents almost all other families of plants. No part of these princes of the vegetable kingdom seems to be useless; and at every stage of their growth some new use appears to be developed. In the Mauritius collection, the Countess Grey exhibited a basket and wreath of flowers formed out of the leaves of the double cocoa-nut palm (*Lodoicea Seychellarum*), which were considered worthy a Prize Medal.

In the Spanish collection were exhibited some most beautiful specimens of plait, made from the fibres of a species of palm: also some elegant cigar-cases from the Island of Luzon, and for which a Prize Medal was awarded to the Economical Society of Manilla. (Spain, 235, p. 1344.)

D. GENERAL MANUFACTURES FROM WOOD, NOT BEING FURNITURE.

Under this head is included turnery in its various branches; carving, not having a special application, and not producing a work of art; all kinds of coopers' work, as well as basket and wicker work.

1. *Turnery.*

Many of the articles exhibited in this Class illustrative of turnery have been already referred to under the head of the materials employed in this art, more especially under Ivory and Vegetable Ivory. The following exhibitors displayed objects presenting many points of interest in the art of turnery, though not regarded by the Jury as of sufficient importance to be rewarded with Prizes:—

B. MITFORD (167, p. 787). Concentric balls, made of solid spheres of box-wood. This curious art was first introduced by the Chinese.

— GARRETT (141, p. 786). Ornamental turned snuff-boxes in ivory and fancy foreign woods.

J. PEEL (175, p. 787). Turning apparatus for cutting in relief in the lathe. Fac-similes of medals, coins, flowers, &c.

OSCAR SMITH (95, p. 784). Specimen of ivory turning and carving, forming a pedestal, vase, and flowers. Unique specimen of ivory turning; a solid piece, the form of an egg, hollowed out to the thickness of the natural shell from a perforation of the twelfth part of an inch. Turned by George A. Smith, 22 May's Buildings, St. Martin's Lane.

W. D. HEMPHILL (158, p. 786). Plain and ornamental ivory turning.

2. *Carving and Working in Wood.*

The more beautiful specimens of this art were referred to the Class of Fine Arts. The following collections, however, presenting many objects of interest, and good instances of the application of carving to utility and the improvement of the form of articles of ordinary use, were adjudged Prize Medals by the Jury:—

N. SCHRÖDER (Grand Duchy of Hesse, 77, p. 1129). A collection of geometrical models. (Awarded a Prize Medal by Jury of Class X.)

N. P. THESEN (Sweden and Norway, 44, p. 1352). A collection of wooden vessels for various purposes, ornamented with carvings. These articles are made by the peasantry, and the present collection came from Christiana.

Captain SHEA (China, p. 1420). A collection of objects brought by the exhibitor from China, and consisting of carvings in various kinds of hard coal and in pearl.

KEHRLI BROTHERS, Meyringen (Switzerland, 242, p. 1282). A collection of articles of various kinds carved in wood.

The HEIRS of G. LANG (Bavaria, 77, p. 1101). Principally toys carved in wood.

J. WIRTZ (Switzerland, 259, p. 1283). Various articles of wood carving.

Spa, in Belgium, has long been celebrated for its work in wood; and a collection of boxes, exhibited by J. E. MARIN (Belgium, 414, p. 1164), was regarded as worthy a Prize Medal.

The Jury also wish Honourable Mention to be made of the beautiful collection of workboxes of the same kind exhibited by E. and L. MISSON (Belgium, 412, p. 1164).

3. *Coopers' Work of all kinds.*

The collection of articles rewarded with Prize Medals in this department are regarded by the Jury as worthy of that distinction, both on account of the neatness and durability of the workmanship, and the cheap price at which they are sold. The American and Canadian pails are a very superior article, and calculated for extensive use in Europe. The tubs and casks from Switzerland and Portugal indicated admirable workmanship:—

J. BAILEY (Canada, 86, p. 965). Water-pails.

J. A. FAESSLER (Switzerland, 229, p. 1281). Milk-tubs, &c.

G. LORING (United States, 424, p. 1462). A large collection of water-pails.

J. W. MACGREGOR (146, Class XXVII., p. 786). Casks for ships.

A. P. RANGEL (Portugal, 1120, p. 1317). Wine-casks.

4. *Basket and Wicker-work.*

Several collections of articles in this division were exhibited, some deserving much credit, as those in the collection of the SCHOOL FOR THE INDIGENT BLIND; but the Jury did not observe any qualities in them that would call for more than the expression of their satisfaction at finding this branch of art represented in the Exhibition. A basket made of willow wood, worked in a peculiar manner, called the Sussex truck-basket, was exhibited by Mr. T. SMITH, of Hurstmonceaux (172, p. 787), to which the Jury awarded a Prize Medal.

E. MANUFACTURES FROM STRAW, GRASS, AND OTHER MATERIALS.

The objects exhibited in this department were not numerous.

1. *Indian-Corn Straw.*

This substance is manufactured into brooms in the South of Europe and in North America, and several collections of these articles were exhibited. The following were considered as deserving of Honourable Mention:—

NELSON and BUTTERS (Canada, 84, p. 965).

D. PASTORELLI (Tuscany, 35, p. 1294).

R. WARNER and Co. (United States, 431, p. 1463).

In the Canadian and American Departments several exhibitors contributed brooms of this material.

2. *Straw Work.*

In various parts of the Exhibition collections of straw, plaited and made into flowers, baskets, &c., were exhibited. In some instances willow shavings were plaited and made into articles of dress. The following rewards comprise various collections in this department which the Jury considered worthy of reward or distinction:—

Prize Medals.

ABT BROTHERS, Wohlen (Switzerland, 227, p. 1281). Straw work. (Awarded a Prize Medal by Jury of Class XX.)

AMBROISE CLARAZ, Fribourg (Switzerland, 228, p. 1281). Straw work.

C. D'HEUREUSE (Prussia, 244, p. 1061). Straw work.

F. P. HAAS (Wurtemburg, 79, p. 1119). Various forms of straw plaiting.

J. RENDALL (144, p. 786). Straw work.

SULZBERGER and AKERMANN (Switzerland, 234, p. 1281). Straw work. (Awarded a Prize Medal by Jury of Class XX.)

S. TANDLER (Austria, 657, p. 1041). Straw flowers.

L. TOMASSIA (Austria, 97, p. 1012). Willow plait.

Honourable Mention.

ISLER and OTTO, Wildegg (Switzerland, 213, p. 1280). Straw work.

London, February 1852.

EDWIN LANKESTER, REPORTER.

CLASS XXIX.

REPORT ON MISCELLANEOUS MANUFACTURES AND SMALL WARES.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

Jury.

Viscount Canning, *Chairman*, 10 Grosvenor Square.

— Wolowski, *Deputy Chairman*, France; Professor to the Conservatory of Arts and Manufactures; Member of the Central Jury and of the Legislative Assembly of France.

Warren de la Rue, Ph. D., F.R.S., F.R.A.S., F.C.S., &c., *Reporter*, 110 Bunhill Row, Finsbury, and 7 St. Mary's Road, Canonbury, Islington; Manufacturer of Ornamental Stationery.

A. W. Hofmann, Ph. D., F.R.S., F.C.S., Corresponding Member of the Royal Academy of Turin; of the Philomathic Society of Paris, &c., *Joint Reporter*, Zollverein, 26 Albany Street, Regent's Park; Professor of Chemistry, Royal College of Chemistry.

Arthur Henfrey, F.L.S., 17 Manchester Street, Gray's Inn Road; Vice-President of the Botanical Society.

John Joseph Mechi, 4 Leadenhall Street; Maker of Dressing-cases and Cutlery.

Otto Schumann, Austria; Member of the Council of Commerce, Vienna.

W. K. Smith, Virginia, United States; Mineralogist.

Associates.

D. W. Mitchell, 11 Hanover Square; Secretary to the Zoological Society.

Richard Owen, F.R.S. (Juror Class iv.); Professor to the College of Surgeons, Lincoln's Inn Fields; President of the College of Surgeons.

Natalis Rondot, France (Juror Class xxvi.); late of the Embassy to China; Member of the Central Jury; Delegate of the Chambers of Commerce of Lyons and Paris.

Members of other Juries, who by request attended some of the meetings of the Jury, and furnished information on the Chemical Arts.

M. Balard, France (Juror Class xxviii.); Member of the Institute; Professor of Chemistry at the College of France, &c. &c.

A. Payen, France (Juror Class iv.); Member of the Institute; Member of the Central Jury; Professor to the Central School, and to the Conservatory of Arts and Manufactures, at Paris.

The number of Exhibitors of all nations in this Class is seven hundred and forty-two.

According to the list furnished under the title of Head Juries, this Class was intended to comprise the following articles:—

A. Perfumery and Soap.

B. Articles for Personal Use, as Writing-desks, Dressing-cases, Work-boxes, when not exhibited in connexion with precious metals (XXIII.), and Travelling-gear generally.

C. Artificial Flowers.

D. Candles and other means of giving light.

E. Confectionary of all kinds.

F. Beads and Toys, when not of hardware; Fans, &c.

G. Umbrellas, Parasols, Walking-sticks, &c.

H. Fishing-tackle of all kinds, archery, &c.

I. Games of all kinds.

J. Other Miscellaneous manufactures.

The latter title is very comprehensive, and might have been made to include all objects not specially enumerated in the lists of other classes. Practically, however, little difficulty was experienced in arranging with the Juries of other Classes for their adjudication of those manufactures with which they were most conversant; consequently to the above list there will have to be added only Artificial Essences, Blacking, Lucifer Matches, Artificial Ivory, Taxidermy, Ethnographical Models, Educational Models, Pipes and Amber-manufactures, and Snuff-boxes. Candles were the only "means of giving light" brought before the notice of this Jury; and of beads those of amber only were taken into their consideration. The term "Miscellaneous" nevertheless was retained in order to enable the Jury to review a few objects not admitting of classification under the preceding heads.

The English Jurors held a preliminary meeting on the 13th of May, 1851, and on the 17th, the foreign Jurors having been appointed, the full Jury assembled and elected their Deputy Chairman and Reporters. From this date until the 23rd of July inclusive, the Jury continued their meetings for the most part three times a week, and having, on the latter day, sent in their final List of Awards, they adjourned.

Owing to the very various character of the manufactures brought before the notice of the Jury, it was quite evident, as its members could not be equally conversant with all, that it would be expedient to divide the Jury into Sub-committees, of which four were formed, whose duty it was to make a preliminary examination of certain allied classes of manufacture, and to report thereon before the discussion of the awards took place. In those preliminary examinations the Committees availed themselves freely of their privilege of calling in the aid of persons more intimately acquainted than themselves with the technical merits of particular branches of art.

It was likewise the duty of the Committees to make a list of objects belonging to their various sections, a labour attended with no little difficulty on account of the necessarily imperfect state of the Catalogue at that time, and also from the classification which was adopted in the British Department, being impossible in the colonial and foreign sections. Even in the British section, Class XXIX. did not include all the articles ultimately submitted to the judgment of the Jury, and the Committees had often to search for them in other Classes.

The examination of the goods was usually commenced before eight o'clock in the morning, and continued for six or eight hours during each day, the earlier hours being occupied by the entire Jury in visiting the various stands and discussing the Awards; whilst soon after the admission of the public the Jury for convenience again divided into Committees. It is quite possible that with all the care bestowed on the search for objects belonging to Class XXIX., some articles may have escaped notice; yet the fact of the same exhibitor having been rewarded by more than one Jury, elicited on comparison of the award books at the close of our labours, amply testifies the anxiety on the part of the Jurors generally not to pass any object of merit, even though they might feel doubtful as to its belonging to their respective classes.

In recommending subjects for the award of the Council Medal, the Jury of Class XXIX. adhered strictly to the spirit of the instructions of the Council of Chairmen, and of the explanation given in the "Minute of the Royal Commission on the award of the Council Medal," and in no case have they made any application for its grant, except for *a new and useful invention in important arts.* The recommendations were three in number, namely, in favour of L. A. De Milly (France, No. 644, p. 1209), for the invention of practical methods of using lime in the manufacture of stearic candles, and the use of boracic acid in the preparation of their wicks; Price's Candle Company (Class IV., No. 83, p. 201*), for the invention of improved methods of treating and distilling fatty bodies, and the application of the products obtained thereby to the manufacture of candles; J. Marques Constantin (France, No. 94, p. 1175), and (Portugal, No. 1299, p. 1318), for the invention of an elastic dressing to the materials used in the manufacture of artificial flowers, whereby they are not permanently injured if crumpled in packing, but regain their form on being slightly shaken; also for the adaptation of textile fabrics to the imitation of flowers for botanical museums. These recommendations were unanimously confirmed by the Group E of Juries; but the Council of Chairmen, whilst confirming the award of the Council Medal to L. A. De Milly and J. M. Constantin, negatived that in favour of Price's Candle Company. The Jury feeling that they had not made the recommendation until after a laborious investigation on the part of the Chemical Committee, Messrs. De La Rue, Hoffman, and Smith, and after ample discussion on their parts, protested on the 23rd of July against the decision of the Council of Chairmen in the following terms:—

"The Jury of Class XXIX. unanimously and respectfully protest against the decision which the Council of Chairmen have come to respecting the recommendation of a Great Medal for Price and Company, and feeling that their decision is based upon insufficient information regarding the merits of the case, they hope that the Council of Chairmen will not refuse to reconsider the matter."

In consequence of this protest, the Chemical Committee were invited to attend the meeting of the Council of Chairmen; two of their number, the Reporters, did so, and fully explained the grounds on which the recommendation had been made; but (as they were informed) it was subsequently found on reference to the minutes of a preceding meeting, that in consequence of a decision with regard to awards generally which had once been taken into consideration, the protest could not be entertained by the Council of Chairmen. The Reporters, however, cannot but regret that there should have existed any impediment to the correction of a decision which, from a careful scrutiny of the merits of the case, they consider erroneous.

The Prize Medal has been awarded for excellence of workmanship, novelty of construction, beauty of design, or goodness of manufacture, combined. At first sight it may appear strange that the same reward has been given to a child's toy and to the botanical models in wax of flowers; to the important chemical art of stearic candle-making, and to the apparently insignificant sugar-confectionary. On reflection, however, it must become evident that the only method of making the Awards was to discard for the moment the consideration of all Arts except the one immediately under discussion, and to reward excellence in that one, irrespective of its value as compared with any other. The estimation of the amount of merit recognized by a Medal must, therefore, mainly depend on the nature and difficulties of the manufacture for which it is given, and marks only that an individual Exhibitor has attained a degree of perfection in no case inferior to that to be expected from the existing state of the art as evinced by the examples in the Building, or known to have been produced elsewhere. In the same branch of industry questions of relative merit were only so far gone into as not to reward mediocre or bad productions; and consequently it will be seen that the Medal is in most cases a mark of *positive*, and not of *relative* merit, the Jury not having pretended to select the *best* only, but also the *very good*. This will be best illustrated by quoting an example, and for that purpose one of the most important arts is selected, namely, that of soap-making. In this no extraordinary superiority of any one manufacturer was evinced above all the rest, but a great number had attained a high degree of perfection, in which only differences of degree might be traced. It is evident that the Jury could not have selected any one, or even two or three, for reward without doing an injustice to many others; and it became necessary either to give no Medals at all, or to give one in all cases of decided merit. The Jury chose the latter alternative.

The distinction of Honourable Mention has been accorded in those cases where the merit of the Exhibitor was far above mediocrity, yet still below that of the recipients of the Prize Medal.

The detailed Report is arranged in an order slightly differing from that set forth at the commencement of this introduction, the following being the arrangement which was decided on:—

A. *Manufactures depending upon Chemical principles.*
Soap and Perfumery.
Candles.
Proteau Stone, or Artificial Ivory.
Blacking.
Chemical Matches.
Confectionary, and Fruits preserved in Sugar.

B. *Manufactures relating to Natural History.*
Artificial Flowers.
Taxidermy.

C. *Articles connected with Education.*
Educational Models.
Ethnographical Models.
Collections of Produce.

D. *Manufactures for Personal use.*
Dressing-cases, Writing-desks, Work-boxes, &c.
Umbrellas and Parasols.
Walking-sticks.
Fans.
Pipes and Amber-manufactures.
Snuff-boxes.

E. *Manufactures relating to Amusements.*
Apparatus for Manly Games, viz., Cricket, Archery, Rackets.
Fishing-tackle.
Toys.

F. *Miscellaneous.*
Including all articles not sufficiently numerous or important to be classified under distinct heads.

The plan followed has, in most cases, been to give a short historical sketch of the progress of an art, to discuss the scientific principles on which it is based, and to add such a description of the process employed as to enable the general reader to comprehend its chief details. The productions of each country, in alphabetical order, are then stated, and, lastly, the chief contributions of the successful exhibitors are specially noticed. The Report, however, is necessarily unequal in its details, some notices being much more complete than others. The Reporters are quite aware of these and other defects, and can only plead the very great difficulty of obtaining correct information on such a variety of subjects as the Report contains, and the very diversified nature of the goods exhibited.

The Reporters have great pleasure in thanking their colleagues, Viscount Canning and Mr. Arthur Henfrey, for Reports on special subjects; M. Natalis Rondot, for information respecting the arts in France and in China;

and Mr. J. J. Mechi, for the communication of statistics in some branches of trade; and, lastly, in acknowledging the assistance of their friends, Mr. Richard Thomson, Librarian of the London Institution, and Dr. Anthony, in supplying much historical matter. The Commissioners of Her Majesty's Customs, and John Wood, Esq., the Chairman of the Board of Inland Revenue, have also obligingly furnished the Reporters with statistical information respecting the Imports into, the Manufactures of, and the Exports from, the United Kingdom, for which they take this opportunity of publicly expressing their best thanks. They have also made free use of those valuable French and Belgian Reports, entitled respectively "*Rapport du Jury Central sur les Produits de l'Agriculture et de l'Industrie Exposés en* 1849," and "*Rapport du Jury et Documents de l'Exposition de l'Industrie Belge en* 1847."

A. MANUFACTURES DEPENDING UPON CHEMICAL PRINCIPLES.

I.—SOAP AND PERFUMERY.

The first of the two branches of industry now to be considered is probably of greater interest than any which will be discussed in the succeeding sections. The magnitude of the manufacture of soap, the importance of the trade, and the enormous capital embarked in it, as well as the wonderful relation which it bears with regard to the most important links in the chain of chemical industry, is not often sufficiently estimated. A distinguished chemist[*] of the present day says—

"The quantity of soap consumed by a nation would be no inaccurate measure whereby to estimate its wealth and civilization. Political economists, indeed, will not give it this rank; but whether we regard it as joke or earnest, it is not the less true, that, of two countries with an equal amount of population, we may declare with positive certainty that the wealthiest and most highly civilized is that which consumes the greatest weight of soap. This consumption does not subserve sensual gratification, nor depend upon fashion but upon the feeling, of the beauty, comfort, and welfare attendant upon cleanliness; and a regard to this feeling is coincident with wealth and civilization. The rich in the middle ages, who concealed a want of cleanliness in their clothes and persons under a profusion of costly scents and essences, were more luxurious than we are in eating and drinking, in apparel and horses; but how great is the difference between their days and our own, when a want of cleanliness is equivalent to insupportable misery and misfortune!"

It is interesting to cast a glance upon the early history of this important branch of trade. No mention of soap is to be found in the works of authors prior to the Christian era. The term soap occurs repeatedly in the Old Testament,[†] but the learned Beckmann[‡] has proved, in his Treatise on Soap, that the Hebrew word "*Borith*," which has been rendered soap, rather means alkali. One of the most ancient descriptions of bathing and washing is to be found in Homer's[§] narrative of the preparations made by the mother of the lovely Nausicaa for the washing expedition to the river. Life-sustaining meats and refreshing wines, softening oil in golden vessels for anointing the skin, are carefully enumerated; but soap formed no part of the inventory. The Homeric virgins were ignorant of this invaluable oleo-alkaline compound. Pliny[||] is the first writer who gives us an authentic account of soap. He states that it is made from tallow and ashes, the best materials being goats' tallow and beech-ash. He was also acquainted with the hard and soft varieties of soap; he calls it a Gallic invention, but states that it was particularly well prepared in Germany, where the men were more in the habit of using it than the women. It served to colour the hair yellow. From the description of Pliny, it is evident that he really means soap, although the purpose for which it was employed creates some difficulty; and it would appear that the soap of the ancients contained some colouring agent, and served chiefly as a hair-dye, and likewise as a remedial agent. It does not seem that it was used for the purposes for which it is now almost exclusively employed. Besides several kinds of fullers' earth,[*] and plants with saponaceous juices (*struthium*), the ancients availed themselves of solutions of soda and potash, which continue in use for washing in the present day. Strabo speaks of an alkaline water (soda) in Armenia which was used by the scourers for washing clothes, and we find express mention of the employment of a lye made with the ashes of plants (potashes), in cleansing oil and wine jars, and the images of the gods in the temples.[†] The method of strengthening the lye by means of quick-lime was known, undoubtedly, in the time of Paulus Ægineta. The agent most commonly used for washing garments, however, was putrid urine, which is still employed in the cloth-districts for washing wool. The fullers were literally and metaphorically in bad odour, and were required to exercise their trade outside the town, or in unfrequented streets; but they were permitted to place tubs at the corners of the streets for the convenience of passengers and their own profit. Regarding urine in the light of soap, the Emperor Vespasian may be said to have originated the soap-duty, as this source of revenue was not lost sight of by him, though, as Beckmann remarks, it does not appear very clear how the tax was collected.

After Pliny, soap is mentioned by Geber, in the second century of the Christian era, and at a later period frequently by the Arab writers; but although undoubtedly used for washing, it is spoken of chiefly as a remedial agent for external application. It would be a difficult matter to trace the onward progress of soap-making, step by step, but it is certain that the boiling of soap flourished in the seventeenth century, as we possess extensive directions of that date for its preparation.

It is only in the most modern times that the soap-manufacture has attained that extraordinary development which distinguishes this branch of trade; various circumstances have contributed to produce it. The valuable researches of Chevreul, although they explain the nature of saponification, have contributed less to the advance of the soap-manufacture than to that of candle-making, hereafter to be described. On the other hand, the development of the manufacture of soda has proved a most powerful stimulus to that of soap, which when freed from its dependence on the uncertain and limited supply of barilla and kelp, made such strides as could not have been anticipated. Mr. James Muspratt, who was the first in England to carry out successfully, and on a large scale, Leblanc's method of preparing soda from chloride of sodium (sea-salt), informs us that he was compelled to give away soda by tons to the soap-boilers before he succeeded in convincing them of the extraordinary advantages to be derived from the adoption of this material. As soon, however, as he had effected this, and when the soap-boilers discovered how much time and money they saved by using artificial soda, orders came in so rapidly that Mr. Muspratt, to satisfy the demand, had his soda discharged red-hot into iron carts and thus conveyed to the soap-manufactories. From that period a constant race was kept up between soap-making and the artificial production of soda; every improvement in Leblanc's process was followed by an extension of the soap trade, and it is a curious fact that the single sea-port of Liverpool exports annually more soap at present than did all those of Great Britain previous to the conversion of chloride of sodium into carbonate of soda. The manufacture of soap has, on the other hand, been a powerful stimulus to the preparation of soda and of the important secondary product, hypochlorite of lime (bleaching powder), which are so intimately allied with almost all branches of chemical trades; thus soap occupies one of the most important pages in the history of applied chemistry. The increase in the consumption of this article has led, moreover, to the discovery of new materials for its production; it has opened new channels to commerce, and thus it has become the *means* as well as the *mark* of civilization. Almost simultaneously with the employment of soda, the oils of the cocoa-nut and the palm have been introduced into the manufacture of soap. The following statistics respecting the imports into the United Kingdom and France best demonstrate the increasing consumption of these oils:—

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[*] Liebig's *Familiar Letters on Chemistry*, Letter xi., p. 129.

[†] *Jeremiah*, c. ii., v. 22; *Malachi*, c. iii., v. 2.

[‡] Beckmann's *History of Inventions*, translated by Johnston, fourth edition (Bohn).

[§] Odyss. vi.

[||] Pliny, *Nat. Hist.*, xxviii. (vol. ii., page 328 of Holland's translation), and in speaking of soap ointment, xxiii., c. 2, page 158.

[*] Several varieties of fullers' earth are exhibited in the Grecian section, Nos. 15 and 16, which, in all probability, are identical with those formerly used by the classical ancients; the reader is referred for the details to the *Illust. Cat.*, vol. iii., pages 1402–3. There is also a specimen of fullers' earth contributed to the South African Department by J. Calf (No. 55). *See* vol. ii., p. 952.

[†] Egypt has sent some very interesting specimens of *Natron*, or native sesquicarbonate of soda: this salt is the *trona* of mineralogists. Tunis has also contributed a specimen. *See* Egypt, Nos. 11, 16, 17 (*Illust. Cat.*, vol. iii., p. 1408), and Tunis, No. 149, (p. 1416.)

				Cwts.
Imports of Palm-oil in –	1820	–	–	17,456
,, ,,	1830	–	–	213,476
,, ,,	1840	–	–	315,503
,, ,,	1850	–	–	447,796
Imports of Cocoa-nut oil in	1820	–	–	8,353
,, ,,	1830	–	–	8,534
,, ,,	1840	–	–	42,428
,, ,,	1850	–	–	98,030

The consumption of palm and cocoa-nut oils in France, although considerably less than in the United Kingdom, is rapidly increasing, as will be seen by the following table:—

Imports of palm and cocoa-nut oils into France—

	Cwts.
1827 – – – – –	3
1829 – – – – –	70
1830 – – – – –	256
1835 – – – – –	253
1840 – – – – –	4,622
1845 – – – – –	33,691
1850 – – – – –	62,610

The development of the trade in palm-oil has contributed largely to the abolition of the iniquitous slave trade on the west coast of Africa, and in many parts of the coast has entirely suspended it.

Theory of the Formation of Soap.

Before we proceed to the examination of the separate specimens of soaps exhibited, a few words may be said respecting the materials employed in their manufacture. They are, on the one hand, alkalies, and on the other, fatty and resinous substances derived from the organism of animals and plants, especially tallow, lard, palm-oil, cocoa-nut oil, olive-oil, linseed-oil, fish-oil, and common rosin. Although physically and chemically widely distinguished from one another, fats and oils present numerous analogies. None of these substances is a pure chemical compound; the majority are mixtures in varying proportions of different chemical bodies, which may be isolated by mechanical or chemical processes. When this separation has been effected, the isolated substances which are the proximate principles of the fatty or oily bodies, though again differing much from one another, exhibit one common chemical character; when exposed to the influence of powerful decomposing agents, they are broken up in a similar manner, yielding on the one hand an acid, and on the other a neutral body.

All fats may be resolved into two proximate fatty substances, one of which is fluid at the common temperature —it is termed olein; the other is solid, and is called stearin. The preponderance of one or the other of these proximate constituents determines the state of aggregation of the fat. The body usually designated *stearine* is generally a mixture of the stearin of the chemist and an analogous body, margarin, the two substances differing in their relative proportion according to the source from which the fat is obtained. Thus, the solid fat from sheep (tallow) contains chiefly stearin, that of the pig (lard) and of olive-oil, chiefly margarin; the solid fat of palm-oil is palmitin, that of cocoa-nut oil, cocin.

Stearin, margarin, olein, palmitin, and cocin are all compounds of certain fatty acids with oxide of glyceryl, and may be viewed as substances resembling neutral salts, or rather compound-ethers. The changes which all these substances undergo when submitted to the action of powerful bases is well illustrated by the deportment of olein with oxide of lead (litharge). When boiled with this base, the olein is decomposed into oleic acid and oxide of glyceryl. The former combines with the base forming an insoluble soap, called oleate of oxide of lead (diachylon plaster), and the oxide of glyceryl, separating in combination with water, forms glycerin (hydrated oxide of glyceryl), a substance having a certain analogy with the group of bodies termed alcohols. It remains dissolved in the water employed. If olein is boiled with a solution of potash or soda, oleates of potash or soda are obtained; but being soluble in water, they remain dissolved together with the glycerin.

The oleates of potash or soda, when separated from the water by processes immediately to be discussed, are what we call in common life *Soaps*. Similar soaps are formed by the remainder of the fatty acids, for example, stearic and margaric acids. Palmitate of soda, obtained by boiling palm-oil with soda, likewise forms a chief ingredient of many soaps.

Potash and soda, as they occur in commerce, are combinations of the alkaline bases thus denominated by the chemist, with carbonic acid; and though, by long boiling, they could decompose (saponify) fats, yet the operation is tedious and the saponification generally incomplete. It is better to deprive the alkalies of their carbonic acid, which is done by mixing them with quick-lime and water; the quick-lime combines with the carbonic acid, forming an insoluble carbonate of lime (chalk), and the water retains the potash or soda in solution, contaminated still with such impurities as the alkalies contained (sulphates and chlorides, for example), and a minute quantity of Caustic lime.

Common rosin (colophony) is the residue of the distillation of natural turpentines, and consists principally of pinic acid, together with a little sylvic and colophonic acids. When rosin is boiled with alkalies, carbonated or not, a compound is readily obtained, but of course no glycerin. Thus, when it is boiled with soda, a pinate of soda is chiefly produced. This compound exists in considerable quantity in yellow-soap, and gives to it its distinctive character.

The character of soap is not only affected by the nature of the acids which it contains, but also by that of the alkali which has served for its preparation; the soaps containing potash are generally soft and pasty, those prepared with soda are hard and solid.

The compounds of stearic, margaric, oleic, palmitic, cocinic, pinic, and sylvic acids with potash or soda are all readily soluble in alcohol and hot water, but more so in the former, which, on evaporation, leaves the soap in a translucent state; hence its application in the preparation of "Transparent soaps." Soaps, however, are insoluble in a solution of many neutral salts, particularly when concentrated; this property is of great use to the soap-boiler, who employs it for the separation of the soap from its solution in water, generally adding common salt to set the soap at liberty. As soaps are likewise insoluble in strong alkaline lyes, the same end is sometimes attained by boiling down the soap to a certain consistence, when it separates from the excess of lye.

The soap made with cocoa-nut oil is, however, soluble in very strong brine, and the same plan of separation does not succeed with it; but as it is more generally employed together with other fats, this difficulty is then overcome. Its property of dissolving in salt water renders it peculiarly adapted to the formation of a *Marine soap*. One remarkable property of cocoa-nut oil soap is, that of solidifying with a much larger quantity of water than most other soaps, thus giving a larger yield, but, of course, being of proportionally less value. This property is, however, unfortunately often turned to profitable account by the soap-maker. As an instance, may be quoted an analysis of Dr. Ure, who found a London cocoa-nut oil soap to contain 75 per cent. of water, whereas 25 per cent. of water is a large quantity for any but potash-soaps to contain, and these generally contain less than 50 per cent.

The greater part of our knowledge concerning the chemical constitution of fats, and the changes which accompany their decomposition under the influence of alkalies, is due to the masterly researches of Chevreul, prosecuted with wonderful acuteness and perseverance from 1813 to 1823, when they were published in Paris, in a collected form, under the title of "*Recherches Chimiques sur les Corps Gras d'Origine Animale*," a work which will ever remain a model of philosophical inquiry.

Processes.

There are two processes chiefly employed in the preparation of soaps, the most simple of which is that called the *Cold-process* (from the combination being attained at temperatures below the boiling point of water), or the *Small-boiler-process* (as it is generally effected in comparatively small vessels). For the purpose of making soap in this manner, the alkaline lye is prepared from the purest commercial soda, and concentrated by evaporation. As the chloride of sodium and sulphate of soda, which commercial soda contains, are nearly insoluble in a strong alkaline solution, they crystallize out, especially on allowing the lye to stand for some days, thus leaving it much purer. A weighed quantity of fat is melted, and the strength of the lye having been previously ascertained by taking its specific gravity, a certain portion is weighed or measured, and separately heated and then stirred with the melted fat. Saponification soon occurs, and, on cooling, the soap solidifies. It is very evident that soap made in this manner, must contain the glycerin; moreover, as it is very difficult to obtain an exact neutralization of the fat or alkali, one or the other is often in excess, generally the fat; this prevents such soap from giving so good a lather as those prepared by the more usual method.

The ordinary method is called the *Large-boiler-process*, as it is usually conducted on a very large scale, in boilers capable of holding many tons. A quantity of weak soda-lye is put into the iron or copper boiler and raised to the boiling point, and the whole of the fat is generally added at one time. The ebullition is then carried on for some hours, and when the lye has become exhausted of its alkali, it is pumped away, and a fresh portion of lye is added. After repeated boilings and pumpings, the saponification is completed, and the soap is brought to strength by boiling down.

Now the soap-boiler may wish to prepare either white or mottled soap. If a white or curd-soap is required, the soap is "*fitted*," that is, boiled, with a certain quantity of water, or weak lye, and allowed to settle, when the black impurities ("nigre") fall to the bottom, and the soap is then removed to the frames and allowed to cool. These frames are composed of a number of separate planks, to facilitate the removal of the soap.

The mottled-soap is prepared in a similar manner, except that the operation of fitting is dispensed with, and the "*nigre*" is left in the soap. This nigre consists chiefly of sulphide of iron, produced by the action of the lye, which always contains a minute quantity of sulphide of sodium, on the vessel. In Marseilles and other countries where olive-oil-soap is made, a quantity of sulphate of iron (green copperas) is added, and in this case the mottling is produced jointly by the sulphide of iron (the black portion) and a true iron soap (the red portion). In order that the metallic compound may not fall to the bottom (as in *fitting*), the soap has to be much more concentrated; when removed from the boiler it is of one uniform slate tint, but as it cools, the metallic compounds separate into nodules, and by the trickling of the excess of lye through the mass, they take up certain forms, which produce the appearance called mottling. Hence mottled-soap is of more value, from its containing a less proportion of water.

It is evident, on comparing this with the cold-process, that it is much more scientific, as an excess of alkali may be employed to ensure complete saponification, with the perfect certainty that it can be got rid of in the lyes; the glycerin is also removed with the impurities contained in the fat, at each pumping; and a very pure chemical compound is obtained, notwithstanding the employment of comparatively impure materials. If the soda-ash employed does not contain sufficient saline impurities to throw up the soap, it is necessary to add a solution of common salt to effect this object each time the exhausted lye is pumped off.

There have been several patents for changes in the process of the manufacture of soap, one of which (by Arthur Dunn) was for effecting the saponification in close vessels, at a very high temperature, 154°·5 C. (310° F.); this plan has not, however, been generally adopted.

Another patent was obtained for an exactly opposite plan, by Mr. Hawes, who making use of strong lyes and much mechanical mixing, effects the saponification of the fats in a comparatively cold state. The product is then put into a copper and "fitted" in the ordinary manner.

Several patents, taken out for supposed improvements, are in reality plans for the adulteration of soap; amongst which may be instanced the preparation of soap from bones, fish, &c., which is merely introducing an adulteration of gelatin. Other plans consist in the introduction of Cornish clay, fuller's earth, and other similar materials.

The Floating-soap, exhibited in many foreign Sections, is prepared by melting ordinary soap with the addition of a certain quantity of water, and then beating it into a thick froth by means of a paddle until it occupies twice its original bulk. Formerly this kind of soap was made in considerable quantities in England, but it is now very rarely manufactured, and was not exhibited at all in the British Department.

The soap called Silicated-soap, now manufactured extensively at Liverpool, is formed by mixing a basic-silicate of soda (made by boiling powdered flint in a close vessel under pressure with caustic soda) with hard-soap in the melted state. It appears to possess remarkable detergent properties, but is liable to feel gritty in the hand.

Wax-Soap.—This soap, which is made from wax and soda by the paper-hanging makers to mix with their distemper colours, in order to prevent their rubbing off, cannot be considered as a true soap in the ordinary acceptation of the term. For Brodie's elaborate researches "*On the Chemical Nature of Wax*,"[*] clearly prove that on boiling wax with weak soda-lye, part only of the wax (the free cerotic acid) is saponified; the remainder, which is a neutral fat or ether (palmitate of oxide of mellissyl[*]), is not acted upon, and is contained in admixture with the cerotate of soda in the state of emulsion. Probably the valuable properties of wax-soap are in some measure due to this circumstance.

Properties and Action of Soap.

The detergent property of soap is usually considered to be dependent entirely on the quantity of alkali which it contains, and hence the question arises why pure alkali should not be employed in preference. An objection to this is the caustic character of the alkali, which is injurious not only to the hands of the person using it, but also destructive of the articles washed, and especially of some colours of dyed goods. By combining with fatty acids, the alkalies are rendered essentially milder in their action without being deprived of their capability of entering into combination with various impurities, and more particularly with certain fatty bodies. The most common explanation of the washing power of soap is founded upon Chevreul's observation that soaps are decomposed by large quantities of water, giving rise on the one hand to acid-soaps, and, on the other, liberating a quantity of free alkali which remains in solution. According to this view soap is a sort of magazine of alkali, which it gives up in the exact quantity required at any moment when it is rubbed with water. The combination of the alkali with some part of the dirt cannot be denied. Several constituents of this very indefinite admixture of many substances are of an essentially acid character, especially those derived from perspiration: others become acid when exposed on a large surface to the action of the air, in consequence of a sort of spontaneous saponification. This action cannot, however, be the sole *modus operandi* of soap, the valuable properties of which without doubt arise, in a great measure, from its power of dissolving substances which are insoluble in water. We know that certain mineral salts exert a solvent power upon substances which are entirely insoluble in water: thus it is well known that borax causes shell-lac to dissolve with great facility, and the chemist will at once call to mind the remarkable solvent property possessed by a soapy-compound ready formed in the animal organism; bile is essentially a combination of an alkali with fatty acids (glycocholic and taurocholic), and it dissolves with great facility the neutral body cholesterin, which, like fats, is insoluble in water. In addition to these two modes of operation, soap doubtless also produces a mechanical effect. The property which it has of increasing the cohesion of water so as to enable it to form a lather or froth is most valuable in the removal of solid insoluble particles of dirt, which are carried away by the frictional action of the suds when forced into and out of the minute interstices of the substances subjected to the operation of washing, and are kept suspended by the froth and thus prevented from again soiling them.

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[*] *Philosophical Transactions*, Part I., 1849.

If we adopt these views regarding the operation of soap, they guide us at once to a correct estimation of its washing capacity. It increases in a direct ratio with the quantity of true soap which it contains; the determination of the amount of water (by the simple device of drying the substance in the state of thin shavings at 100° C., 212° F.), consequently materially assists in the determination of the value of soap. But to arrive at an exact and rigorous knowledge of this value, a chemical analysis is necessary, and more especially when adulteration is suspected. We need scarcely remark, that the Jurors were unable to subject to analysis the varieties of soap of the numerous Exhibitors, many of whom had sent ten or more samples of different kinds. They, therefore, contented themselves generally with comparative trials of the detergent power of the various soaps, and for that purpose they had samples from all the Exhibitors. The toilet-soaps were judged of likewise by their perfume and presentability, and their freedom from gritty particles.

Perfumery.

From the earliest times of which we have any record, the sense of smell has been gratified with perfumes; the Egyptians applied them as conservative of the bodies of their deceased friends, and as incense before their venerated deities. On the wall of every temple in Egypt, from Meroe to Memphis, the censer is depicted smoking before the presiding deity of the place; on the walls of the tombs glows in bright colours the preparation of the spices and perfumes for the embalment of the mummy, and these very mummies and the vases of Oriental alabaster transported to our museums, tell with eloquence the same tale.

From the time of the *Exodus* throughout the long period of Jewish history, Holy Writ records the use of perfumes. Moses speaks of being directed by the Lord to prepare two perfumes, according to the art of the apothecary or perfumer, one of which was to be offered from the Golden Altar, and the other to be used on the person of the officiating priest. The "Spouse" in the Canticles is enraptured with the spikenard, the cinnamon, the aloë, and the myrrh; and Ezekiel accuses the Jews of diverting the use of perfumes from the Holy things to their own persons. In the New Testament, also, are contained frequent references to the use of perfumes, many of which will be in the memory of our readers. Especially, however, they will remember in chapter xiv. of the Gospel of St. Mark, that when Jesus sat at meat in the house of Simon the Leper,—"There came a woman having an alabaster box of ointment of spikenard, very precious, and she brake the box and poured it on his head."

Of the use of these luxuries by the Greeks, and afterwards by the Romans, the detail is more copious. Pliny gives much information respecting perfume-drugs, the method of collecting them, and the prices at which they sold. Oils and powder-perfumes, according to Seneca, were most lavishly used; for even three times a-day did some of the luxurious people whom he describes anoint and scent themselves, carrying their precious perfumes with them to the baths in costly and elegant boxes called "*Narthecia*."

The trade from the East in these perfume-drugs caused many a vessel to spread its sails to the Red Sea, and many a camel to plod over that track which gave to Greece and Syria their importance as markets, and vitality to the Rock-City of Petra. And Southern Italy was not long ere it occupied itself in ministering to the luxury of the wealthy by manufacturing unguents or perfumes. So numerous were the "*unguentarii*," that they are said to have filled the great street of ancient Capua, the Seplasia. In short, whether to regale the nostrils of their deities while sacrificing, or their own while feasting, or to prevent those nostrils from being offended by defunct humanity or the exhalations from crowded masses of people, the consumption of perfumes by the ancients was enormous. Happily in modern times the free use of soap has superseded the necessity for their lavish employment.

When we consider that there are some persons who appreciate the strong smelling musk more highly than any other, and another who would "die of a rose in aromatic pain," the definition of a perfume becomes a matter of some difficulty. Notwithstanding, however, the various impressions that volatile substances make upon different constitutions, a few general principles may be determined by which perfumery may be judged. In the first place, it is necessary to distinguish whether the substance is a chemical compound, or whether it is a mechanical combination of various chemicals. In the former case, if carefully prepared, it is independent of the perfume, and its odour, whether agreeable or repulsive, has a determined character of its own. In the latter case, that is, if the scent depends upon a mixture of substances, an opportunity is offered to the manufacturer of exhibiting his skill. Perfumes, on evaporation, should yield no resinous residue, and the various essential oils of which they are made ought to be combined so harmoniously that none of the components is perceptible, not only at first, but even during the progress of evaporation. The less the ingredients differ from one another in odour and volatility the less difficult it becomes to achieve this desideratum. Hence well-prepared Eau-de-Cologne is generally considered to be the perfection of perfumery. The constituents of this scent are, so far as is known, the essential oils of the lemon, the citron, and orange, prepared from the fruit in different stages of maturity, and they approximate so closely to one another as to produce a single aromatic impression. Other oils are added to Eau-de-Cologne, but in so minute a proportion that they scarcely demand any notice in comparison with those mentioned. Eau-de-Cologne that leaves a residuary odour either of otto-of-roses, oil-of-cloves, or oil-of-cinnamon, after volatilization, however agreeable these oils may be to individuals, must be designated as of inferior quality.

Still much practice is necessary to ascertain differences in the quality of the perfumes, and the task is rendered more difficult if numerous specimens have to be compared; for this reason the Chemical Committee returned repeatedly to the examination of the various specimens before reporting to the Jury, by whom the Awards were only fixed after a farther investigation.

Several of the perfumes, or rather essences exhibited, are of particular interest, and deserve an especial notice. We allude to a series of artificial organic compounds possessing qualities which permit of their substitution for natural volatile oils and essences. Most of them are substances belonging to the group of compound-ethers. The fruity odour of these bodies has been long known; but they do not appear to have been used in flavouring until the chemist had shown that many of the oils of vegetable origin resemble in their composition the above-mentioned products of the laboratory. For some years past a scent called Winter-green-oil has been extensively used in perfumery; it is obtained from an ericaceous plant, the *Gaultheria procumbens*, and is imported from New Jersey, in America, where it is obtained in considerable quantities. Chemical analysis of this oil has yielded the interesting result that it is a true compound-ether, consisting of salicylic acid and pyroxylic spirit, which may be formed by a combination of its proximate constituents, so as to possess all the characters of the natural substance. This observation was not lost upon commercial enterprise, and several of the numerous ethers prepared by the chemist were soon discovered to present the odour of certain fruits in so marked a degree, that it was difficult not to conclude that the fruits in question owed their smell to these ethers.

Several artificial essences of this kind are exhibited. Neither the time nor the quantity of material at the command of the Reporters permitted them to examine all these products; they are, therefore, obliged to confine themselves to a notice of the following:—

Pear-Oil is a spirituous solution of acetate of oxide of amyl. The latter may be obtained with facility and to any amount by distilling equal parts of concentrated sulphuric acid and fusel oil (the oily residue obtained by the rectification of potato or grain spirit) with two parts of acetate of potash. It is remarkable that the ether itself does not possess a very pleasant odour, and that its striking resemblance to that of pears does not become apparent until properly diluted with spirit. Artificial pear-oil is now prepared in large quantities in England. It is chiefly employed in the manufacture of the lozenges called pear-drops, of which the Exhibition presents some specimens, so that the flavour in its applied state may be tested side by side with the perfume.

Apple-Oil consists mainly of valerianate of oxide of amyl. It is obtained as a secondary product in the preparation of valerianic acid, by the distillation of fusel oil with bichromate of potash and sulphuric acid. The distillate has to be shaken up with a dilute potash-solution in order to remove the valerianic acid, when the ether floats on the top, and may be removed with a pipette.

Pine-apple-Oil is contributed by most of the Exhibitors of artificial essences; the specimen analysed was found to consist almost exclusively of butyrate of oxide of ethyl, or common butyric ether. It is easily obtained by boiling butyric acid (obtained from sugar by fermentation with putrid cheese) with strong spirit and a small quantity of concentrated sulphuric acid. It resembles the acetate of oxide of amyl in not presenting the characteristic agreeable fruity flavour, in a pure state; it requires to be considerably diluted before the odour appears. This oil is largely manufactured in England, and is employed in the preparation of a beverage called pine-apple-ale. The process commonly used for its preparation does not yield perfectly pure butyric ether. It consists in saponifying fresh butter with potash; the soap that forms is separated from the liquor, dissolved in strong alcohol, and distilled with concentrated sulphuric acid. This yields a mixture of butyric ether, and various other ethers; but the liquid obtained is perfectly adapted for the purposes of flavouring.

Cognac-Oil and Grape-Oil.—Specimens of these oils, especially of the former, are contributed by English, French, and German manufacturers. They seem to be often employed with the view of giving ordinary varieties of brandy the prized flavour of genuine cognac. Unfortunately the samples exhibited are too small to permit of a careful analysis. A few superficial examinations proved undoubtedly that they are compounds of fusel oil dissolved in a large quantity of alcohol; and it is curious that a substance which is most carefully eliminated from brandy on account of its offensive flavour, should be introduced in another form and in minute quantities in order to render the same beverage aromatic.

Artificial Oil of Bitter-Almonds.—As early as 1834, Professor Mitscherlich, of Berlin, pointed out a peculiar liquid formed by the action of fuming nitric acid upon benzole, and possessing the odour of natural oil of bitter-almonds in a high degree. It was called nitro-benzide or nitro-benzole. The preparation of this compound was, however, too expensive to admit of its substitution for natural oil of bitter-almonds, as the sole sources of benzole, at that period, were the compression of oil gas and the distillation of benzoic acid. In 1844, one of the Reporters[*] succeeded in demonstrating the presence of this substance in common light coal-tar-oil; and in 1849, C. B. Mansfield[†] showed by a careful investigation that benzole may be easily obtained in large quantities from tar-oil. In the French Department, under the fanciful title of "*Essence de mirbane*," the Reporters met with several specimens of oils, which on examination proved to be nitro-benzole of more or less purity; they were, however, unable to obtain any positive information as to the extent of this manufacture; but it does not appear to be very considerable. The method employed in England for its preparation was devised by Mr. Mansfield, and is very simple; his apparatus consists of a large glass tube in the form of a coil, which at the upper end divides into two tubes, each of which is provided with a funnel. A stream of concentrated nitric acid flows slowly into one of the funnels, and benzole, which for this purpose need not be perfectly pure, into the other. The two substances meet at the point of union of the two tubes, and chemical combination ensues with the evolution of much heat; but as the newly-formed compound flows down through the coil, it becomes cool, and is collected at the lower extremity. It then merely requires to be washed with water, and, lastly, with a dilute solution of carbonate of soda, to render it fit for use. Nitro-benzole is closely allied to oil of bitter-almonds in its physical characters, yet it presents a slight difference of odour which may be easily detected by an experienced person. It is very useful for perfuming soap, and is probably capable of application in confectionary and cookery, as its flavour resembles that of bitter-almonds, without containing any hydrocyanic (prussic) acid.

UNITED STATES OF AMERICA.

The greater portion of the soaps exhibited in the American section are transparent, the preparation of which requires the employment of a large quantity of alcohol. This is sufficiently cheap in the United States to permit of its free use by the soap-maker in the production of toilet-soap. Transparent soap is there much esteemed, and forms an important article of commerce. There are Three Exhibitors of transparent, and One of other toilet-soaps, in the American Section, and also Four of soap for household or manufacturer's use.

The American spirituous perfumery, which was found to be inferior to that exhibited by other countries, is contributed by the makers of toilet-soaps. One Exhibitor sends only a tooth-wash or dentifrice.

AUSTRIA.

About 3,750 tons of olive-oil-soap, valued at 235,000*l.*, are manufactured annually in Austria, besides soap made with tallow, and other fats. The two large stearic candle-works of Vienna, "Milly," and "Apollo," produce annually about 2,000 tons of oleic-acid soap, as a secondary product. The chief manufactories of olive-oil-soap are situated in Venice and Trieste, from which latter place there is One contribution to the Exhibition; thus affording an opportunity of judging of the state in that locality of a manufacture which is mainly confined to southern Europe. It appears that lately the production of olive-oil-soap has much decreased in Austria, but this must be attributable to other causes than a deterioration in its quality, which was found most excellent. There are Two contributors of this and other soaps, both of whom have exhibited the floating or froth soap.

The only Exhibitor of perfumery, **JOHN MARIA FARINA** (748, p. 1044), sent Eau-de-Cologne, which was so liberally distributed by means of a small fountain, that the supply in charge of the attendant was exhausted before the Jury had made the Awards, so that only the residue left in the fountain was submitted to them. As the specimen had evidently lost much of its perfume from exposure to the air, the Reporters, at the request of the Austrian Commissioner, M. C. Buschek, and with the sanction of the Executive, examined, subsequently, a fresh sample, which was taken from a cask of Eau-de-Cologne which had remained under the care of the Customs, and which had been overlooked by the attendant. This sample was found to be equal in quality to the Eau-de-Cologne rewarded with Honourable Mention.

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[*] Dr. Hoffman.—W. D. L. R.

[†] *Quarterly Journal of the Chemical Society*, vol. i., p. 244.

BELGIUM.

It is very remarkable that Belgium has sent to the Exhibition no green soft-soap (potash-soap), for which it has been famous from a very early period, and which, at one time, was an important article of exportation. Even now it is produced to a far greater extent than the hard soda-soap, the manufacture of which was commenced but a few years since, for the preparation of toilet-soaps. There is only One Exhibitor in the Belgian Section, and he sends toilet-soap only.

BRITISH COLONIES.

The British colonies have not yet progressed sufficiently in the art of soap-making to compete successfully with the world, as regards quality; at the same time it must be stated that their productions are, in most cases, creditable. The yellow-soap from Canada possesses a most disagreeable odour; the fancy soaps are likewise badly made, giving no lather whatever. The Cape of Good Hope sends a specimen of well-made yellow-soap from J. SMITHERS. India has contributed soap from Malabar, composed of cocoa-nut-oil and soda, and made up into irregular balls and long bars; this soap contains an excess of alkali, which effloresces at the surface, and is in general a very crude production. From Madras there is a specimen of well-made marine-soap manufactured by F. KEY (p. 922); and from Ceylon ornamented soap, called olas-soap, manufactured at Kandy, from cocoa-nut-oil. New South Wales sends very creditable specimens manufactured at Bathurst, 140 miles from Sydney; the collection comprises yellow, curd, and toilet soaps. Nova Scotia contributes very good yellow-soap, manufactured by — CLARKE, of Halifax (p. 970, Central Committee). New Zealand.—J. A. SMITH (No. 6. p. 1001), exhibits good soap made in Auckland. South Australia.—The specimens from this colony are all of yellow-soap, which was made by W. H. BURFORD (Class XXIX., Award Lists, p. 613), who is noticed in the List of Awards. Van Diemen's Land sends samples of good household soap, made by R. CLEBURNE, of Hobart Town (No. 144, p. 995). The West Coast of Africa sends specimens, which are interesting, as having been manufactured on the Oil-coast; they consist of soap made with a mixture of palm-oil and palm-kernel-oil, some made entirely with palm-kernel-oil, and soap made with ground-nut-oil. The oils used in their production are likewise exhibited.

EGYPT.

A few interesting and excellent specimens of perfumery have been sent from Egypt, comprising Rose-water of Fayoum, Orange-flower-water, and Mint-water of Rosetta.

FRANCE.

Although modern discoveries in chemical science, by furnishing a cheap substitute for barilla, have deprived Marseilles of some of its local advantages, this town is still the chief centre of the soap-manufacture in France, and from its position in the midst of the oil-producing countries, it is likely for a long period to retain the high reputation which for ages it has enjoyed for the olive-oil-soap to which it has given its name.

At one period Marseilles supplied the whole of France with soaps, in addition to large quantities exported to all parts of the world; but this privilege is becoming gradually curtailed by the establishment, round Paris, and other large towns, of soap-manufactories, in which tallow, palm-oil, and other fats, are employed in lieu of olive-oil; besides which nearly all the stearic-candle-makers convert their oleic acid into scouring and household soaps.[*]

The Parisian perfumers produce excellent toilet-soaps by the "large-boiler-process," remarkable for the fragrancy of the perfume, and giving a good lather. In many cases toilet-soap is manufactured by the "cold-process," and is generally of an inferior quality, giving only a disagreeable slime when used in washing; there are, however, samples in the Exhibition free from this defect.

Many French people never use soap to their faces, employing as a substitute aromatic vinegar, a few drops of which are added to the water used in washing. Hence the "vinaigre-de-toilette," is an important manufacture, which is chiefly monopolized by Paris, whence it is sent to all parts of France. There are Three Exhibitors of this aromatic vinegar.

Spirituous perfumery is prepared in great perfection by the manufacturers of Paris, some of whom distil their own essential oils; they generally, also, combine with it the manufacture of toilet-soaps, and hence, with a few exceptions, toilet-soaps and perfumery are exhibited together, and have been conjointly rewarded. In the preparation of essential oils the flowers are placed in a still, with water, and distilled. The vapour of the water carries over with it that of the essential oil, and both condense together, the essential oil swimming on the surface of the water, which, however, always retains a minute portion in solution. To recover this, the water is usually returned to the still and again passed over; M. Piver, one of the French exhibitors, however, instead of so doing, employs the water for the perfuming of pomatum and hair-oil, which, from their attraction for essential oils, withdraw them from the water.

In 1847 there were, it appears,[*] 110 perfumers in Paris, employing 721 workpeople in the manufacture of toilet-soaps, cosmetics, essential oils, and spirituous and aqueous perfumery, the value of whose productions was 389,680*l.* The workmen earned, on the average, 2*s.* 7*d.* per day; the workwomen, 1*s.* 6*d.*

According to M. Natalis Rondot, 12,042,970 lbs. of soap, valued at 142,012*l.*, were exported in 1850 from France, a quantity which, as will be hereafter seen, nearly equals that exported from Great Britain in the same year: besides which, 3,398,930 lbs. of perfumery, in value 431,638*l.*, were also exported from France.

There are Two Exhibitors of artificial essences in France. One sends simply a series of compound flavourings, intended to imitate the savour of various fruits; the second exhibits two specimens of chemical compounds, namely, artificial essence of bitter-almonds and artificial essence of pine-apple. The Jury did not, however, meet with any confectionary or perfumery in the French Section in which they had been employed.

Of the Nine Exhibitors of soap in the French Section, Two represent Marseilles, and Six, Paris; and, with two exceptions, these manufacturers exhibit toilet-soap only. There is likewise a small contribution of soap from Algiers.

GERMANY.

At one period all soap was manufactured in Germany by the *indirect*, or as it was called, the *German method*; but this is now fast giving way to the direct method, and will probably be ultimately superseded entirely by it. The indirect method, the result of empirical trials, and perfected only by long practice, is perhaps the most beautiful of all plans for making soap; the formation of this substance depending on a series of reactions, which modern chemistry explains, while at the same time, it fully confirms the correctness of the mode of procedure. Soap made on this plan is first prepared as a potash-soap by boiling the fats with a lye made with wood-ashes (a potash-lye), and is then decomposed while still in the boiler, by the so-called *salting-process* (*Aussalzen*), which consists in adding a strong solution of common salt (muriate of soda) to it, not merely to separate the soap from the water, but in sufficient quantity to yield the requisite amount of soda to take the position of the potash. The two bases, soda and potash, exchange places, the stronger base, potash, combining with the muriatic acid, and forming muriate of potash (chloride of potassium), the soda combining with the fatty acids, and forming a soda-soap. At one time this plan was of great value to a country like Germany, removed from the source of barilla, and producing little or none herself. Modern chemistry, by furnishing an abundant supply of cheap soda, however, renders this circuitous plan of much less value, and it must therefore give way to the onward march of science.

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[*] M. E. Péligot has proposed to use the oleic acid of the stearic works for the scouring of wool, because it may be readily removed by carbonate of soda. This valuable plan does not appear to have met with the encouragement it deserves, more especially out of France.

[*] *Statistique de l'Industrie à Paris*, par MM. Say et Natalis Rondot. 2me. partie, p. 829.

The Zollverein States of Germany are represented by Four Exhibitors of soap; Three manufacture household and scouring soap of excellent quality; the other, toilet-soaps. Hamburg is represented by One Exhibitor of floating and other toilet-soaps.

The perfumers of Germany are in great force, being Eight in number, and reckoning two John Maria Farinas in their ranks, making no less than four Farinas in the Exhibition, all claiming to be the original. It appears that speculation is carried to so high a pitch in Cologne, that any child, entitled to the surname of Farina, is bargained for as soon as born, and christened Jean Maria; at times this event is even anticipated. The perfumery of Germany is generally very good.

HOLLAND

is represented by One soap-maker, who exhibits olive-oil-soap, and toilet-soap of fair quality.

PORTUGAL

sends the produce of the Royal Soap and Tobacco Contractor. The collection comprises olive-oil-soda-soap (Marseilles); rosin-and-tallow-soap (yellow-soap) and toilet-soaps, all of which are creditable.

RUSSIA.

There are only Two Exhibitors of soap in the Russian Section, one from St. Petersburg, the other from Warsaw. The latter sends very excellent toilet-soaps.

Russia possessed, in 1842, Sixty-four soap-manufactories, which produced soap valued at 205,800*l.*; and, in the government of Moscow, Three manufactories of perfumery, employing Fifteen workmen, which produced goods valued at 5,080*l.*

SPAIN.

The quantity of soap manufactured in Spain is very large, and exceeds that required for her home consumption, a considerable portion being annually exported to the Spanish colonies. The common hard-soaps are those principally produced, and they are made by the "cold-process." The following is a list of the towns and provinces in which the manufacture is chiefly carried on, the figures indicating the number of manufactories, wherever it was ascertainable:—Badajoz; Caceres; Cadiz, 3; Burgos, 4; Gerona; Guadalajara, 2; Guipuzcoa; Huelva, 2; Huesca; Jaen, more than 10; Logrono; Malaga, 7; Madrid; Navarre, 7; Oreuse; Port St. Maria, 1; Tarragona; Toledo, 4; Valencia; Seville, 12; Soria; Saragossa, 16; Xeres de la Frontera, 1. Madrid is represented by One Exhibitor of hard olive-oil-soap made by the "cold-process," which is sold at about a penny per pound less than that prepared in the ordinary manner. Malaga sends the produce of one of its manufactories, consisting of the ordinary mottled Castile-soap, made with barilla and olive-oil, in the large boiler, the colouring being obtained by sulphate of iron. This soap is very perfect, and is sold at the rate of 5*l.* 11*s.* 3*d.* per cwt., or almost exactly 1*s.* per pound. In 1843, Malaga produced 19,700,000 lbs. of soap; and in 1844, according to information collected on the spot by M. Natalis Rondot, Cadiz, Xeres, and Port St. Maria yielded 450,000 lbs.

SWITZERLAND.

The contributions from Switzerland consist merely of a small quantity of tooth-powder and hair-oil. It is stated that the tooth-powder is in general use, and is prepared from an indigenous stone, which is calcined and pulverized.

TUNIS.

The Tunisian soaps are composed of olive-oil and soda, and are made in every part of the Regency, generally in copper vessels, holding from 40 to 50 cwt. each. The soda-lye is prepared by mixing the crude soda with the necessary quantity of lime, and putting the mixture into a reservoir, when water is added; under the reservoir is a well which catches the caustic lye as it flows from a hole in the bottom; from the well it is transferred to a copper vessel, and mixed with a proportionate quantity of oil, and boiled until it is made either into a hard-soap, or into one of a softer sort. The price of the hard-soap is from 30*s.* to 32*s.* per cwt., according to that of the olive-oil; the soft-soap is about 25*s.* per cwt. Soap is a very important article of commerce in Tunis, and is generally used by the lowest classes, whose habits of cleanliness are remarkable. There are five specimens of soaps made into bars; a toilet-soap, moulded by putting it into a small brass cup; and a jar of soft-soap; all of which are of a very primitive make.

The Tunisian collection of perfumery consists of scented waters, without any admixture of alcohol; they are prepared by distilling the flowers with water in a copper still. The ottos of Tunis, which are obtained by repeated distillations, are prized as being more fragrant, and are consequently more costly, than those made in Eastern countries, the usual price being from 3*l.* 15*s.* to 5*l.* per ounce,[*] according to the description of flower from which they are obtained. Perfumery constitutes a most important branch of commerce in Tunis, a great quantity of scented waters being annually exported to France, Genoa, and Malta. There are also specimens of Swak, which is used by the Moorish women for whitening their teeth; and perfumed necklaces, noticed in the List of Awards.

TURKEY.

Turkey has sent a great variety of soaps, many of which are perfumed with musk, and ornamented with inscriptions; one kind, from Adrianople, is made up into hollow balls, containing a small bell, similar to those sometimes attached to the collars of horses; the Reporters could not, however, ascertain the purpose of the bell. The collection comprises soap from Adana, Adrianople, Candia, Jerusalem, Damascus, and Tripoli, besides a soft-soap called Alicant soap. None of these soaps afford a good lather.

The perfumery consists of:—orange-flower water and rose-water, both very fragrant; Tensouh or musk-paste; Kouderma or pastilles, for burning in the Seraglio; Tensouh, or musk-paste medallions, purses, and necklaces; and amber Tesbihs or chaplets, made of a paste composed of various perfumes. As the names of the Exhibitors of these various articles are not given, and as it appears that the specimens were bought at the bazaars, they are included in one general Award to the Sultan.

TUSCANY.

Tuscany sends the produce of One Exhibitor, comprising olive-oil-soap, tallow-soap, and yellow-soap; the two former may vie with any in the Exhibition, but the yellow-soap is not equal to that of English manufacture. In 1848, Tuscany possessed Sixty manufactories of soap and candles.

UNITED KINGDOM.

In no country in the world is the manufacture of soap carried on to so large an extent as in the United Kingdom, in which there are Three hundred and twenty-nine makers, besides Sixty-eight soap-remelters (perfumers). Ireland not being subject to a duty on soap, there are no ready means of ascertaining the quantity which is there manufactured; but in Great Britain alone the production amounted in the year 1850 to 204,410,826 lbs., and yielded an Excise-duty of 1,299,232*l.* 10*s.* 2*d.* Of this quantity 12,555,493 lbs. were exported to foreign parts, the drawback on it being 82,308*l.* 18*s.* 9*d.* The total quantity consumed in Great Britain, therefore, amounted to 191,855,333 lbs. Of this quantity 22,858,382 lbs. were used by manufacturers, on which the duty, amounting to 97,342*l.* 0*s.* 11*d.*, was remitted. This leaves the net revenue derived from the soap-duty at 1,119,581*l.* 10*s.* 6*d.*, after deducting the drawback and the remission to manufacturers. Deducting the quantity exported, and that used by manufacturers, it appears that 168,996,951 lbs., or, in round numbers, 75,445 tons, were consumed in 1850 for domestic use in Great Britain (making 8 lbs. 1 oz. each person); besides that manufactured and consumed in Ireland, of which there are no returns. The Excise-duty was first imposed in Great Britain in 1711, the rate being 1*d.* per pound. In 1713 it was raised to 1½*d.* per pound, and in 1782 the duty on hard-soap was fixed at 2¼*d.*, and that on soft-soap at 1¾*d.* per pound. In 1816 the duty on hard-soap was raised to 3*d.* per pound, at which rate it was levied until May 31, 1833, when the duty was reduced to 1½*d.* per pound on hard-soap and 1*d.* per pound on soft-soap. The present duty is according to these rates, with an addition of 5 per cent. The collection of this duty (notwithstanding the great improvement in the Excise regulations of late years) places the British manufacturer under certain restrictions as to his operations, which prevent him from conveniently making toilet-soap. In order to obtain toilet-soap the ordinary soap has to undergo a second process of clarification, and, after having been perfumed, has to be made up in some presentable form; it is this which has given rise to the business of the soap-remelter, who buys his soap of the maker, remelts, perfumes, and then makes it into tablets. Two Exhibitors, however, of toilet-soap carry on all the operations in their works. In Ireland the perfumer generally makes his own soap by the "cold-process," and One Exhibitor sends toilet-soap made in this way.

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[*] In documents published from time to time by the French Minister of Commerce, it is stated that the common otto-of-rose is sold in the bazaars at 5 piastres the mitkal: reckoning the mitkal at 4·78 grammes, or 73·774 troy grains, the avoirdupois ounce of 437·5 grains would cost 18*s.*

Several descriptions of fat are used by the British soap-maker, the principal one being tallow (prepared from the inside and outside fat of oxen and sheep), which is imported in large quantities from Russia, South America, and Australia, the produce of the two last-named countries being more generally employed. Palm-oil, rosin, and cocoa-nut-oil are likewise used, to which must be added bone-fat and "kitchen-stuff." Kitchen or "rough stuff" is collected from private families, where it is usually the perquisite of the cook, who frequently adds a few candles and occasionally a potato, in order to increase the weight. The kitchen-stuff is bought up by the stuff-collectors from the rag and oil shops, and then sold to the soap-maker, who melts it down previous to use.

Before the repeal of the duty on salt, large quantities of barilla (then the only source of carbonate of soda) were imported into this country from Sicily, Teneriffe, and Carthagena for the use of the soap-maker; its repeal was most beneficial from the stimulus it gave to the manufacture of soda from sea-salt, destined soon to supply exclusively the wants of the soap-boiler, who after a short time discarded the impure barilla, which not only was much more costly, but had to be ground to powder in a horse or steam-mill, before the lyes could be prepared, the operation usually occupying two days; whereas the soda-ash (prepared in enormous quantities in Liverpool, Glasgow, and Newcastle), besides containing twice as much soda as the barilla, comes to him in a powdered state ready for immediate use, and enables him to prepare the lyes in a few hours.

Within the last three years the soap manufacturer has been supplied with fine American rosin (colophony), very much purer and of a much paler colour than that of English make; from this cause yellow-soap has been much improved, and is now made of a beautiful pale yellow colour (primrose soap).

Yellow-soap, first manufactured in England, is that produced in the largest quantities, and is composed of tallow, rosin, and soda. Mottled-soap is next in importance, and is usually made from kitchen-stuff and soda. Curd-soap, which is used to a great extent by the cloth-manufacturers of Yorkshire, and the lace and stocking bleachers of Nottingham, is made with tallow and soda (100 lbs. of tallow yielding from 150 lbs. to 155 lbs. of perfect curd-soap). Besides these, there are various other kinds, as, for example, palm-oil-soap, which is usually prepared as a component of yellow-soap; cocoa-nut-oil-soap; and other kinds prepared chiefly for exportation, in which a low price, unfortunately, is a more important consideration than a high quality.

Soft-soap is made with potash (instead of soda) and various kinds of oils; Greenland, Southern, and other fish-oils being generally employed, when the soap is intended for the cloth-districts. There is usually a small quantity of tallow mixed with the oil, so as to produce the fig-like appearance common in soft-soap; this is due to the stearate of potash formed in consequence of this addition, and which is less deliquescent than oleate of potash. Sometimes lime is added to imitate the white particles, but it is easily detected on dissolving the soap in water.

At present very little soap is made in this country from olive-oil, partly because, since the alteration in the duty on foreign soap, its manufacture does not repay the soap-maker, and partly on account of the "London New Pharmacopœia" directing soft-soap to be used in lieu of "Castile-soap," as it is found to be better adapted for the retention of a proper degree of moisture in pharmaceutical preparations.

Out of the 329 soap-makers of the United Kingdom, only Seven come forward to represent the soap-trade. On comparing the productions of other nations with theirs, it is evident that as regards tallow, palm-oil, and rosin-soaps, the British soaps are generally better manufactured, notwithstanding the Excise restrictions under which the English manufacturer labours.

The English toilet-soaps are in no respect inferior to those of other countries, and are generally far superior in their detergent qualities, on account of their being made from soap manufactured exclusively by the "large-boiler-process." The high reputation of the so-called Windsor-soap in all civilized States is an ample testimony of the estimation in which English toilet-soap is held by the makers of other countries, who adopt its name for any sort they wish particularly to recommend. The preparation of toilet-soaps is generally confined to the remelter, who perfumes and ornaments them in various ways. The marbling is effected by rubbing up the colours, such as vermilion or ultramarine, with a little olive-oil or soap, and taking a small portion on a palate-knife, which is pushed through the melted mass, and moved about according to the fancy of the operator. Many soaps are coloured throughout their mass with mineral colours. Vermilion is used to produce the pink colour of rose-soap, artificial ultramarine to produce blue, and various ochres to produce browns. Tablets are made by placing a soft mass of soap into a mould, fixed in a lever-press, and composed of a top and bottom die, which fit into a loose ring; by a rapid pressure the shapeless mass takes the form of the ring, and is at the same time embossed on the top and bottom of the cake. The ornamenting by means of coloured cameos is effected in a similar manner, but requires two presses, one of which forms the cake, and makes depressions for the reception of a different coloured soap, which is filled in by hand, and the cake is then placed in the second press, which embosses the coloured portion.

No less than Twelve out of the Sixty-eight soap-remelters of Great Britain exhibit. Most of them send also perfumery; and Eight manufacturers, besides the Twelve above-named, exhibit perfumery only. The English perfumery was found in many cases to be very fragrant and agreeable, but in others the employment of an excess of some strong-smelling essential oil rendered the compound anything but a desirable article for the toilet. The Imports of perfumery into the United Kingdom in the year 1850 were valued at 1,907*l.*, and a duty was paid of 191*l.*, but in all probability some spirituous perfumes are included under the head of "Oils, chemical, essential, and perfumed," of which 172,139 lbs. were imported, and which yielded a duty of 12,772*l.*

Two Exhibitors have contributed specimens to which allusion has been made in the preceding pages, and to which a great degree of interest attaches, as being among the first attempts at the application of harmless chemical compounds for the imitation of the flavours of fruits and liqueurs, namely, Oil-of-Pears, Oil-of-Apples, Oil-of-Pine-apples, Oil-of-Cognac, Oil-of-Grapes, and Onion-Sauce.

There are Ninety-five Exhibitors of soap and perfumery; of this number Sixty-two are solely or chiefly manufacturers of soap, and Thirty-three solely or chiefly makers of perfumery, though many of the perfumers send both soap and perfumery. Of those who exhibit soap, Seven (English) are merely remelters and perfumers of the goods they purchase of the soap-boilers; Five are makers of a floating or foam-soap; and Four exhibit soap made by the "cold-process."

Among the perfumers there are Two who exhibit savory sauces, and Five the artificial essences before described.

Of the Ninety-five Exhibitors there are—

31 Holders of a Prize Medal.
18 Who obtained Honourable Mention.
46 Unrewarded.
95

The number of Exhibitors from the various countries is as follows:—

America, United States	9
Austria	4
Belgium	1
British Colonies:—	
Canada	2
Ceylon	1
Cape of Good Hope	1
India	2
New South Wales	1
Nova Scotia	1
New Zealand	1
South Australia	1
Van Diemen's Land	1
West Coast of Africa	2
Egypt	1
France and Algiers	14
Germany, Zollverein and North Germany	13
Holland	1
Portugal	1
Russia	2
Spain	2
Switzerland	1
Tunis	2
Turkey	3
Tuscany	1
United Kingdom	27
	95

Besides this number, Eight stearic-candle makers have also sent soap made with the oleic acid, derived as a secondary product from their manufacture; these eight raise the number to One hundred and three, but no special notice will be given of their productions in this portion of the Report.

List of Awards.

Allard and Claye, Paris (France, No. 750, p. 1216). Prize Medal. A collection of fancy Toilet-soaps, in large blocks, marbled and otherwise ornamented; soap in cakes and balls; Potash-shaving-soap. These soaps are made in the ordinary manner, in the large boiler, and afterwards perfumed; they are most agreeable in use, giving very readily an abundant lather, and are free from an excess of alkali. Their perfumery is of various kinds, and very good.

Arnavon, H., Marseilles (France, No. 402, p. 1197). Prize Medal. A very large collection of Marseilles mottled (Castile-soap), Yellow palm-oil, and Bleached palm-oil-soaps. The yellow soaps are not so sightly as those manufactured in England, but are good. The mottled Marseilles soap is, however, excellent.

Bazin, Xavier, Philadelphia (United States, No. 36, p. 1434). Prize Medal. A very large collection of fancy soaps; Transparent-soaps, made up into cakes and balls; Transparent-shaving-paste; Hazel-nut-oil-soap; busts of American *savants*. The soaps are well manufactured, fragrant and agreeable.

Besides the above, various spirituous perfumes are exhibited, which are not included in the award.

Bleuze, H., Paris (France, No. 1091, p. 1230). Honourable Mention. Soaps and perfumery. The soaps are manufactured by the "cold-process," and they give a tolerable lather.

Burford, W. H. (South Australia, p. 1061). Honourable Mention for well-made Yellow-soap.

Busch, P. A. (Frankfort, 5 Zollv., No. 2, p. 1121). Honourable Mention for Rectified Cognac-oil.

Cadwell, Payson, and Co. (United States, No. 510, p. 1467). Prize Medal. A soap called Excelsior-soap, not very sightly, but possessed of remarkable detergent properties, especially in very strong brine. In the trial made with this soap, it was found to possess the valuable property of readily removing tar even in salt water, which renders it peculiarly well adapted for a Marine-soap. A comparative trial was made at the same time with scouring-soaps, selected from the best in the Exhibition; they all answered as well as the Excelsior-soap, except in the removal of tar when washing with a solution of salt.

Much stress was laid on the low price (30*s.* per cwt.) at which this soap may be produced; but as on examination it was found to contain earthy matters, with which any soap may be much reduced in cost, the lowness of the price did not influence the Jury in their Award.

Chiozza, C. L., and Son, Trieste (Austria, No. 43, p. 1009). Prize Medal. Soaps of excellent quality, and in great variety. Superfine Marseilles; Blue-marbled; Floating white Genoa; Hard imitation English soap; Cocoa-nut-oil-soap; common Floating rose-coloured soap; white Curd soap, for toilet purposes, also Blue and Red-marbled; Cocoa-nut-oil toilet-soap; besides various scented soaps; all of which afford an excellent lather, and are, in every respect, carefully manufactured, and free from an excess of alkali.

Cleaver, F. S., 18, Red Lion Square (Class XXIX., 20, p. 790). Prize Medal. Mr. Cleaver is a soap perfumer and remelter; his large and varied collection comprises the following descriptions:—Honey-toilet-soap; this soap contains no honey; it is perfumed with the essence of citronelle, and is a very agreeable toilet-soap. May-blossom-soap is a honey-soap containing cream of tartar. Peach-blossom-soap is a composition flavoured with oil of bitter almonds, and made up into balls, which derives a peculiar peach-like partial stain from the addition solely of cream of tartar. Soaps marked by Dunn's process of lettering, which consists in stamping recesses of the shape of the letters, and filling them with soap of a different colour.

All the soaps are of most excellent quality, very fragrant, and afford a copious lather.

Collas, M. A., Paris (France, No. 801, p. 1219). Honourable Mention. (*The same Award by the Jury of Class II.*) Artificial essence of Bitter-almonds; artificial essence of Pine-apple. (See pages 1347 and 1348.)

Conti and Son, Leghorn, (Tuscany, No. 23, p. 1293). Prize Medal. Olive-oil-soap (white Marseilles); Olive-oil-mottled-soap (Castile-soap); Tallow-curd-soap—most excellent in quality.

Cowan and Sons, 139 New Gravel Lane, Shadwell. (Class XXIX., No. 19, p. 790). Prize Medal. Pale-yellow-soap of very excellent quality; Curd-soap, most carefully prepared; Marine-soap, for washing in salt water. This collection, though comprising few varieties, is valuable from its showing the degree of excellence attainable in the art of soap-making.

De Leon y Rico, E., Madrid (Spain, No. 243, p. 1344). Honourable Mention. A very hard Olive-oil-soap, made in twenty-four hours, by the "cold-process." It affords a lather with some difficulty at first, but by the second day's use acquires a little moisture and then gives one more readily. This plan of making does not yield a soap equal to that of the "large-boiler-process," but the specimen is very good of its kind, and free from excess of alkali.

Douglas, J. S., and Sons (Hamburg, No. 92, p. 1139). Prize Medal for toilet-soaps, made from cocoa-nut-oil and soda, (probably by the "cold-process"); Marbled-soap, made from tallow; likewise the Floating or froth-soap;

all of which are of good quality. This latter, in the true spirit of puffing, is alleged to be made according to a recipe which a friend transmitted from China, and which he obtained by bribery, on penetrating into the Imperial Soap-Manufactory of Canton.

Ede and Co., 47 Ludgate Hill (Class XXIX., No. 18, p. 790). Honourable Mention. For a case containing Perfumery of various kinds. The imitation of the scent of flowers was found in many cases to be successful.

Farina, John Maria, 23 Rhein Strasse, Cologne, and 1 Salter's Hall, Cannon Street, London (Class XXIX., No. 21, p. 790). Honourable Mention. For a long period after the opening of the Exhibition, M. Farina distributed his fragrant Eau-de-Cologne, with great liberality, by means of a fountain.

The specimens exhibited in bottles were of excellent quality, evaporating perfectly without resinous residue.

Farina, John Maria, Cologne (Prussia, No. 426, p. 1074). Honourable Mention. Very fragrant and agreeable Eau-de-Cologne, evaporating perfectly without resinous residue.

Farina, John Maria, opposite the Julichs Place, Cologne (Prussia, No. 858, p. 1096). Prize Medal. Eau-de-Cologne of most excellent quality, possessing in a high degree that fragrance and freedom from unpleasant residuary odour, for which this article of toilet is esteemed.

Farina, John Maria, opposite the New Market, Cologne, and 52 Mark Lane, London (Austria, No. 748, p. 1044). Eau-de-Cologne. Honourable Mention.—See Introductory matter, Austria, p. 609.

Fisher, T. W., and Co., King's Head Court, Barbican (Class XXIX., No. 22, p. 790). Honourable Mention. Three cases of perfumes, and a sauce known as Harvey's sauce. The Jury accord an Honourable Mention of the perfumery, which is fragrant and leaves no residuary unpleasant odour after evaporation.

Gellé and Co., Paris (France, No. 845, p. 1220). Prize Medal. For a very large collection of fancy Toilet-soaps, made by the small boiler, or *cold-process*, and free from the defect of not giving a lather, which is usually the case with soaps made in this way. And also, for an assortment of very agreeable perfumery.

Gibbs, D. and W., Milton Street (Class XXIX., No. 305a, p. 818). Prize Medal. These exhibitors are among the few British soap-boilers who also perfume their soaps for toilet-purposes. Their soaps for manufacturers' use comprise:—a perfectly neutral Curd-soap, employed by woollen and silk manufacturers for the more delicate goods; soap used by silk dyers to give brilliancy to their goods; and a Black-soft-soap made from the fats recovered by Mr. Bawens, from waste lyes (see the article on Candles, page 615): it is chiefly used for scouring coarse wools and carpets, and is sold wholesale at 2*d.* per lb. The household soaps comprise White-curd of excellent quality; Mottled equally good; and very fine Pale-yellow-soaps. The Toilet-soaps exhibited are chiefly those ornamented with inlaid, embossed, and coloured cameos. They are well perfumed, and give a good lather. The Shaving-tablet, contained in a gutta-percha case with a moveable bottom, is one of the very best possible contrivances for that purpose.

Giró, Juan, Malaga (Spain, No. 244, p. 1344). Honourable Mention. Three bars of Olive-oil-mottled or Castile-soap, made in the ordinary manner, in the large boiler. The alkali used in its formation is barilla, which, as before stated, was at one time the only source of carbonate of soda; but it is almost entirely superseded in other parts of Europe by that prepared from sea-salt.

Grossmith, John, 39 Friday Street (Class XXIX., No. 13, p. 790). Prize Medal. The Jury award a Prize Medal to this Exhibitor for his Perfumery and the manufacture of Artificial-essences applicable to the flavouring of confectionary and other purposes; for instance Pine-apple, Jargonelle, Onion, Oil-of-cognac; these artificial essential oils are generally used in the proportion of 1 oz. to a gallon of spirit.—See pages 608, 609.

Hauel, Jules, Philadelphia (United States, No. 4, p. 1433). Prize Medal. Olive-oil-soap, Transparent-toilet-soaps, very agreeable and well-manufactured. They afford a good lather.

The perfumery which is exhibited, is not included in the Award.

Hendrie, Robert, Tichborne Street (Class XXIX., No. 10, p. 790). Prize Medal. A collection of soaps amongst which are some curious matters. Brown-Windsor-soap; Amber-soap containing amber-oil; Wax-soap used to mix with colours for distemper-painting; Petroline-soap prepared with a mixture of 30 per cent. of Barbadoes tar, and 70 per cent. of soap; this soap is intended to be used as a remedy in cutaneous affections. Benzoamygdaline-soap, which is a soap prepared with a mixture of almond-meal and gum-benzoin.

M. Hendrie exhibits likewise a large collection of very good Perfumery.

The Jury have not pretended to discuss the merits of the unusual compounds; but make their Award on the general excellence of Mr. Hendrie's Perfumery and Toilet-soaps.

Kendall and Co., Dublin (Class XXIX., No. 25, p. 790). Prize Medal. These manufacturers have exhibited two cases containing twelve very large blocks of Marbled-soaps, besides sixty boxes of various Fancy-soaps. All the soaps are made by the "cold-process," and consequently contain the glycerin resulting from the saponification of the fat. The materials used in their formation are lard, and a very pure soda-lye. Great care has been bestowed by Messrs. Kendall and Co., in the manufacture of these soaps.

Knight, John, 9 Old Gravel Lane, St. George's (Class XXIX., No. 8, p. 790). Prize Medal. Most excellent Primrose or Pale-yellow-soap, made with tallow, American rosin, and soda; Mottled tallow-soap for household purposes, equally good; Soft or Potash-soap, having the fig-like appearance, which is much esteemed as an indication of careful manufacture.

Landon and Co., Paris (France, No. 1290, p. 1238). Honourable Mention for Aromatic-vinegar for toilet-purposes, very refreshing, and free from adhesive residue on evaporation.

Langdale, Edward F., 83 Upper Thames Street (Class XXIX., No. 55, p. 792). Honourable Mention. A collection of Artificial-essences, now much used for flavouring confectionary and beverages, consisting of the following:—Oil-of-Cognac, Oil-of-Pears, Oil-of-Apples, Oil-of-Pine-apples, Oil-of-Grapes. The Jury accord an Honourable Mention to this Exhibitor for the successful preparation of these various ethers applicable as a substitute for natural fruits.—See pages 608, 609.

Leistner, G. L., Paris (France, No. 908, p. 1223). Prize Medal. Excellent Aromatic or Toilet vinegar; Creosote; Eau-de-Paris, a fragrant and agreeable perfume, resembling Eau-de-Cologne, but possessing a characteristic odour of its own.

Lipp, Frederick van, Düsseldorf (Prussia, No. 658, p. 1086). Honourable Mention. For an agreeable perfume, called Düsseldorf water.

Martin, Maria Clementine, Nun at Cologne (Prussia, No. 425, p. 1074). Prize Medal. Eau-de-Cologne of very superior quality, being that which was considered the most fragrant and agreeable in the Exhibition. The same odour was found to be persistent throughout the evaporation of a small portion, none of the essential oils becoming distinguishable, which is frequently the case with the inferior descriptions. Also Melisse Carmelite spirit, or holy water (alcohol).

Melzer, D., Hermannstadt (Austria, No. 44, p. 1009). Honourable Mention. The Jury accord an Honourable Mention to the Olive-oil-soap, Fancy-soaps and Floating-soap, which are of fair quality.

Milliau, jun., Marseilles (France, No. 929, p. 1224). Prize Medal. White Marseilles or Olive-oil soap. This is a good specimen of the kind to which Marseilles gives its name, and for which it is celebrated.

Oger, J. L. M. (France, No. 939, p. 1225). Prize Medal. Collection of Household and Toilet-soaps in bars and cakes. The household-soaps are excellent, and the toilet-soaps agreeably perfumed; one of these, the Jasper-soap, has a very peculiar jasper-like mottling, not seen in English soaps. The collection also comprises Floating-soap; white Marseilles or olive-oil-soap; tallow or Curd-soap; rosin or Yellow-soap. This collection is very important, and highly interesting, and consists entirely of soaps of the very highest class.

Palis, A., Berlin (Prussia, No. 263, p. 1063). Prize Medal. Palm-oil-soap and tallow Mottled-soap (with a peculiar wavy mottling), of excellent manufacture and great detergent power. Both the soaps are free from any efflorescence of neutral salts, although they have become very dry.

Pears, A. and F., 91 Great Russell Street, Bloomsbury (Class XXIX., No. 24, p. 790). Honourable Mention. The Jury accord an Honourable Mention to Messrs. Pears for a small collection of Transparent-soaps, the manufacture of which they allege their father invented upwards of forty years since. The Jury tried one ball of the soap which was stated to be twenty-five years old, and found it, though much darker in colour, to be very good. The price of spirit of wine in this country has prevented Messrs. Pears from obtaining a very large sale for this soap, but in America its manufacture is carried on to a considerable extent.

Piver, L. T., Paris (France, No. 1678, p. 1257). Prize Medal. Various kinds of Toilet-soap; spirituous Perfumery; perfumed Hair-oil and Pomatum; Transparent-potash-soap or Shaving-paste. Two soaps are especially deserving of notice, that called Lettuce-soap, and the Orange-flower-soap, as being perhaps even more agreeable than the others. All M. Piver's perfumes and soaps are of the very highest class.

Rimmel, E., 39 Gerrard Street, Soho, and Paris (Class XXIX., No. 3, p. 789). Honourable Mention. The Jury accord an Honourable Mention for the Perfumery exhibited, which is of good quality. Besides these there are Hair-dye, Perfumed-bouquets, Pomatum, &c.

Sarre, H., jun., Berlin (Prussia, No. 255, p. 1063). Prize Medal. A block of Palm-oil-soap, and Tallow-curd-soap, well manufactured, of great detergent power, and free from any efflorescence.

Stier, H., Warsaw (Russia, No. 364, p. 1383). Prize Medal for Brown Windsor-soap, Floating, and other Toilet-soaps, well manufactured and very agreeable.

It is curious to find that the name "brown Windsor," should have been adopted even in so distant a locality as Warsaw. The soap, moreover, has a great resemblance to that manufactured in this country.

Taylor, H. P. and W. C., Philadelphia (United States, No. 292, p. 1453). Prize Medal. A very large collection of Transparent-soaps, some of which are quaintly arranged to form a window, in imitation of stained glass. They are very agreeable, and afford an excellent lather.

Taylor and Son, King's Road, Chelsea (Class XXIX., No. 5, p. 790). Prize Medal. These Exhibitors are perfumers of the soaps which they buy of the soap-boiler, and they have carried to great perfection the art of perfuming and mixing the various sorts of soap so as to produce agreeable compounds for the toilet. The "Old Brown-Windsor-soap" is particularly to be distinguished as one of great excellence. The other soaps are Almond, Otto-of-rose, Lavender, Honey, and Shaving. Besides soaps, Messrs. Taylor and Son exhibit spirituous and aqueous Perfumes, of which they are the distillers, and which possess the fragrance of the respective flowers. The Rose-water, Elder-flower-water, and spirituous Lavender-water, may be cited as examples of great excellence. The spirituous perfumes comprise "Pure Lavender-water," "Perfumed-lavender-water," Millefleurs and Eau-de-Cologne; the aqueous perfumes are Rose-water, Honey-water, Peppermint-water, and Dillseed-water.

Thollon, Grenoble (France, No. 1701, p. 1257). Honourable Mention. Concentrated essences for flavouring liquors: these are very numerous: some resemble the flavours of the fruits which they are intended to imitate, whilst others require a little imagination on the part of the epicure.

Touche-Gillés, E., St. Laurent, Antwerp (Belgium, No. 434, p. 1164). Prize Medal. Excellent Toilet-soaps, affording a very abundant lather. The collection comprises very good Olive-oil, or Marseilles soap; tallow, or Antwerp soap; marbled Antwerp soap; lard Toilet-soap; scented Palm-oil-soap, which is most agreeable for the toilet; also a toilet soap called "*Savon d'adoucissement*" (emollient soap).

Bey of Tunis (Tunis, Nos. 53 to 57, p. 1415). Prize Medal. A collection of a variety of Perfumed-waters (not spirituous). There are Ninety bottles of these perfumes, amongst which may be cited Rose-water, Quince-water, Apple-water, Musk-water, Jasmine-water, which is very fragrant; Millefleurs-water, composed of jasmine and other perfumes; White-rose-water, Aloe-water, Benzoin-water, Citron-water, Cinnamon-water, Carraway-water, Orange-flower-water, water distilled with a mixture of benzoin and other perfumes, Cedar-wood water. Also perfumed tablets and necklaces worn by ladies; these are composed of a paste made of amber, musk, and aloe. Likewise jasmine pomatum.

The greater portion of the perfumed waters are very fragrant; some few are peculiar, and to persons unaccustomed to their use not agreeable.

Williams, John, and Son, 28 Compton Street, Clerkenwell (Class XXIX., No. 4, p. 790). Prize Medal. A collection of soaps for manufacturing and household purposes, and also perfumed toilet soaps. These Exhibitors are soap-boilers, as well as soap-perfumers, a combination of two, generally, distinct branches. Their common soaps are exceedingly well manufactured, and are possessed of great detergent properties. The collection comprises, Olive-oil-soap, which is much used by the fine-cloth manufacturers; White-curd (tallow) soap, used principally by the lace bleachers; Pale-yellow and Mottled-soap, for household purposes; Scouring-soap, containing designedly an excess of alkali, which effloresces on the surface: this soap is made chiefly for consumption at Leicester. It answered well for washing in a strong brine, and therefore might be used on board ship.

The fancy-soaps are agreeably perfumed, and give readily an abundant lather. The principal description of toilet-soaps are Brown Windsor, Rose-soap, and the so-called Honey-soap.

Wunder, L., Liegnitz (Prussia, No. 250, p. 1063). Prize Medal. Tallow-soap, with a peculiar wavy mottling, very well manufactured; Palm-oil-soap, of good quality, and excellent white Curd-soap; the Award is to the foregoing. Besides these, there is a toilet-soap called Ananas-soap, the perfume of which does not at all resemble that of the pine-apple, and is moreover very disagreeable.

Yardley and Statham, Vine Street (Class XXIX., No. 2, p. 789). Honourable Mention. A soap called the "genuine Honey-soap," is very good, and gives an excellent lather, but it does not contain any honey. At one time honey was put into toilet-soap, but was discontinued in consequence of the unsightly appearance it produced; the name, however, is still retained. The other soaps exhibited are, the "True Winter-soap," Heliotrope-soap, White and Brown Windsor-soap, which are equally good.

Many of the Toilet-soaps are stated to have some peculiar emollient and whitening effects on the skin; it is, however, to be hoped that the public will soon become sufficiently enlightened to buy the soaps for their real and not for their fabulous qualities.

II. Candles.

In tracing the little which is known respecting the early history of Candles, it is impossible to avoid the mention of Lamps also (although these were not amongst the articles submitted to the consideration of this Jury), as both are intimately connected not only in their history, but also in their philosophical bearings; for however much candles and lamps may differ in other respects, they are identical in this, that both are contrivances in which, for the purposes of illumination, a wick of fibrous material is employed to effect the combustion of fatty bodies; which, for the most part, under ordinary circumstances, could be ignited only with difficulty, and if ignited, would soon become extinguished. The chief point of difference is, that in the lamp the fuel is a fluid, at the common temperature; whilst in the candle it is liquified only gradually, and in the required quantity, by the heat of the flame. This distinction, however, does not entirely hold good, for it is known that in many countries, especially in those where oil-yielding plants are not common, animal-fat is employed for feeding lamps; and it is even probable that the ancient Hebrews may likewise have used occasionally solid fats for the same purpose. The modern mortar night-light is also a lamp of this kind.

Frequent mention is made of the candle in the Old and New Testaments, in metaphorical as well as literal significations; but from the description of the candlestick of gold which Moses made by the command of God, it is more than probable that the Hebrew expression translated "candle" really means lamp,[*] for in *Exodus* xxv., after the minute description of the form of the candlestick, with its six branches, it is said, at verse 37, "And thou shalt make the seven lamps thereof, that they may give light over against it." Again, in *Leviticus* xxiv., v. 4, the Lord directs that Aaron shall order the lamps upon the pure candlestick; and in verse 2 of the same chapter, the fuel used in the lamps is shown to have been olive-oil.

Torches[†] may be regarded as a coarse description of candles, which indeed possibly originated from them. They are mentioned also in Holy Writ, in a passage, remarkable as being the only one in the New Testament where the *lantern* is spoken of (*John* xviii., v. 3): "Judas then having received a band of men and officers from the chief priests and Pharisees, cometh there with *lanterns* and *torches* and weapons."

The information respecting candles, mentioned in Pliny's *Natural History*, is very slight and ill-defined. That which is most to the present purpose is contained in book xiii., chap. 13, where in describing the books reported to have been found in a perfect state of preservation in the grave of Numa, 535 years after his interment, the author states that they lay near a quadrangular stone in a box which was bound all over with *candles*, and to that defence their preservation is ascribed. From this passage it would appear that candles were employed in the earliest ages of the Roman history; and, inferentially, that they resembled in some degree either our longest wax-tapers, or else match-lights made of pitched rope, for short candles could not have been bound round any object.[‡] In describing in book xvi., chap. 37, the "brittle rushes" that grow in marshy districts, he says that they serve to thatch houses and make mats; and the pith of them, when the rind is peeled off, is used for making wicks for *watch-candles* and funeral-lights, to burn by dead bodies whilst they lie above ground. This description may be considered as referring to candles very similar to, if not identical with the modern rushlight; but as the fat used in their formation is not alluded to, nothing certain is known on the subject.[§] In book xix., chap. 1, when speaking of flax, Pliny remarks that the fibres nearest the rind are only fit for lamp and candle wicks; and in book xxxvii., chap. 3, that if the scrapings of amber are put into *oil*, they will burn and maintain light both longer and more clear than wicks made of the *best of flax*: from which it would appear that, although the refuse flax was usually appropriated to lamp and candle wicks, the best flax was sometimes used for them.

As regards the fuel used in lamps, in addition to the mention of oil, Pliny, in book xxxvi., chap. 15, states farther that the inhabitants of Sicily burned a kind of bitumen, resembling an unctuous or oily liquor, in their lamps; and that they collected it from the surface of a spring in the territory of Agrigentum. Although in book xxi., chap. 14, various kinds of bees'-wax are mentioned, and the method of wax-bleaching is minutely described, which, it may be remarked, somewhat resembles the process employed in the present day,—no allusion is made to the application of wax to the manufacture of candles: nor in speaking of tallow and other animal fats, and their separation from the cellular tissue, is it stated that they were employed for candles.

From Fosbrooke (*Encyc. Antiq.*, p. 472, 4to Edit.), who copiously refers to most of the best authorities elucidating this subject, the principal of which have been carefully examined for this Report, we learn that wax was employed by the classical ancients for candles; the wick was made of rope and leaves of the papyrus, and such candles were carried by children at marriages, and were used at funerals. And the same authority (p. 405) adds that their illuminations were made not only with lamps, but also with links and wax-flambeaux.[*] He states, moreover (p. 240), that the rich Romans used lamps, and the poor employed candles. Beckmann has recorded a notice that the Emperor Constantine, about the beginning of the fourth century, "caused the whole city of Constantinople to be illuminated with lamps and *wax-candles* on Christmas-Eve." (*Hist. of Inv.*, Bohn's Edit., ii. p. 174.) Apuleius distinguishes wax and tallow candles by the terms *Cerei* and *Sebacei*.

In the middle-ages, continues Fosbrooke, wax-candles were made of various sizes, some exceedingly small, and others weighing so much as 50 lbs.: they were made in moulds, the wicks being formed of twisted tow. He likewise states that they were made at home in gentlemen's houses. Whilst describing the architecture of the Britons, Anglo-Saxons, &c., he mentions that *tapers*, ornamented with flowers,[†] were used on high festivals to burn before particular images, and be borne in procession. That wax-candles were not made in the Saxon period by regular chandlers as now, appears from the description in *Asser's Annals*, translated for Bohn's *Six Old English Chronicles*, p. 84, of King Alfred's device for marking the hours of the day, by the consumption of wax-candles (six of which, lighted in succession, burned exactly twenty-four hours). It there appears that "he commanded his chaplains to supply wax in sufficient quantity, and he caused it to be weighed in such a manner that when there was so much of it in the scales as would equal the weight of seventy-two pence, he caused the chaplains to make six candles thereof, each of equal length, so that each candle might have twelve divisions marked across it."

There can be no doubt, however, that the occupation of the wax-chandler existed in England at a very early period, as well for the manufacture of tapers for religious rites, as for the preserving of the bodies of important personages in waxed cloths, which was called *Cering* them. Hence the art was probably practised chiefly, if not exclusively, in monasteries; the tenants of which paid several of the rents in kind, and one of these was delivered in wax, and called *Cerage*. The persons whose office it was to make this wax into paste and tapers were termed *Ceragii* and *Cerarii*, and Ducange shows them to have existed so early as A.D. 779. In 1397, John of Gaunt, Duke of Lancaster, directs by his will that his body should be carried direct to the Friars-Carmelites in Fleet Street, but that there should "be no *cering* or embalming of his corpse;" indicating that this operation was probably even then performed by ecclesiastics. In 1495, however, a contemporaneous authority states that the Princess Elizabeth, daughter of Henry VII., "was cered by the wax-chandler." Ducange shows that *Candelarii*, or persons who made and sold candles, were known in the middle of the thirteenth century.

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[*] In Lane's *Manners and Customs of the Modern Egyptians* there is a description of a folding-lantern of waxed cloth, and the lamp which is put into it. This, in Arabic, is called *Chandee'l*, with which our word candle may possibly have some connexion; for it is more than likely that the same word was used to designate in former times either lamps or candles.

[†] British Guiana has contributed an interesting specimen of torch-wood from the river Demerara, which, when beaten so as to separate the fibre, is used for torches by the Indians. It is supposed to be obtained from a species of *Amyris* or *Icica*.

[‡] The same story is also related by Livy, lib. xl., c. 29, with the additional statement that the books were bound round in a package with *two* candles; which seems to indicate that flax formed into torches with pitch or wax, were employed, simply to hold the manuscripts together. These torches probably somewhat resembled the tarred string used for the purposes of illumination in the present time by workmen engaged at night in laying down gas or water pipes.

[§] The description of the Irish candles in Fosbrooke's *Encyc. Ant.*, p. 240, however, throws much doubt upon this conclusion. It is there stated that they were formed, like those of other nations, of peeled rushes dipped in butter or grease, and placed in *lamps of oil*. (Ledwich, *Ireland*, 1790, p. 225.)

[*] *Annal Tacit.*, lib. iii. c. 9. Edit. *Lips.*, p. 78, n. 21.

[†] Some examples of wax-candles, ornamented in this manner, are exhibited in the Russian Department.

By the sixteenth century the trade of wax-chandler was probably extensively established in England. In Brand's *Popular Antiquities* (vol. i. p. 29, Edit. Knight), is an extract from the churchwarden's accounts of St. Martin Outwich, London, under the year 1510:—"Paid to Randolf Merchaunt, wax-chandiler, for the Pascall, the Tapers affore the Rode, the Cross candelles, and Judas candelles, ix$_s$. iiij^d. In the *Memoirs of the last Two Years of the Reign of Charles I.*, by Sir Thomas Herbert and others (p. 128), is described the night-light used in his chamber as "a cake of wax set in a silver basin, that then, as at other times, burned all night;" this description referring to the years 1646-1649 closely agrees with some of the forms of the modern mortar night-lights. Long coiled Wax-Tapers were manufactured in the 17th century in Venice, and the invention appears to have been brought to Paris about the middle of the same century by Pierre Blesimare, of that city.

In the year 1775, the Rev. Gilbert White, in his *Natural History of Selbourne*, pp. 198 and 199, 4to edit., describes the method of making Rushlights then practised by the cottagers of Hampshire, from which it might be inferred that they must have closely resembled those made by the ancients. A full abstract will be found in Tomlinson's *Cyclopædia*, p. 290, whence the following passage is taken:—"A pound of rushes (*juncus effusus*), containing 1,600 individuals, was coated with 6 pounds of tallow, so that 228 lights weighed one pound, and cost a little over 5*d*. The rushes were peeled on three sides for the best lights, and on two only for watch lights, which were not required to give so much light, and which, Gilbert White says, 'it is true only shed a dismal one—'darkness visible.'" Of the other kind he says, that "a good one, which measured 2 feet 4½ inches in length, burned 57 minutes;" and that he was assured by an experienced old housekeeper that 1½ lb. of rushes, after having been coated with tallow, completely supplied his family for a year. The cost of lighting with rushes he estimated at one farthing for 5½ hours, whilst a halfpenny candle in the "blowing" open rooms of the poorer cottagers only lasted 2 hours.

In the year 1799, William Bolts took out a patent in England for improving the form, quality, and use of the candle, the specification of which probably contains the first account of an attempt at the improvement of the quality of candles made from tallow and other animal fats, by subjecting the material to a considerable pressure during the act of cooling, and which, in effect, is the preparation of the so-called *Stearine* from fats. He likewise describes a solid candle with a short wick, which is placed in a holder, and kept pressed on the end of the candle by a spring, or else the candle is placed in a tube and pressed against the wick by a spiral spring; as well as other contrivances, some of which have been revived and successfully carried out in our own days.

The object of the preceding notices, incomplete as they are, is merely to enable the reader to form some idea of what may be gleaned relating to the various means of producing light at different periods, and especially regarding the construction and materials of the candle. Great interest, indeed, would be attached to a complete history of *Domestic Illumination*, tracing its gradual development from the solitary watch-lantern graven on the Pyramid, through the graceful but very imperfect lamps of the Greek and Roman period, as exhibited in our museums, and the clumsy contrivances of the middle-ages, up to the productions of modern times, satisfying the demands both of taste and science. In such a narrative might be shown the progress of light, in the literal signification of the word, by a careful examination of the various forms in which it has been at different times employed, as lamp, lantern, torch, flambeau, falot or cresset, candle, and gas; whether for the celebration of religious ceremonies, for increasing domestic comfort, adding to the security of the streets of towns, or forming a beacon to guide the mariner at night.* It would be, at the same time, a history glancing at the advancement which the improvements in illumination have given to the social condition of mankind; and at the advantages which science has derived from the study of this subject. Nor would entertainment or interest be wanting, in the recital of the many superstitions connected with the burning of lamps and candles; the shape of whose flame trembling in the moving air, and whose wick, bending or spreading under the influence of heat, has been suggestive to human imagination from the time of Pliny up to the enlightened days of our own century. Such an inquiry, however, even were it possible with the time and the materials which are at the disposal of the Reporters, would far exceed the limits assigned to this Report. The same restriction as to space prevents them from following step by step all the various mechanical contrivances which have been invented in recent times to facilitate both the manufacture and combustion of candles. The Reporters cannot, however, refrain from entering into some details regarding the remarkable chemical improvements which have occurred within the last thirty years; especially since they possess the additional interest of being the result of investigations of a purely scientific character, undertaken without any view to their ultimate practical application. In the present day it is too much the custom to require an instantaneous practical result, much to the detriment of the persevering prosecution of abstract science: the numerous, brilliant, and continually occurring proofs of that most important truth are too often overlooked, that all truly scientific studies tend to increase, sooner or later, not only the intellectual, but also the physical wealth of nations; and materially benefit the world at large.

(*a*.) *Tallow-Candles.*

The ordinary tallow-candle labours under many disadvantages, which are so well known that they scarcely require to be specified. It has an unpleasant odour, which becomes more marked whilst burning; and the attempts at supplying it with a self-consuming wick have been only partially successful on account of the low fusing-point of the tallow. The slightest draught, from the same reason, causes the tallow to melt in larger quantity than can be consumed by the burning wick, and it therefore gutters down; this renders the tallow-candle ill adapted for being carried about a house, as grease spots are apt to be produced which are very difficult of removal;† to which we may add that it cannot be handled without soiling the fingers.

The disagreeable smell of tallow-candles arises chiefly from the tallow being imperfectly purified; for if it contain a portion of the cellular tissue of the fat from which it is obtained, this putrifies and communicates the process of decomposition, like a ferment, to the fatty matter, which becomes rancid and evolves a most unpleasant odour. This is always the case with tallow as it occurs in commerce, which, although fit for the soap-boiler, is too impure to be employed by the candle-maker without clarification. The first step towards the improvement of tallow-candles was made in the recognition of this fact; more attention was in consequence bestowed upon the manner of purifying or "*Rendering*" the tallow, as it is called. In England the "rendering" is effected by melting the tallow in an open copper pan exposed to the direct action of the fire. After it has remained in a fused state for some time, the water which the fleshy particles contain evaporates, and they then rise to the surface and are skimmed off and pressed. The pressed cake is called "greaves," or "cracklings," and is used for feeding dogs. On the Continent, however, D'Arcet's method is now universally employed, which has also been adopted in Ireland: it consists in treating the raw tallow melted by steam-heat with very diluted sulphuric acid, for the purpose of destroying the cellular tissue. This method, besides being much safer, yields three per cent. more tallow than the older process; and though it does not entirely remove the smell, essentially improves it. The purification of the tallow, at the same time, induces an amelioration in the flame of the candle, more particularly in point of uniformity in the development of light; as the cause of the frequent obstruction of the wick during combustion by less combustible nitrogenous substances is removed.

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* For a history of the "Lighting of Streets," the reader is referred to *Beckmann's Hist. Inv.* (Bohn, vol. ii., p. 172.)

† Common ether is one of the best vehicles for the dissolution and removal of oil or grease spots.

Less success has attended the attempts to supersede snuffers, which still continue a necessary appendage to a candlestick with a tallow-candle. The plaited wick which, as we shall see farther on, followed in the wake of stearic candles, is not applicable to the tallow-candle without some special contrivance, as in curling over outside the flame (by which it becomes consumed) it causes the tallow to melt in such large quantities that a considerable guttering is the consequence. It is therefore necessary to protect the candle if a self-snuffing wick be employed; this is effected in Palmer's lamp. Here the candle is enclosed in a vertical metallic cylinder with a cap whose orifice is smaller than the candle; as the candle is consumed a spiral spring presses it upwards against the cap. This contrivance much resembles the plan proposed by W. Bolts in 1799, and to which allusion has already been made.

The next improvement in the tallow candle was effected by a reduction of the fusibility of the materials employed. This was first done by the same inventor, W. Bolts, but received farther development from Chevreul's researches. The observations of this celebrated chemist, to which we have already alluded in our article on soap, showed that all varieties of solid fats might be split into a solid crystalline fat (stearin and margarin) and an oily liquid (olein);* in his laboratory experiments this separation was effected by means of solvents; but subsequently it was found that by attending to the *temperature* of the fat, it might for all practical purposes be produced equally well by pressure. Common tallow melts at between 37°–40° C. (99°–104° F.) The melting-point of stearin is 62° C. (144° F.) By removing a considerable portion of the olein from the tallow, its fusing-point was consequently raised, and thus a great evil removed. Candles have been repeatedly made of pressed tallow; they fairly deserve to be called stearin-candles, while those that now go by that name actually do not merit the appellation.

To prepare stearin, tallow is melted and allowed to cool as gradually as possible, with constant agitation, so that the stearin and margarin may crystallize; at 35° to 38° C. (95° to 100° F.) the mass becomes pasty, and is subjected to slow pressure in cloths. By repeating the operation, the stearin is obtained gradually of greater purity.

Cocoa-nut-stearin is very largely employed in England to mix with stearic acid, to form composite candles, the neutral fat appearing to be better adapted for this purpose than the fat acids which may be prepared from it; but on the Continent it is but little used

As regards the employment of tallow-stearin, many obstacles have stood in the way of its development which might, there is little doubt, have been removed by persevering investigations, had not the more careful researches into the nature of the process of saponification of fats, and the separation of solid acids from the fatty bodies, the result of these researches, directed the inquiry into a new channel. When it was found that stearic acid fusing at 70° C. (158° F.) could be obtained from stearin fusing at 62° C. (144° F.), and margaric acid with a melting-point of 60° C. (140° F.) from margarin fusing at 47° C. (107° F.), while the oleic acid remained as fluid as the olein from which it was derived, it became evident that the difference in the fusing-points of the solid and liquid acids being so much greater, the separation of the former from the latter might be effected without difficulty. Thus the transition of the tallow-candle to the stearic candle was effected.

Tallow-candles are of two kinds, "dips" and "moulds." Dips are made by dipping the wick repeatedly in melted tallow; allowing a sufficient time to elapse between every operation, in order that each coat may consolidate.

Mould-candles are usually made in pewter moulds, although glass moulds have been lately introduced. The mould consists of two parts, a cylinder and a conical cap, which is perforated to allow a passage for the wick. Several of these moulds are fixed in a wooden frame, the upper part being formed like a trough in which the open end of the mould is inserted, the capped end pointing downwards. To insert the wick, the frame is laid on its side and a long wire with a hook at one end is passed through the hole in the cap; the wick is then attached to the hook by means of a loop which is formed in it; on pulling back the hook the wick is drawn with it. A wire is now inserted across the top of the mould and through a loop at the other end of the wick; lastly, the wick is drawn tight through the cap, and a small wedge of wood is inserted to keep it in its place. The moulds are filled by running the melted tallow into the trough, and are then allowed to cool until the next day.

There have been several improvements of late years in the mechanical arrangements for the manufacture of tallow-candles, which it would be difficult to describe clearly without engravings; these have tended much to lessen their cost, and consequently the consumption continues very considerable; still it may be expected, notwithstanding their moderate price, that they will be gradually superseded by the more elegant and harder candles of stearic acid, or of compounds of stearic acid with solid neutral fats, which have the advantage of being self-snuffing. As yet the general introduction of stearic candles is impeded by their price, but we may confidently hope that the progress of science will soon afford us the means of still farther reducing their cost of production, and thus render the use of the tallow-candle less frequent in the dwellings of the poorer classes of society, as it has already disappeared from the homes of the middle classes.

It is remarkable that the ordinary tallow-dip candle is not exhibited by any nation whatever, although there must exist far more makers of this kind than of any other.

AUSTRIA.

This is the only foreign country which has contributed tallow mould-candles. They are sold at 19 kreuzers per Austrian, or 5½*d.* per English pound; which is a halfpenny more than far superior candles may be bought for in Ireland.

BRITISH COLONIES.

Two colonies, namely *Nova Scotia* and *Van Diemen's Land*, have sent mould-candles, in which there is, however, nothing remarkable.

UNITED KINGDOM.

The manufacture of tallow-candles in the United Kingdom still continues to be a most extensive trade, notwithstanding the increasing consumption of gas, and the introduction of stearic and composite candles. Prior to 1831, when the duty on candles was repealed, they yielded an important revenue in Great Britain, as may be seen from the following statement (see p. 619). The duty, it may be remarked, was first imposed in 1803, and continued at the same rates from that period until 1831, viz., 1*d.* per pound on tallow, and 3½*d.* per pound on wax or spermaceti candles. It did not extend to Ireland.

In 1830 the number of candle-makers in Great Britain was 2,695, who paid 500,048*l.* 14*s.* 1*d.* duty; since the repeal of the duty no record has been kept of their number, but judging from the tallow imported, it cannot be less than in 1830.

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* The American Section contains several specimens of olein obtained by pressing lard, which, under the commercial name of lard-oil, is exhibited at Nos. 18, 19, 208, 562.

M'Culloch's Dictionary of Commerce, p. 228.

Years.	Tallow.	Duty, per lb.	Wax.	Duty, per lb.	Spermaceti.	Duty, per lb.	Net Revenue.		
	lbs.		lbs.		lbs.		£.	s.	d.
1820	88,352,461	1*d.*	692,705	3½*d.*	193,463	3½*d.*	373,455	14	5
1821	93,816,346	,,	697,196	,,	165,647	,,	395,911	8	7
1822	98,311,801	,,	682,241	,,	179,208	,,	415,609	15	3
1823	102,461,879	,,	694,194	,,	180,401	,,	433,537	15	8
1824	109,810,900	,,	759,751	,,	179,454	,,	466,042	16	1
1825	114,187,550	,,	851,370	,,	208,377	,,	485,014	8	9
1826	110,102,643	,,	705,615	,,	201,790	,,	467,069	12	1
1827	114,939,578	,,	713,655	,,	226,277	,,	487,318	3	4
1828	117,342,157	,,	748,293	,,	270,263	,,	497,770	2	9
1829	115,156,808	,,	746,052	,,	303,683	,,	489,059	1	9

Quantity of tallow entered for home consumption in the United Kingdom in the last ten years:—

Years.	Cwts.	Years.	Cwts.
1841	1,241,278	1846	1,183,834
1842	1,030,960	1847	1,069,301
1843	1,174,945	1848	1,406,725
1844	1,081,039	1849	1,412,484
1845	1,191,896	1850	1,219,101

Detailed report of the imports of tallow into the United Kingdom in 1850:—

	Cwts.	Duty paid.
Tallow imported from—		£.
Russia – – – – – – –	803,697	60,278
British Settlements in Australia	179,567	752
United States of America – –	32,523	2,439
South America – – – – –	184,321	13,824
Other parts – – – – – –	18,993	977
Total – – –	1,219,101	78,270

Of tallow-candles only 1,067 lbs. were imported in the same year.

In 1830 the quantity of tallow imported into the United Kingdom was 1,073,833 cwts.

There are Four Exhibitors of mould-candles, two English and two from Dublin. The Irish candles only are deserving of notice, and may be regarded as the perfection of tallow-candles; indeed it appears that the makers of Dublin have acquired a high reputation for mould-candles, by bestowing great care on the purification of their tallow and on the moulding.

The price of tallow-mould-candles is 5*d.* per lb.; those with waxed wicks, 5½*d.*; and the composite candles, formed of tallow and cocoa-nut-stearin, 8*d.* per lb.

(*b.*) *Stearic Candles.*

With this term we designate the candles made from the isolated solid fatty acids in contradistinction to those consisting of pressed tallow or lard (stearin), although in commerce both are called "stearine candles." The manufacture of stearin-candles is on the decrease, and tallow is now very rarely pressed. The stearin from cocoa-nut-oil (cocin) is, however, still prepared in considerable quantities, and mixed with stearic acid, and manufactured into the numerous kinds of composite candles which are so generally used in England. Compared with other fats, the importation of cocoa-nut-oil is not large; the following is the detailed account for 1850, from which it will be seen that by far the largest quantity comes from India:—

	Cocoa-nut-Oil Imported into the United Kingdom in 1850.
Cocoa-nut-oil imported from—	Cwts.
British Possessions in India –	85,096
British Settlements in Australia	6,315
Other Parts – – – – – –	6,628
Total – – –	98,039 Duty free.

The foundation upon which the manufacture of stearic acid candles is based is the saponification of fats, and the separation of the fatty acids from the soaps, which the beautiful researches of Chevreul have made known to us. It would, however, be an error to suppose that these investigations alone solved the difficulty. Seven years, in fact, elapsed after the publication of Chevreul's discoveries, before they were successfully applied; but this can be a matter of no surprise to those familiar with the establishment of a new industry, and who are aware of the immense chasm which separates the laboratory of the chemist from the workshop of the manufacturer; they only can comprehend fully the obstacles of all kinds that must be vanquished, in order to fructify a purely scientific germ, and render it a healthy and vigorous branch of art.

The first steps in the manufacture of stearic candles were surrounded by difficulties of all kinds which frequently clouded the prospects of the enterprising inventors. Chevreul's experiments were published as early as 1823, but the idea of making candles from the isolated fatty acids does not appear to have been matured until two years later. At this period Chevreul allied himself with his celebrated colleague Gay-Lussac, with the intention of applying his discoveries to the practical purposes of life. In the year 1825 these two chemists took out a patent in France for the manufacture of fatty acids, and their application to the making of candles. Gay-Lussac took out, moreover, a patent in England in the name of his agent Moses Poole, on the 9th of June of the same year. The specification of these patents is highly interesting, as evincing a remarkable sagacity on the part of the patentees in anticipating the progress of this branch of industry; they call in aid all the agents which have been adopted up to the present day, even including the distillation of fatty acids with the aid of steam, which has only been brought into practical operation within the last ten years. Nevertheless the proprietors of the patents derived no benefit from them. The processes which they employed resembled too closely the proceedings of the chemist in his laboratory, rendering their industrial execution too costly. Although lime was specified by Gay-Lussac for the saponification of the fat, the ordinary alkalies continued to be employed; and for decomposing the soap, hydrochloric acid was used, the alkaline salts of which were never completely separable from the fatty acids. In their French patent Chevreul and Gay-Lussac even spoke of the necessity of cold and hot alcohol for the perfect purification of the stearo-margaric acid. If we compare this proceeding with the present practice, we perceive that it had yet to pass through various ordeals.

A formidable and unforeseen difficulty presented itself in the fact that the new stearic candles would not burn with the ordinary wick; a long series of experiments were necessary in order to construct a wick which would not sputter the fat during its combustion. Chevreul and Gay-Lussac succeeded in doing this in the course of 1825, and indeed the plan was specified in the English patent before spoken of; they endeavoured to secure their invention in France by a rider to their patent, but this was not done until another inventor had taken out a patent for a similar contrivance.

A discovery like the separation of the fatty acids necessarily excited in many minds the desire for its practical application. Almost immediately after the publication of Chevreul's work, Cambacérès, an *Ingénieur des Ponts et Chaussées*, appears to have directed his attention to the utilization of Chevreul's investigations; at all events he took out a *brevet* for the improvement of the wicks of stearic candles in February 1825, which was prior to the date of the rider to Chevreul and Gay-Lussac's patent in France, and that of Gay-Lussac's in England: the value of the patents of these chemists was therefore considerably reduced. Cambacérès' first plan was a hollow wick, but in May of the same year he patented the plaited and twisted wicks, by which snuffers were rendered superfluous. The tension of the separate threads of the plaited wick causes the portion which rises from the candle to curl outwards, so that its point projects beyond the flame, and is rapidly consumed in the air that plays freely around it.

Cambacérès had observed that the wicks soon became clogged in the stearic candles, although this did not happen if they were used in ordinary tallow-candles; he ascribed this phenomenon to the formation of soaps produced by the action of the fatty acids on the carbonated alkali resulting from the combustion of the wick. Whatever may be the cause, he succeeded in removing the difficulty by treating the wick with dilute sulphuric acid; he supposed that the presence of this acid prevented the formation of soaps by combining with the alkalies in the ash to form sulphates.

Another essential improvement in this branch of industry was brought about by the introduction of the cheaper material, lime, as a saponifying agent, followed up by the decomposition of the lime-soap by dilute sulphuric acid. The merit of having *successfully* introduced the saponification by lime (*saponification calcaire*) belongs to De Milly, who has earned great praise by his contributions to the stearic manufacture. His plan formed part of the original patent of Chevreul and Gay-Lussac, and it redounds much to his credit that he brought a plan to bear which had failed in the hands of his illustrious predecessors. The saponification by lime, in an industrial sense, dates from 1831.

As the wicks were frequently corroded by the sulphuric acid used according to Cambacérès' preparation, De Milly, in 1836, took out a patent for employing the borate, phosphate, or sulphate of ammonia, for the same purpose. These improvements, and the endeavours of De Milly to promote the introduction of the new branch of industry in other countries, gradually caused its extension.

Nevertheless numerous difficulties still remained to be overcome. The limits of the present sketch will not permit us to do more than give the main features of the development of the stearic manufacture: we are unable consequently to trace year by year all the little improvements which have taken place; but we cannot avoid a short notice of the numerous experiments necessary to prevent the crystallization of the stearic acid during the moulding of the candles. The first attempt made was to introduce another acid; and though successful in its immediate object, the choice (arsenious acid) was an unhappy one, for it almost threatened the very existence of the youthful art. It is true that this deleterious substance was added in very minute quantities, yet it was entirely incompatible with health, and was soon prohibited on the Continent by authority, and in England by equally powerful public opinion. Here commenced all the manufacturer's troubles anew; in all directions he sought a substitute, and yet found none; at last, after innumerable experiments, and when almost driven to despair, he hit on two expedients—very simple when once found out—which answered as perfectly as the discarded plan. The means now employed are—the addition of a very minute quantity of wax to the stearic acid: a still more common plan is to allow the melted acid to cool down almost to the point of congelation before it is poured into the moulds, which are warmed to the same temperature as the fatty acids. The refrigeration and occasional stirring of the liquid fat produces a sort of liquid pulp, which congeals in the moulds without crystallization.

Sulphuric saponification (*Saponification sulfurique*).—While the stearic manufacture was gaining ground extensively, as we have indicated, a new art sprang up during the last ten years, having the same objects, and being based on the same foundations, but seeking the attainment of the goal by entirely different means—we speak of the saponification of fat by means of concentrated sulphuric acid, and subsequent distillation of the resulting fatty acids.

The origin of this proceeding must undoubtedly be sought in Chevreul's work; still E. Frémy deserves the credit of having, in an important paper, perspicuously exhibited the relations of fats to sulphuric acid. He demonstrated, in a treatise which he published in 1836, that the action of powerful acids on fatty substances has a close analogy to that of the alkalies. Both re-agents decompose the fat, but while the alkalies combine with the fats, and set the glycerin free, the sulphuric acid combines both with the acids and the glycerin; thus we obtain conjugate sulpho-acids, sulpho-stearic, sulpho-margaric, and sulpholeic acids, on the one hand, and on the other sulpho-glyceric acid. The first three are of a very ephemeral character; water decomposes them into slightly modified fatty acids insoluble in water, and sulphuric acid, which, with the sulpho-glyceric acid, dissolves in the water.

To George Gwynne is due the merit of having first described a method of obtaining fatty acids by the sulphuric saponification of neutral fats, and subsequent distillation of the resulting products. In a patent obtained in March 1840, he describes very fully his proposed plan for effecting this object, which consisted in distilling *in vacuo*, by means of an apparatus similar to that employed in sugar refining; the difficulty of sustaining a good vacuum on the large scale was, however, found to present so many obstacles that the plan was subsequently abandoned. Mr. Gwynne proposed also to distil, in the same manner, fatty acids obtained by means of lime-saponification, and even to obtain fatty acids by the distillation of neutral fats.

George Clark also directed his attention to the practical application of Frémy's experiments. On the 5th November 1840, he took out a patent for utilizing this property of sulphuric acid in decomposing fats, but without having recourse to their subsequent distillation: the difficulty in cost, however, of purifying the fat after decomposition rendered the attempt unsuccessful, notwithstanding that the quantity of sulphuric acid proposed to be used was only one-fourth the weight of the fat, whilst Frémy employed, in his laboratory experiments, double this quantity. Farther experiments were still necessary to establish, on a firm footing, saponification by means of sulphuric acid, which ultimately again led to the adoption of an improved system of distillation.

In the patent before mentioned, which Gay-Lussac took out in England, and which is distinguished by its comprehensive treatment of the question, the distillation of fatty matters is spoken of, and the remark incidentally made that the process is much accelerated by the presence of moisture; this part of the specification was, however, never worked.

Nearly sixteen years later, on the 22nd August 1841, Dubrunfaut obtained a patent in England, and about the same time likewise one in France, for the purification of fatty bodies and their distillation. The plan proposed by M. Dubrunfaut was to heat the commoner oils to a high temperature, and to pass steam through them, by which means their disagreeable odorous principle was intended to be removed. The distillation of fatty bodies was also claimed by Dubrunfaut, but the chief object of his patent was evidently the purification of common oils. By decomposing the neutral fatty bodies in this way, acrolein is produced, the vapour of which is so pungent and irritating, both to the eyes and the throat, that no workman can be found to endure it; hence this patent was not successfully worked, yet it contained a germ, which in the hands of Jones, Wilson, and Gwynne, was elaborated into the art now practised.

In an English patent, dated the 8th December 1842, and granted to William Coley Jones and George Wilson, we find the first application of the combined process of sulphuric saponification and *steam*-distillation. They decompose fats with sulphuric acid, aided by heat, and distil the fat thus decomposed by means of steam, which passes in minute streams out of a perforated coil fixed in the bottom of the still.

This combination of the sulphuric saponification and subsequent distillation solved the fundamental conditions of success; nevertheless a whole series of improvements followed, which essentially contributed to establish the present extension of this system of manufacture.

Patents taken out by Gwynne and Wilson, on the 16th November 1843, and on the 28th December of the same year, secured to them farther improvements in this process; in the latter a method is described of reducing the quantity of sulphuric acid employed for decomposing the fats to from 10 lbs. to 6 lbs. for every 112 lbs. of fat, that is, to one-sixth, and even to one-tenth of the quantity employed by Frémy in his investigations. This saving was effected by heating the fat to 177° C. (350° F.) Another improvement was the heating of the steam in a series of pipes after it had left the boiler, instead of depending on the temperature of the fat to effect it.

Their last patent on the subject is that of the 30th October 1844, in which they propose to use a jet of supersaturated steam* to heat the fats previous to sulphuric saponification. These patents embody all the plans which, since July 1844, have been in operation at the works of Price's Candle Company at Vauxhall and Battersea, of which Mr. Wilson is the managing director.

Similar manufactories, though not of such magnitude, have been established in other countries; the principal are those of Masse and Tribouillet, at Neuilly, near Paris, Motard in Berlin, Bert at Gijon (Spain), and of the Milly Candle Society in Vienna.

There can be but little doubt, after inspection of the candles in the Exhibition, that the process just described is applicable to the production of the higher class of candle, white, inodorous, and dry to the touch; but this is not the only part which it has filled up to the present time, it is in the treatment of palm-oil and cheap fatty bodies that it renders most valuable service. By its aid fats the most fœtid and impure furnish candles of the finest quality; and thus it utilizes the waste of the glue-maker, and oily residues derived from the waste lyes of woollen and other manufactories.

We now proceed to describe the practical processes of the workshop, the various stages of which will be followed without difficulty after what has been said in the article on soap, and in the foregoing sketch respecting the constitution of fats and their decomposition.

(c.) *Description of the Lime Process as practised at Messrs. Ogleby and Co.'s Works at Lambeth.*

Saponification.—Into a large wooden vat, containing a coil of steam-pipes, pierced with small holes, ten tons of tallow are placed, with a quantity of water. The steam, when turned on, issues through the holes into the water, raises its temperature, and melts the tallow; as soon as the water has entered into brisk ebullition, a quantity of lime, in the state of thin cream, is added, and the ebullition continued for six hours, or until complete saponification is effected. From 10 to 15 parts of dry quick-lime are added for every 100 parts of tallow. The lime decomposes the tallow and combines with the resulting stearic, margaric, and oleic acids, forming a lime-soap (rock-soap), and sets the oxide of glyceryl at liberty in its hydrated state as glycerin, which dissolves in the water. The whole is allowed to cool in the vessel in which the boiling is effected, and the solution of glycerin run off.*

The rock-soap, when cold, is reduced to a coarse powder by a mill, consisting of a pair of fluted rollers, over which an axis is placed, carrying tiger-like claws, which revolve between a series of horizontal prongs. The claws, by passing between the prongs, tear the large lumps into small pieces, which are then crushed by the fluted rollers.

Decomposition of the Lime-soap by Acid.—The ground lime-soap is now placed in lead-lined vats, supplied with a perforated copper steam-coil, each vat being capable of holding from eight to ten tons. When the temperature has reached the boiling-point, sulphuric acid, previously diluted, is added in the proportion of about 25 parts to every 100 parts of tallow employed. The sulphuric acid combines with the lime, forming an insoluble sulphate of lime, and liberates the oily acids which float at the top, and are then termed "yellow matter." This yellow matter is run off by cocks, placed at the proper level, into large spouted vessels, called "jacks," and poured from these into flat tin-moulds, in which it is allowed to cool and crystallize.

The sulphate of lime, after being well washed with boiling acidulated water to remove the adhering fat, is sold as manure.

Pressing the Fatty Acids to remove the Oleic Acid.—The cakes of yellow matter are interleaved with cocoa-nut mats (without being sliced and enlosed in bags, as was formerly the case), and subjected between iron-plates to a pressure of 600 tons in a vertical hydraulic press. A great portion of the oleic acid is thus removed, and the mixture of stearic and margaric acids rendered much whiter.

Refining.—The cold-pressed acids are then melted by steam in a lead-lined wooden vat, with a little dilute sulphuric acid, to remove any oxide of iron, or other impurity; poured into flat tin trays, and again allowed to cool and crystallize.

Hot-pressing.—The cakes of stearic acid, when cold, are put separately into a linen-bag, interleaved with cocoa-nut matting and iron-plates, previously heated by steam, placed in the trough of a horizontal hydraulic press, which is likewise heated by steam, and then subjected to great pressure for some time. By this operation the remainder of the oleic acid, holding a little of the solid acid in solution, is removed. The pressed cakes retain a small quantity of oleic acid at the edges; these are scraped off, melted, and again pressed.

Second Refining.—This process is simply a repetition of the first process of refining.

Moulding.—In the manufacture of the best description of stearic candles, the moulding is generally performed by hand. The moulds are of pewter, several being fixed in a wooden frame; these moulds are heated to a temperature approaching the fusing-point of the stearic acid, and are rapidly wicked, in the manner already described in speaking of tallow mould candles.

The wicks are all previously prepared by immersion in a solution of boracic acid, or the ammonia-salts of this and other acids, the preparation varying with the experience of different manufacturers. This preparation, called flux, serves to fuse the ashes of the wick into minute globules, which are frequently seen on the extremity of the wick, and which are readily dispersed, and also prevents the formation of earthy and alkaline soaps.

The melted material having been allowed to congeal to a great extent, is run into the moulds. After cooling, the candles shrink sufficiently to be removed with a few light taps on the frame.

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* Steam heated to a higher temperature, after it has left the boiler, than it can acquire if kept in contact with the water from which it is generated at any given pressure.

* Until within the last four years the glycerin was a valueless product; its utilization is due to Mr. Thomas De La Rue, who, being engaged in experiments on its application in the arts, happened to observe its property of alleviating any irritation of the skin, and suggested to a medical friend its use in the treatment of cutaneous affections.

The fusing-points of stearic candles are remarkably uniform, though manufactured by various makers in different countries; for example, those taken from Messrs. Ogleby's case congealed at 55°·25 C. (131°·5 F.), and one from De Milly's at 55°·50 C. (132° F.) This coincidence is very remarkable. Stearic acid fuses at 70° C. (158° F.) Margaric acid at 60° C. (140° F.) So that from the mixture of the two a compound is formed which fuses at a lower degree than either of the components, for it is almost impossible to assume that the solid acid should still contain a sufficient quantity of oleic acid to reduce its fusing-point to such an extent.

(*d.*) *Description of the Sulphuric Saponification and Distillation Process employed at the Works of Price's Patent Candle Company.*

Sulphuric Saponification.—About 20 tons of fat, say palm oil, are placed in a large lead-lined vat, and fused by a steam-jet. The fluid mass, after being allowed to settle, has now to be exposed to the combined action of concentrated sulphuric acid and heat, and for this purpose is pumped up into the acidifying vessel, in which its temperature is raised to 177° C. (350° F.) The means of heating is a jet of low-pressure steam, which, in its course from the boiler, passes through a series of iron pipes heated in a furnace. The quantity of acid used is in the proportion of 6 lbs. for 112 lbs. of palm-oil. In this operation the palm-oil is decomposed and becomes much blackened. Withdrawn at that period it is seen that an important change has been effected by the action of the acid, as the mass now readily crystallizes to a tolerably solid fat. The fat is now drawn off from the acid and transferred to the washing tank, where it is boiled up with water by means of a steam-jet.

Distillation.—Afer one or two washings the blackened fat is withdrawn and pumped up to the supply tank, which commands the stills. The stills, which are made of copper, are heated by an open grate; each still is capable of holding five tons of fat. When charged, the temperature is raised to 293°·5 C. (560° F.), and low-pressure steam passed through the mass; this steam is previously heated by passing through a system of iron pipes placed in a furnace.

The current of steam carries with it the vapour of the fatty acids, and thus facilitates the process. The mixed vapours of fatty acids and water pass together to a series of vertical pipes, which retain a temperature above 100° C. (212° F.), where the fats only condense while the steam passes to a second refrigerator, cooled by a current of water; here it is condensed along with the minute quantity of fat carried over by it. A separating tank, from which the water escapes at the bottom, whilst the fats float on the top, serves to recover this small quantity.

Distillation of the Residue—After continuing the distillation for a certain period, the residue in the still is transferred to another still formed of iron pipes, set in a furnace, and there submitted to a much higher temperature, and a jet of steam more strongly heated. The residue left in these iron stills is a sort of pitch, and is applied to the same uses as ordinary pitch; by this means an additional quantity of fatty acids is obtained.

The fatty acids, as they run from the still, are used to a great extent for the manufacture of candles without pressing, and form what are called Composite candles, which possess all the advantages of being self-snuffing, but are more fusible and softer than the pressed stearic acid candles.

A large proportion of the distilled fats, however, is pressed to make a better sort of candle, and for this purpose 50 hydraulic presses are employed.

Cold-Pressing.—The fats are spread by ingenious machinery on woven mats, and submitted to powerful cold pressure, between iron plates; the oleic, or metoleic acid, runs out, and is collected, and chiefly exported to Germany, where it is employed in soap-making.

Hot-Pressing.—After cold-pressing, the fat acids are subjected to hot pressure, in hydraulic presses, confined in a chamber heated by steam. The pressed cakes, after the removal of the edges, are melted in contact with a little diluted sulphuric acid, and run into blocks. When the Reporters visited the works, the Company were distilling at the rate of 130 tons of palm-oil per week.

Moulding.—The moulding of the cheaper descriptions of candles is effected by ingenious machinery invented by Mr. Morgan, of Manchester, and improved by the engineer of the Company. By this machine 18 candles are moulded at one time; the wicks, 60 yards long, are wound on 18 separate reels, one for each mould. As one set of candles is pushed out by a series of plungers, they draw with them into the moulds the wicks for the next lot; these wicks being held temporarily with one clip, whilst the candles are held with another, are cut off close to the candles by a traversing circular cutter. Compound forceps, having 18 holders, now seize the wicks at the open end of the moulds, and hold them in their places; the plungers then return and draw the wick tight. The moulds, which during the operation have remained in a horizontal position, are now turned in a vertical direction, the small end downwards, and are then passed on a railway, to the person who is to fill them, they being heated to the proper temperature by their transit through a hot closet. They are then passed to other parallel railways and left to cool: after remaining a sufficient time to allow of the solidification of the candles, the moulds are brought back in succession by means of turn-tables to their first position. The forceps (which during the moulding have remained *in situ*) are now removed, and the frame of moulds again turned in a horizontal position. Eighteen plungers or pistons are made to press forward the loose bottoms of the moulds which correspond to the small end of the candle. In pushing these forward the candles are pressed out, and thus the cycle of operations is completed. It must be added that the return-stroke of the piston brings back the bottoms of the moulds against shoulders provided to keep them from falling out.

Pressed cocoa-nut oil is largely employed to mix with the pressed acids of palm-oil to make the best composite candles.

Price's Candle Company (Class IV., 83, p. 201*) is the most colossal establishment in the world in this branch of chemical manufacture; possessed of five distinct manufactories, besides plantations of cocoa-nut trees in Ceylon, of a capital but little short of half a million sterling, and employing, notwithstanding the best arrangements for economising labour, 800 workpeople, it is not surprising that they divide annually in profits a sum equal to the gross returns of some of the largest continental works (between 40,000*l.* and 50,000*l.*).

The fusing-point of Price's Candle Company's candles of pressed distilled fats obtained by distilling palm-oil is 51°·3 C. (124° F.); those prepared from the pressed fats obtained by distilling Chinese tallow (derived from the *Stillingia sebifera*), according to a patent taken out on the 20th of December 1845, by Wilson, Gwynne, and Wilson, fuse at 57°·7 C. (136° F.)

AUSTRIA.

In the Austrian Department there are Four Exhibitors of stearic candles, whose productions are generally of the highest character. The two principal are, firstly, the APOLLO COMPANY (39, p. 1009), which is the largest establishment in that country; having two manufactories, and employing about 600 workmen. These works produce about 1,000 tons of stearic candles, and 1,500 tons of soap, annually. The stearic candles of this Company are the whitest in the Austrian section. Secondly, the MILLY CANDLE SOCIETY (40, p. 1009), which was established in 1837, with the aid of M. de Milly, who instructed his brother in the art, and sent him to Vienna for that purpose. They have two manufactories, giving work to 200 people; they also employ machinery for moulding. In the one they produce, by the lime-process, 300 tons of candles, and 450 tons of soap, annually; in the other, they employ the distillation-process, and produce, by distilling palm oil, 300 tons of candles: in all, 600 tons of candles annually.

According to Mr. Buschek, the total annual value of the stearic manufactures in Austria is between 5,000,000 and 6,000,000 florins (428,572*l.* to 514,286*l.*); this includes the soap made as a secondary product from the oleic acid. Tallow costs 29*s.* per English cwt., and is reckoned to produce 45 per cent. of stearic acid, and 45 per cent. of oleic acid. Stearic acid sells at 66*s.* 3*d.* per cwt., and the manufactured candles at 112*s.* per cwt., which is an extraordinary advance on the price of the acid. Oleic acid sells at 18*s.* per cwt., and oleic acid-soda soap at 25*s.* per cwt.

BELGIUM.

The manufacture of stearic candles was introduced into this country by De Milly, in 1833, and has since attained a high state of excellence.

The manufactory of C. and J. **QUANONNE** (431, p. 1164), (who exhibit) was established with his aid; and they have adopted his name, of *Bougies de l'Etoile*, for their candles. They have six hydraulic presses, and produce annually about 240 tons of stearic candles, 70 tons of which are exported.

There are Two other Exhibitors of candles from Belgium, viz.:—**DELSTANCHE** and **LEROY** (510, p. 1167), who employ 17 workmen, and produce 80 tons of stearic candles, 30 tons of which are exported; and **CHARLES VAN CAMPENHOUDT** and Co. (436, p. 1164), whose manufactory was only established in April 1850; they nevertheless have sent the finest specimens. At present they are producing at the rate of about 90 tons per annum.

The wholesale price of stearic candles is from 10*d.* to 1*s.* per lb.

CANADA.

The stearic candle manufacture has extended to Canada; which contributes the productions of a single manufactory: from what has been sent it is fair to anticipate that this art will soon be perfected.

DENMARK.

There is only one exhibitor of stearic candles in the Danish Department; his productions are very high in price (1*s.* 4½*d.* per lb.), a natural consequence of the high protective duty of 27*s.* 6*d.* per cwt. on candles imported. At present Mr. **HOLMBLAD**'s works (27, p. 1357) are on a very small scale, producing only 20 tons of candles per annum. There are, however, two other manufactories established near Copenhagen.

FRANCE.

As the stearic manufacture was originated in this country, it was to be expected that there would be many Exhibitors representing this art, and that their productions would be of the finest quality, an anticipation which is confirmed by the result, for there are six Exhibitors of stearic candles by the lime process, and one of stearic candles by the sulphuric process, most of whom have been rewarded. There is likewise one Exhibitor of ornamented candles, which are, however, unimportant. M. **DE MILLY** (644, p. 1209), who was the first to apply the lime process successfully, established his manufactory of stearic candles in Paris in 1831, and gave the name of *Bougies de l'Etoile* to his products, because it was situated near the *Barrière* bearing that name; his manufactory now produces, on the average, 2 tons of candles per day. Since that period many other makers have sprung up in France; and there are now in Paris and its environs six makers besides De Milly, who collectively produce, at the least, 10 tons per day by the lime process. Besides which there are in the French provinces seventeen other manufacturers, who make collectively about 17 tons per day. These figures must only be taken as approximations; but they show, that in France alone, at least 7,400 tons of stearic candles are produced by the lime-saponification process. Besides these, **MASSE** and **TRIBOUILLET**, who employ the processes of sulphuric saponification and distillation, are mounted to distil about four tons of fat per day. They have exhibited a series of most interesting products, which are described in the List of Awards.

According to a statement furnished by **MASSE** and **TRIBOUILLET** (1346, p. 1240), the wholesale prices of the various stearic manufactures are as follow:—The best stearic candles, 11*d.* per lb.; second quality, 10*d.*; third quality, 9*d.*; candles made from unpressed distilled fat acids (composite candles) 7½*d.*, 8¼*d.*, and 9*d.* per lb., according to quality; grease recovered from waste suds, 2*d.* per lb.; oleic acid, 3½*d.* per lb.; oleic acid soda-soap, 3½*d.* per lb.; and, lastly, paraffin-candles, 1*s.* 8*d.* per lb.; but it does not appear that they have yet been supplied in the way of trade.

Candles exported from France in 1850:—

	lbs.		£.
Tallow-candles – – –	1,133,590	valued at	28,792
Stearic-candles – – –	1,777,086	,,	84,000
Wax-candles (yellow) – –	3,925	,,	256
,, ,, (bleached) –	113,227	,,	10,334
Spermaceti-candles – –	10,418	,,	1,096
All kinds – –	3,038,246		124,478

HOLLAND.

Mr. **BRANDON** (70, p. 1145), who has sent very beautiful productions, established his works in 1839; he employs two steam-engines, five hydraulic presses, and about 100 workpeople.

INDIA.

Excellent stearic candles are sent from Cossypore (p. 922). *Ceylon* (p. 937) has contributed specimens of cocoa-nut stearin and olein.

PRUSSIA.

M. **MOTARD** (Zollverein, 262, p. 1063) was selected as the only exhibitor to represent Germany in stearic manufactures; and his articles fully justify the choice of the local authorities. M. Motard exhibits candles made by distillation as well as by lime saponification.

The wholesale price of stearic candles in Berlin is 1*s.* 0¾*d.* [per pound avoirdupois: of stearic acid, 10¾*d.* per lb.; of candles made from the unpressed distilled acids of palm-oil (composite candles) 8*d.* per lb.; and of the unpressed acids, 7*d.* per lb.

In 1846 there were sixty-nine manufactories of soap, candles, and oils, giving employment to three hundred and fifty-five artizans; also five establishments for wax-bleaching and wax-candle making, employing thirty-two workmen.

RUSSIA.

There are Five Exhibitors of stearic candles in the Russian Department, whose productions are most creditable.

Russia possessed, in 1842, sixty-two candle-manufactories, which produced annually goods valued at 142,800*l.*; and two hundred and sixty-six tallow-melting establishments, which yielded tallow valued at 1,578,000*l.*

The price of stearic candles in Russia varies from 10*d.* to 10½*d.* per English pound.

SARDINIA.

There is One Exhibitor of stearic candles from Sardinia.

SPAIN.

In 1839, while the effects of the civil war which paralysed Spain for some years were still severely felt, M. **JULIAN BERT** (246, p. 1344), aided by M. de Milly, had the courage to establish a manufactory of stearic candles in Spain. The difficulties of inducing capitalists to join in forming a company being overcome, M. Bert had still to contend with formidable obstacles, from the discontinuance, at that time in Spain, of several collateral branches of industry. He was obliged to erect leaden chambers, and manufacture his sulphuric acid; also to establish a cooperage and a boiler-making shop. In spite of these obstacles, his efforts were so successful, that, since that period, his Company have established still more extended works at Gijon, where saponification and distillation are both practised; as well as soap-making on a very large scale. The distillation furnishes 3,500 lbs. of vegetable fatty acids per day. One hundred and fifteen workpeople are employed in the two establishments; they are all Spaniards, and were instructed at the works. There are two other manufactories of stearic candles, one at Barcelona, the other at Hernani. The wholesale prices of tallow and palm stearic candles are both 1*s.* 3*d.* per pound avoirdupois.

SWEDEN AND NORWAY.

Some of the finest stearic manufactures in the Exhibition are sent by J. JOHANSSON, of Stockholm (98, p. 1354). The beauty of these productions arises chiefly from the employment of newly-invented machinery, which this Exhibitor obtained from J. and C. G. Bolinder, engineers in the same town. Several candle-moulds are exhibited which are remarkable for their internal polish. They are made by simply dipping a cold highly-polished steel-rod into a melted alloy, chiefly composed of tin. In this way two workmen can produce from 100 to 110 moulds per hour. M. Johansson employs a steam-engine of twelve-horse power to work the hydraulic presses, slicing and mixing machines, and also a polishing machine, to which the great lustre of his candles is partly due.

TURKEY.

Moldavia contributed some very good specimens of stearic candles from its only manufactory, which possesses a steam-boiler and two hydraulic presses; and produces about twenty tons of candles per annum.

UNITED KINGDOM.

In 1832 a manufactory of stearic candles was established in London, with the co-operation of M. de Milly; and in 1833, M. Burjot introduced them into the market under the name of moulded wax.

In 1834, W. S. HALE (p. 796) commenced working, and has from this period gradually extended his works, until he has become one of the largest makers of stearic acid and candles in England by the lime process. His aim being the manufacture of a commercial article in large quantities, the productions which he contributes have not the whiteness and high degree of finish of those of some other Exhibitors.

It was likewise in 1834 that C. OGLEBY and Co. (p. 797) commenced working. They have since devoted themselves almost exclusively to the highest articles, and their stearic acid and candles are the whitest in the World's Show.

Soon afterwards J. C. and J. FIELD (p. 205*) commenced the manufacture, and have likewise directed their attention successfully to the best class productions.

The manufactory of M. Burjot is no longer in existence, but has supplied the foremen employed in the first instance in the works of the three English exhibitors.

The wholesale price of stearic candles in England is 10*d.* per lb., and that of stearic acid 9*d.* per lb.

Besides those just named, PRICE'S CANDLE COMPANY (p. 201*) exhibit interesting products obtained from the distillation of fats; and Mr. BAUWENS, the fat acids recovered from waste lyes.

The wholesale price of palm stearic candles is 9½*d.* per lb., and that of composite candles 5½*d.* per lb.

Imports of palm oil into the United Kingdom in 1850:—

	Cwts.
West Coast of Africa - - -	434,179
Other Parts - - - - -	13,617
Total - -	447,796

In 1850, 4,672 lbs. of stearic candles were imported into the United Kingdom, and paid 24*l.* duty. This quantity is very insignificant compared with the annual consumption, and arises in a great measure from the cheapness of production in England: another cause, however, is the preference shown by the British public for candles coloured yellow to resemble wax, which description is not manufactured in other countries. It is much to be regretted that this tendency to imitate one material by another should prevail to the extent it does, as it undoubtedly frequently retards the development of each in its own particular sphere. Many instances might be cited in illustration: the imitation of a carpet or marble pavement by oil-cloth, and chintz and silk by paper-hangings, immediately occur; to which we may add, as more immediately connected with the subject under discussion, gas burners made to imitate oil lamps and candles, as if a tube conveying gas could not be arranged in an ornamental form. But to lower the beautiful white of the pure stearic candle by any contamination appears absurd, after bestowing so much skill in obtaining it free from colour. Our French neighbours, who, in matters of taste, are at least our equals, have long since discarded the less luminous wax candle, and invariably use those of pure white stearic acid for their grand fêtes. The Jurors lately witnessed a brilliant illustration of this fact in the gorgeous illumination of the Hotel de Ville at Paris.

WURTEMBURG.

Although the name of one manufacturer is given in the *Illustrated Catalogue*, no stearic candles are exhibited in the Wurtemburg department.

We now come to the consideration of candles made from wax and spermaceti. These substances, though differing from fats properly so called, present some analogy; they are even more closely allied than the fats themselves to the class of bodies called compound-ethers, inasmuch as they are actually combinations of certain fatty acids with the oxides of various alcohol-radicals; for, whilst oxide of glyceryl is common to all the fats and oils before spoken of, the waxes and spermaceti have their own peculiar bases, which, when liberated, are (unlike glycerin) insoluble in water; moreover, waxes are only partially acted upon by weak solutions of alkalies, and spermaceti not at all under ordinary circumstances; and although they may be split up into their proximate components by fusion with the solid hydrated alkalies, or ebullition with their very concentrated solutions, they must be considered as non-saponifiable in the ordinary acceptation of the term. The individual differences of wax and spermaceti will be farther elucidated as we proceed.

(*e.*) *Wax-Candles.*

Under the name of wax are included substances of various origin and of very different composition.[*] The wax employed in the manufacture of candles is secreted by the honey bee, which has the power of producing this substance from its food (sugar). At one time it was thought that the bee collected the wax ready formed from plants, until Liebig advanced the contrary opinion, which was subsequently corroborated by the experiments of MM. Dumas and Milne Edwards.

A wax known as Chinese wax, and resembling spermaceti in appearance, was formerly supposed to be a vegetable wax; but the researches of Sir George Staunton and M. Stanislaus Julien, have demonstrated that it is the secretion of a male insect, the *Coccus ceriferus*, which deposits it on the trees on which it feeds, particularly the *Rhus succedaneum.*[†] We owe to Mr. Brodie, a knowledge of the true chemical composition of wax.

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[*] The attention of the reader is directed to the following specimens of wax obtained from different sources, and which are but little known. Two examples (273 and 283) of bees'-wax from Tasmania, in the section of *Van Diemen's Land*; berry-wax and bees'-wax from *South Africa*; vegetable wax from *St. Domingo*; and in the *Chinese* section a so-called vegetable wax produced in Szechuen, and also white and yellow bees'-wax.

[†] For much valuable information respecting the so-called vegetable waxes of China, as well as the other products of that vast empire, the reader is referred to the *Etude Pratique du Commerce d'Exportation de la Chine*, by our colleague, M. Natalis Rondot. Paris, 1849. Guillaumin.

This chemist, by his recent elaborate researches, has shown that Chinese wax is a compound of a peculiar fatty acid (cerotic) and the oxide of an alcohol radical (cerotyl), and is consequently cerotate of oxide of cerotyl. Ordinary bees'-wax he finds generally to contain 22 per cent. of free cerotic acid, which is soluble in alcohol, and, with potassa, forms readily a soap. The residue, which is nearly insoluble in alcohol, and which has been usually called myricin, he has shown to be a compound of palmitic acid and the oxide of another alcohol radical (melissyl), that is, palmitate of oxide of melissyl. He has likewise been able to prepare from wax two new solid hydrocarbons (compounds of carbon and hydrogen), similar to paraffin.

Paraffin would be much too costly to be converted into candles if made from wax, as its preparation entails a considerable loss of material; it is, nevertheless, desirable that it should be obtained cheaply from some source, as it is much better adapted than any other substance for illuminating purposes, from its containing no element besides carbon and hydrogen, which are united in equal equivalents; it is, therefore, exactly of the same composition in a hundred parts as olefiant gas, which gives to ordinary coal and oil-gases their illuminating power. Examples of paraffin-candles are exhibited by **MASSE** and **TRIBOUILLET** in the French Section, which were made from paraffin obtained by distilling bituminous schist; but far more interesting specimens are sent by **JAMES YOUNG**, Class II., No. 7B, which seem to realize the great problem which the rare sagacity of Liebig[*] pointed out as far back as ten years ago. "It would certainly be esteemed one of the greatest discoveries of the age," says he, "if any one could succeed in condensing coal-gas into a white, dry, solid, odourless substance, portable, and capable of being placed upon a candlestick or burned in a lamp." Now this very problem Mr. Young appears to have accomplished by distilling coal at a comparatively low temperature, whereby he obtains, instead of gas—the product of intense heat—a mixture of liquid and solid substances, the former capable of being burned in lamps like sperm-oil, or of being used for lubricating machinery, the latter yielding a beautiful mould-candle as solid and white as any prepared from paraffin from other sources. The Reporters have not, as yet, been able to obtain a fuller account of the economical bearings of Mr. Young's process,[†] which will most likely be considered in the Report upon another Class, but they confidently hope that this truly beautiful discovery will not meet with similar difficulties as the plan proposed some years ago for making paraffin-candles out of Irish peat. If coal-paraffin can actually be obtained in sufficient quantity and at moderate cost, we may witness another revolution in the processes of illumination; and the brilliant discoveries of Chevreul, but lately threatened by the splendour of the electric light, may be eclipsed by the general adoption of solidified coal-gas candles.

In most countries wax intended to be made into candles is previously bleached by a process presently to be described. That this, however, is not always the case, we find by specimens exhibited in the Egyptian and Tunisian Courts. The candles in the latter, which we may infer resemble those of the classical ancients, are true yellow wax "dips," and have a very ungainly appearance. The bees'-wax from which they are made is principally produced in the province of Kirwan; and the primitive method usually adopted for their manufacture consists in merely melting the wax in a copper vessel, and then dipping the wick repeatedly into it. Although such is the usual mode, the wax is sometimes bleached, and of course finer candles produced, but none such were exhibited. No animal fat is employed in Tunis for the manufacture of candles, although stearic candles of European manufacture are imported, and are in very general use.

Wax is more valuable when bleached, not only on account of the greater beauty, but also from the removal by this operation of impurities which would clog the wick during combustion. It may be bleached by chlorine, but the process is of no value, because its constituents retain a portion in combination, and hence hydrochloric acid is given off in burning.[*]

The method of bleaching employed is very simple, although tedious; the following, with some trifling variations, is the plan adopted in most countries.

Wax Bleaching.—The wax is cut up into small pieces and placed in a vat, into which steam is made to pass through a perforated coil of pipes: a small quantity of very dilute sulphuric acid being added, in the proportion of one pint measure of strong sulphuric acid (oil of vitriol) to one ton of wax, and the whole well agitated for some time. This addition of sulphuric acid facilitates the separation of impurities which subside into the acidulated water.

As soon as, by subsidence, the wax has become bright, it is removed into a trough, with holes in the bottom about the size of an ordinary quill. The melted wax runs through these holes in small streams, on to a wooden cylinder, which is made to revolve, and the lower half of which is immersed in a cistern of cold water. The motion of the cylinder carries up a layer of water, on which the streams of wax fall, and form exceedingly thin ribbons, varying from half to one inch in breadth; these ribbons, by the revolution of the cylinder, dip under water, and as they rise upon the opposite surface, are removed, and spread out thinly and evenly on tables, placed in the open air, so as to be exposed to the action of the sun and air for a period varying from five to ten weeks. Once or twice, during that period, the wax is again subjected to the same process of melting; it requires also frequent turning, so as to present every portion to the bleaching agency of sunlight.

The fusing-point of wax is raised by bleaching, for yellow wax fuses between 62° and 63° C. (144° and 146° F.), and bleached wax between 64° and 65° C. (147° and 149° F.).

All waxes are not found to bleach with equal facility, according to the statement of Mr. Barclay. For example, English, Hamburgh, Odessa, Portuguese, Mogadore, Zanzibar, East and West Indian, and North American waxes bleach very readily, whilst those from Cuba, Dantzic, Kœnigsberg, Gambia, and Gabon are only bleached with difficulty, and seldom acquire a good colour.

Notwithstanding the difficulty with which Gambia wax is bleached, and its liability to become of a rusty brown, that country furnishes the greater part of the wax which is imported into Great Britain. Large quantities are likewise imported from Mogadore, the East Indies, particularly Ceylon and Singapore, and North America; the Mogadore wax is frequently largely adulterated with fat.

From Brazil a curious wax has been imported, the product of a black bee, which hives under ground. It is soft, and exceedingly tenacious, and of a dark mahogany colour. It does not appear in the slightest degree bleached after exposure to the sun. A considerable quantity might be imported, but no use has as yet been found for it.

The English wax is the most esteemed of all, but the small quantity produced is absorbed for various purposes without bleaching, on account of its fine quality and its brightness and fragrancy.

In 1850 the quantity of bees'-wax imported for home consumption in Great Britain was 10,761 cwt., besides a small quantity of vegetable wax amounting to only 5 cwt. There is no duty on wax.

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[*] Familiar Letters on Chemistry, 3rd edition; Letter XII., p. 158.

[†] According to a statement furnished to the Reporters, 100 parts of cannel-coal, from Bathgate, yielded 40 parts of oil, and 10 parts of paraffin.

[*] The attempt to bleach wax by means of chlorine, although unsuccessful in a practical point of view, has been very fertile in theoretical results. It is not generally known that one of the leading views in chemistry, the so-called theory of substitution, derived its origin from Gay-Lussac's observation, that wax, when exposed to the action of chlorine, absorbed this element into its composition, releasing an equivalent quantity of hydrogen in the form of hydrochloric acid.

1,067 lbs. of wax candles were also imported and paid 9*l.* duty.

Wax is not well adapted for moulding on account of its tendency to adhere to the mould, and its great contraction in cooling; and though these difficulties may be overcome, yet it is found more advantageous to make wax-candles in the manner about to be described, as they are found to burn much better.

The first process consists in warming the wicks in a stove, and then suspending them to a hoop placed over a vessel of melted wax. The workman pours the melted wax with a ladle on to each wick in succession, and at the same time causes the wick to revolve on its axis by the motion of the fingers; when the candles are about one-third made, they are allowed to cool for a time, and the operation of pouring repeated until the candles are about half made, which is ascertained by the eye or by weighing. Whilst still warm, they are removed from the hooks and subjected to a process of rolling between two marble slabs, so as to render them uniform in thickness. The upper end of each candle is now formed by cutting down the wax to a metal tag which covered one end of the wick. The candles are then again suspended to the hoops, the end which had previously hung downwards being now upwards; and the operations of basting and rolling repeated as often as necessary. Lastly, the lower ends of the candles are cut off to make them of equal length.

The wicks of wax-candles are always made of twisted unbleached Turkey cotton, the fibre of which appears better to resist the temperature of the highly heated wax during combustion. Plaited wicks are not adapted for wax-candles, as the plaiting, by diminishing the capillary action, entails the employment of so large a wick that it obscures the light; beside which, it is apt to curl round and round in the flame, and to collect a quantity of soot.

The large wax-candles, used in churches, are formed by laying the wick on to a slab of wax, which is then folded over on the wick, and the candle finished by rolling.

Long wax tapers are made by winding the wick on a drum, and then leading it under a guide-roller, placed in a trough of melted wax; from this it passes through a series of holes, progressively smaller, on to a second drum; the operation resembling somewhat that of wire-drawing. A little turpentine is added so as to render the wax pliable enough to wind.

Wax candles are coloured with the following materials:—

Blue - -	Artificial ultramarine.
Green - -	Mixture of verdigris and emerald green, or verdigris only.
Yellow - -	Chrome-yellow.
Red - -	Vermilion.
Pink - -	Madder-lake.

Wax mortar-lights, which are used as night-lights, have wicks of flax, as cotton is not found to be so well adapted to resist the long-continued action of the high temperature, and is not so uniform in its capillary action.

The larger mortar-lights have plaited wicks, and are used principally for warming dishes.

China.

The Chinese employ bees'-wax, the insect-wax before spoken of, and also vegetable tallow (obtained from the *Stillingia sebifera*, a tree of the order *Euphorbiaceæ*), in the manufacture of candles. The insect-wax is purified by filtration through moist rice, and is then, for the purpose of candle-making, mixed with one-hundredth part of oil. Bees'-wax is used either alone, or to form thin shells, into which the vegetable tallow is poured. This plan of encasing a soft with a hard material has been long in use in China, though only of recent introduction in Europe. The only contribution in the Chinese Department is from the Honourable **East India Company** (p. 922), who exhibit some examples of wax-tapers from Pekin.

Egypt.

From Egypt are contributed a few specimens of wax-candles, some of unbleached and others of bleached wax, which must be characterised as crude manufactures.

India.

The Indian Department contains some well-made short candles of bleached wax, six and nine inches in length, which are manufactured at Patna. They are designated camphorated wax.

Russia.

The most important contribution of that country is **V. Sapelkin's** (309, p. 1370), which consists chiefly of wax-lights, plain and ornamented, for the use of churches, though there are several for household use. Most of the other collections are small, and consist in some cases only of wax-twisted tapers. Two Exhibitors have sent fancy-baskets made of waxed wicks. In 1842 the wax produced in Russia was valued at 59,200*l.*

Tunis.

This department contributes the most ungainly candles in the Exhibition.

Turkey.

The Turkish Department contains specimens of very well-made and well-bleached wax-candles, and twisted tapers. The Jury have included these in their Award to **His Highness the Sultan**, as in common with most of the articles exhibited, they were bought in the bazaars, and no individual Exhibitor's name was given.

United Kingdom.

The most remarkable collection of wax-candles, and specimens to illustrate wax-bleaching, is that of **Barclay and Son**, wax-bleachers (Class IV., 24, p. 196), who exhibit in the South-West Gallery. The manufactures are of the highest quality as regards the uniformity of the candle, and especially the very careful attention bestowed on the wick, the value of which was only to be ascertained by burning. The night-lights have the excellent quality of burning the indicated number of hours, which is a point of some importance.

f. Ornamented Candles.

The collection of ornamented wax-candles for weddings and fête days is in fair proportion. **France, Portugal,**[*] **Russia**, and **Wurtemburg** furnish specimens. Some decorated wax-candles for Catholic churches are also contributed by **Tucker and Co.** to the Mediæval Court (Class XXVI., 536, p. 762).

The only three objects still to be noticed are candles made of two different descriptions of vegetable wax in its natural state. Those from **St. Domingo** (p. 1429) are of a greenish colour, and probably from the wax of the *Myrica cerifera*. The others, from **New Brunswick** (23, p. 969), are dark green. Lastly, there are black candles made from bituminous shale of the Binney Quarry, Scotland, exhibited in the North Gallery (94, p. 795).

g. Spermaceti.

Spermaceti is a white crystalline body, fusing at 49° C. (120° F.) In its chemical relations it is closely allied to wax, and, according to the experiments of Mr. Laurence Smith, appears to be a compound ether, namely, cetylate of oxide of cetyl; cetylic acid having the same per centage composition as palmitic acid, derived from palm-oil.

Spermaceti is obtained from the oil of the sperm whale, from which it readily crystallizes, especially in cold weather. The purification of sperm oil depends in a great measure on the complete separation of the spermaceti: hence, sperm oil "bagged" in winter, from yielding a larger quantity of spermaceti, is less liable afterwards to congeal than that bagged in summer.

Description of the Process of Spermaceti Refining at Messrs. Ogleby and Co.'s Works, Lambeth.

Bagging.—To separate the crystallized spermaceti, the sperm-oil is filtered through long cylinders of bagging, lined with linen, these are at one end tied on to the nozzles of a feed-pipe communicating with a tank elevated about 6 feet, whilst the other end of the cylinder is tied up with a string. The oil being pressed upon by its own column, readily passes through the bags, which retain the spermaceti. This operation is called bagging, and is performed on a very large scale in the autumn and winter.

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[*] There is a manufactory of stearic candles in Lisbon, but it has not contributed any of its productions.

The spermaceti is of a dingy-brownish colour; and is readily removed from the bags, which are open at both ends; in this state it is called "bagged sperm."

Pressing.—The bagged sperm is then placed in hempen sacks, and subjected to a pressure of about 80 tons in an hydraulic press, which removes the greater portion of the adhering oil.

Second Pressing.—The pressed sperm is now melted, and crystallized by slow cooling, and after being ground to powder, is folded up in square pieces of bagging, and then subjected to the action of a much larger hydraulic press, capable of exerting a force of six hundred tons. The oil which runs from this press contains a small quantity of spermaceti, and is, therefore, returned to the bags to be filtered.

Refining.—The spermaceti is next melted in a large iron vessel, and boiled for some time with a solution of caustic soda, which readily saponifies the sperm-oil still adhering to the spermaceti, whilst it has scarcely any action on the spermaceti itself. By this means the sperm-oil is removed in the form of soap.

Hot-pressing.—The purified spermaceti is removed from the boiler, and run into flat tin-moulds to crystallize. It is then ground again to powder, and placed in linen bags, interleaved with horse-hair mats, and previously-heated iron plates, and pressed in a horizontal hydraulic hot-press, heated by steam.

Second Refining.—The hot-pressed spermaceti is then removed and boiled with a strong alkaline lye, the temperature reaching 113° C. (235° F.). By this final operation it becomes as colourless as water, and has only to be cast into blocks for the convenience of storing.

The wholesale price of spermaceti at present is 1*s.* 10*d.* per pound in England.

Spermaceti-candles are moulded in the usual manner, about 3 per cent. of wax being added to prevent crystallization. Spermaceti-candles are often coloured yellow with gamboge, and are then known by the name of transparent wax.

The wick of the spermaceti-candle is of plaited bleached cotton, and requires no previous preparation.

UNITED KINGDOM.

There are remarkably fine specimens of spermaceti and spermaceti-candles in the English Department, contributed by Four Exhibitors.

There are also specimens from the UNITED STATES and NEW SOUTH WALES, of a less important character.

It will be seen, from the subjoined account of Imports into the United Kingdom, that very little spermaceti is brought in as such, and that the major part is obtained by refining sperm-oil.

Imports during the Year 1850.

			Duty.
Sperm-Oil	Tuns	5,792	Free.
Spermaceti	lbs.	1,120	„
Spermaceti-candles	„	728	2*d.*

There are Sixty-four Exhibitors of candles of all nations: of these there are:—

1	Holder of a Council Medal.
20	Holders of a Prize Medal.
10	Who obtained Honourable Mention.
33	Unrewarded.
64	

The number of Exhibitors from the various countries is as follows:—

America	1
Austria	6
Belgium	3
British Colonies	8
China	1
Denmark	1
Egypt	1
France	8
Great Britain and Ireland	14
Holland	1
Portugal	1
Prussia	2
Russia	8
Sardinia	2
Spain	1
Sweden and Norway	1
St. Domingo	1
Tunis	1
Turkey	2
Wurtemburg	1
	64

The Sixty-four Exhibitors of candles admit of classification according to the description of candles they chiefly exhibit, for only two have contributed in more than one of the classes into which they may be subdivided. Thus, there are Seven tallow-candle-makers, Twenty-one wax-candle-makers and wax-bleachers, Four spermaceti-refiners or spermaceti-candle-makers, and Thirty-two stearic acid and stearic-candle manufacturers. Nine of the latter exhibit soap, but only as a secondary product of their stearic manufacture; it has not, therefore, been taken into consideration under the head of soap and perfumery.

Before specifying the contributions of each Exhibitor who has received the award either of a Council Medal, Prize Medal, or Honourable Mention, a few words may be said to illustrate the point of view from which their merits have been judged. From our introductory remarks respecting the different varieties of candles, it is evident that tallow, stearic acid, composite, wax, and spermaceti candles cannot be judged by the same standard, as the various products serve different purposes, and on account of the difference in their cost can scarcely be said to compete one with the other. The physicist may determine their relative illuminating power by experiment, and can, by comparing the price of similar quantities of different materials, ascertain the relative illuminating value of each variety. If carefully executed, such experiments may yield very positive results as to the purely economic question of the money cost of a given quantity of light, but are of no avail in estimating the advantages offered by the different articles in point of cleanliness, purity, or presentability: how, for example, can the relative purity of stearic acid, wax, or spermaceti be estimated? how can the blue white of stearic acid, the brightness of wax, the transparency of spermaceti, be measured by such means; and how the convenience of the self-snuffing candle?

If photometric experiments on the different illuminating powers of flames are to be of any value, they must be instituted with extreme care and accuracy. Hitherto the results obtained by different physicists have been marked by great discrepancies; this is to be explained by the difficulties which present themselves in the method of determination at present pursued. We need scarcely remark that we have not instituted experiments of this kind for the purpose of comparing the different varieties of candles exhibited. The amount of material submitted to the Jurors was so extensive, as to compel them to confine themselves to judging of the quality of the productions by their external appearance and the manner in which they burned. On account of the great difference in the fiscal relations of the countries contributing, and the great variation in the price of the raw material, it was not even possible to take into consideration the question of price which was given in some instances.

A little practice, however, soon enabled the Jurors to separate the different articles into the three classes of Excellent, Good, and Mediocre. The characters by which these were fixed were - colour, density, and fusing-point of the candles, brilliancy and steadiness of the flame, continuous consumption of the wick, and less or greater tendency to gutter in a current of air.

List of Awards.

Apollo Stearin Company, Vienna (Austria, 39, p. 1009). Prize Medal, for an interesting display of stearic acid in blocks, and stearic candles; this is one of the largest, while, at the same time, it is one of the best in the Exhibition. The great excellence of these candles manufactured by the process of lime-saponification, their hardness and whiteness, are evidences of a thorough knowledge of this chemico-mechanical art, and of a minute attention to all the details of the various processes, without which no such articles could be produced.

Barclay and **Son**, Regent Street, London (Class IV. 24, p. 196*). Prize Medal. A very large collection, illustrative of the processes of wax-bleaching and wax-candle-making. Also wax night-lights, and wax mortar-lights for warming dishes on the dinner-table.

The Medal is awarded to these Exhibitors, chiefly on account of the excellence of the above-named products; but as they exhibit likewise remarkably good stearic and spermaceti candles, these latter are included in the Award.

Bauwens, L. F., Grease-Works, Wakefield (Class IV., No. 26, p. 197*). Prize Medal. The Award to this Exhibitor is for the recovery of fatty acids, applicable to soap-making and to the manufacture of candles, from the waste lyes and suds of the woollen, silk, and cotton manufactories. The quantity of soap used by the various branches of manufactures in favour of which the soap-duty is remitted, amounted in the year 1850 to 22,858,382 lbs., which may be estimated as containing on the average about 50 per cent. of fats, or 11,429,191 lbs., or in round numbers 5,000 tons. The importance, therefore, of economising this otherwise waste product will be fully appreciated if it be taken into consideration, that the manufacture of wool entails moreover the employment of a large quantity of oil, which is afterwards removed by washing. The quantity of oil employed for this purpose in Great Britain may be estimated at about 6,000 tons,* contained in the suds in addition to the fat contained in the soap, making together about 11,000 tons. But supposing that from unavoidable sources of waste only 5,000 tons were annually recoverable, and estimating it to produce 15*l.* per ton, the value would still amount to 75,000*l.*

Bert, J. J. and Co., Madrid and Gijon (Spain, 245 and 246, p. 1344). Prize Medal. The Jury award to M. Bert a Prize Medal for products of the highest class from the two manufactories he has established in Spain. From that of Madrid, in which saponification by lime only is practised, he sends beautiful stearic acid and stearic candles; from that of Gijon, in which he has lately erected a distilling apparatus to include the most recent improvements of England and France, he sends palmitic acid equal to any in the Exhibition, together with candles made of it. These latter candles are allowed by the Catholic clergy of Spain to be used in the churches.

Brandon, N. D., Amsterdam (Holland, 70, p. 1145). Prize Medal. The candles exhibited by Mr. Brandon are a proof that in Holland the stearic manufacture has reached its highest state of perfection; his candles are all that can be desired in hardness and careful moulding. The long stearic candles, which in Holland are allowed by the clergy to be used in churches, are very beautiful specimens of manufacture. The interest in the collection of this exhibitor is enhanced by the intermediate products which he has sent to illustrate the various stages of the process.

Brien, C., Dublin (90, p. 794). Honourable Mention. Mr. Brien exhibits very well-manufactured tallow mould-candles, which are white and hard.

Campenhoudt, Charles van, and Co., Heusden, Flanders (Belgium, 436, p. 1164). Prize Medal. The productions of these makers, whilst they are the finest in the Belgian division, may vie with most in the Exhibition for whiteness and hardness. Their candles named "*Bougies de l'Etoile*" are beautifully moulded, and have a high degree of polish.

Delacretaz and **Fourcade**, Vaugirard, near Paris (France, 158, p. 1178). Honourable Mention. Messrs. Delacretaz and Co. are extensive contributors to the Exhibition, having sent some very large blocks of stearic acid, which is hard, but not of the highest degree of whiteness; the Jury, therefore, though they cannot award a Prize Medal to them, accord an Honourable Mention for their productions, which are very good, and which it appears they manufacture on a very extensive scale.

Dixon, George, Dublin (91, p. 795). Honourable Mention. The Jury make Honourable Mention of the clarified tallow mould-candles of great whiteness, hardness, and exterior polish, made of a mixture of purified tallow and stearic acid; also of the composite candles and the yellow soap exhibited by Mr. Dixon, which is likewise well manufactured.

Donneaud and Co., Paris (France, 478, p. 1200). Honourable Mention. The Jury accord an Honourable Mention to Messrs. Donneaud and Co. for their stearic acid, and stearic candles, called "*Bougies du Phare;*" though not possessing that whiteness for which the stearic acid of many exhibitors is remarkable, still their products are very creditable, the candles being well moulded.

Dumortier and Co., Lyons (France, 1593, p. 1253). Prize Medal, for most excellent white and hard stearic candles, well polished and carefully moulded.

Field, J. C. and J., Wigmore Street (Class IV., 130, p. 205*). Prize Medal, for the very fine blocks of white and hard stearic acids which they exhibit, and which evince a thorough knowledge of the stearic manufacture.

Freeman, E., Wigmore Street (Class IV., 25, p. 197*). Prize Medal, for very excellent spermaceti candles, called "transparent wax." The spermaceti candle (containing a small quantity of wax, to prevent crystallization) is in many cases preferred to wax, on account of its greater transparency, and brilliancy of flame. The peculiar tint of the wax is imitated in these candles by the addition of gamboge.

Hale, W. S., Queen Street (99, p. 796). Honourable Mention. The productions which Mr. Hale exhibits, though very creditable, are not of the highest class, and seem more especially confined to the cheaper description of stearic candle, and those very economical, though not so presentable, sources of light, the so-called "Composite candles," which possess the property of being self-snuffing, and are much cheaper than the cheapest stearic candle, though, from their low fusing point, they are not so well adapted for use in hot climates.

Holmblad, L. P., Copenhagen (Denmark, 27, p. 1357). Honourable Mention, for a small collection of stearic candles, exhibited in connection with other articles by M. Holmblad. They are white and hard, but extremely high in price.

Jaillon, Moinier, and Co., La Villette, near Paris (France, 273, p. 1190). Prize Medal. The stearic acid manufactured by these exhibitors is made according to a recently patented plan, which consists in passing a rapid current of sulphurous acid into the lime-vat during the process of saponification, by which they state that they are able to produce a much greater quantity of solid fats than if they operated without the introduction of sulphurous acid;* besides which, that they are enabled to use the commonest tallow, and produce white inodorous candles. The Jury could not enter into an experimental investigation of the merits of this new plan, and, therefore, wish it to be understood that the novelty or the supposed or real advantage of the process did not in the least influence the award of the Prize Medal, which is given solely on the merits of the products exhibited. The stearic acid and candles are, without doubt, amongst the best in the Exhibition, whilst they are the whitest in the French department made by the process of lime-saponification.

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* In the year 1850, 278,022 bales of foreign wool, each containing on the average 250 lbs., were imported into London, Liverpool, Hull, and Leith, so that about 31,000 tons were imported in that year; and as about 20 lbs. of oil are consumed in "working" or scrubbing every 112 lbs. of wool, there must have been upwards of 5,500 tons used for the *foreign* wool only.

* The chemist cannot help thinking of the conversion of the liquid oleic acid into the solid elaidic acid.

JOHANSSON, J., Stockholm (Sweden and Norway, 17, p. 1350). Prize Medal. The stearic acid contributed by this exhibitor is eminently pure, white, and hard, and is, with one single exception, the whitest in the Exhibition. It is most creditable to M. Johansson to have stood the test of comparison with so many veterans in the art, and to have come off with such high honours. The candles exhibited are most beautifully polished, more highly so than any others, and in other respects well moulded; the polish is due to a peculiar mould, which is exhibited, and which is produced by a peculiar method already described in the introductory notice (p. 624).

MASSE, TRIBOUILLET, and Co., Neuilly (France, 1346, p. 1240). Prize Medal. Messrs. Masse, Tribouillet, and Co. are amongst the largest exhibitors in this department, having contributed no less than thirty-five samples, illustrative of several very important branches of art connected with the manufacture of candles. Seven samples relate to that important industry in an economical point of view, the recovery of fats from waste suds and other refuse matter; as, for example, the parings of skin, and animal intestines. The candles manufactured from the distilled and pressed fats are very beautiful, hard, and white. There are seven also which show the progress of the manufacture of palmitic candles by the process of distillation, and include candles made with the unpressed fat acids, likewise very hard and white pressed palmitic acid candles, also candles made with a thin shell of hard palmitic acid, the centre being filled with the unpressed fatty acids.* Three are the products of the recovery of fats from the waste suds of the wool-washers, and are similar to the first named. Four relate to the manufacture of candles from vegetable wax. There are also three specimens of the products of distillation from bituminous schist, including paraffin-candles and candles covered with lithographic transfers, which it appears are used in France, but they have a very common appearance. Besides these, there are specimens of oleic acid, olein, from pressed tallow, and oleic acid-soda soap. The Jury award the Prize Medal to Messrs. Masse and Tribouillet for their very beautiful candles, manufactured from various fatty acids produced by the process of distillation, and their extensive and interesting collection of products relating thereto.

MATISEN, A., and Co., St. Petersburg (Russia, 305, p. 1376). Prize Medal, for very beautiful stearic acid, of which MM. Matisen have sent seven blocks, and stearic candles, of excellent manufacture. These productions have a great degree of hardness, and are very carefully moulded.

MILLER, T. J., Dorset Wharf, Westminster (Class IV., 29, p. 197*). Prize Medal. An interesting collection in the South-West Gallery, showing the progress of spermaceti-refining; also an enormous and beautifully crystallized hollow block, or grotto of spermaceti, in the Western Nave. The Jury award the Prize Medal to this manufacturer on account of the very high degree of excellence to which he has brought the process of spermaceti-refining, as evinced by the absence of colour and impurity in the large mass he has exhibited; to produce which, no less a quantity than 3 tons, or 6,720 lbs., were fused at one time. After being allowed to remain at rest for a week, the spermaceti had cooled sufficiently round the circumference of the cask to be tapped, when about one half was run out; so that the shell which is exhibited, at 1*s.* 10*d.* per lb., is worth 308*l.*

MILLY, LOUIS ADOLPHE DE, Paris (France, 644, p. 1269). Council Medal. M. de Milly exhibits stearic candles, called by him "*Bougies de l'Etoile*," a name which, with that of Milly (stearin), is applied all over Europe to similar products. He has sent, likewise, lime-soap, the mixture of fat acids resulting from the decomposition of this soap, pressed stearic acid, and oleic acid, so as to illustrate the various steps in the process; and besides these, oleic acid, potash or soft, and soda or hard soaps, made with the oleic acid. In consideration of M. de Milly being the first to solve the manufacturing problem of applying M. Chevreul's beautiful theoretical discoveries to the production of candles, the application of boracic acid for the preparation of candle-wicks, and the aid he has always rendered in establishing this chemical art in other countries, the Jury recommended M. de Milly to the Council of Chairmen as worthy of the Medal in their gift.

MILLY STEARIN-CANDLE COMPANY, Vienna (Austria, 40, p. 1009). Prize Medal, for a very splendid display of the stearic acid manufacture, both by the process of distillation and the older one of lime-saponification. This society have, in compliment to the Exhibition, sent three large and well-executed stearic acid Medallions; one of the Emperor of Austria, one of Her Majesty Queen Victoria, and one of Prince Albert. Their candles, made by the process of lime-saponification, are very hard, white, and well moulded, and their night-lights, or *veillieuses*, carefully manufactured. They have also exhibited the so-called "Composite" candles made with the unpressed products of the distillation of palm-oil.

MOTARD, A., Berlin (Prussia, 262, p. 1063.) Prize Medal. Very excellent stearic candles manufactured by the process of lime-saponification, exhibited in connection with the stearo-margaric acid of which they are made; also, stearic candles made of the unpressed and pressed fatty acids derived from palm-oil, by the process of distillation. The stearic candles from the hot-pressed fatty acids of palm-oil are very beautiful: those made with the acids, as they run from the still, are an excellent and cheap substitute for the tallow candle. The collection is well arranged, and illustrates both processes very satisfactorily.

OGLEBY, CHARLES, and Co., Lambeth (139, p. 797). Prize Medal. The stearic candles contributed by this firm are the whitest in the Exhibition, and were used by the Jury as a standard of excellence, with which the productions of other exhibitors were compared. The so-called "Transparent wax" candles, made with a mixture of stearic acid and wax, are very beautiful, and burn with a remarkably dry cup. The spermaceti, in block, also exhibited, is of the greatest whiteness, and most beautifully crystallized. The spermaceti-candles, and those made of a mixture of spermaceti and wax, are exceedingly well manufactured. The Prize Medal is awarded by the Jury for the spermaceti and stearic manufactures, either of which would have entitled these exhibitors to the award.

PITANSIER, Odessa (Russia, 307, p. 1376). Prize Medal. The piece of hot-pressed stearic acid exhibited by M. Pitansier is prepared from mutton-tallow. It is extremely hard and sonorous, and beautifully white; the stearic candles are the whitest and best in the Russian Section, and occupy a first rank in the Exhibition.

POISAT (Uncle) and Co. (France, 1399, p. 1243). Honourable Mention. The Jury make Honourable Mention of a few small pieces of stearic acid, exhibited with other articles by MM. Poisat and Co.; and which, from their diminutive size, had almost escaped observation. The stearic acid was very white and hard.

PRICE'S PATENT CANDLE COMPANY, Belmont Works, Vauxhall (Class IV., 83, p. 201*). Prize Medal, for the invention of improved methods of distilling fatty bodies, illustrated by the following articles: very beautiful white and hard candles manufactured from the distilled and pressed stearic acid of palm-oil; candles equally hard and white, made from distilled animal fatty acids recovered from the refuse of the glue-maker, and which possess an additional interest in being obtained from a waste product; and candles made from the distilled vegetable tallow obtained from the *Stillingia sebifera*. Besides these, they exhibit the unpressed distilled fatty acids of palm-oil, in the state in which they are largely employed for the manufacture of the so-called composite candles, which appear to be destined to supersede the ordinary tallow candle. (See the Prefatory Notice respecting the recommendation for the award of the Council Medal.)

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* See page 626, China.

QUANONNE, C. and J., Cureghem, Brabant (Belgium, 431, p. 1335). Prize Medal. The manufactory of these exhibitors, which was the first established in Belgium, is one of the offshoots of that of De Milly, in Paris; hence they adopt the name for their candles which was given to stearic candles by their instructor, namely, "*Bougies de l'Etoile.*" As regards colour and hardness, their stearic acid leaves nothing to desire; but their candles are not quite so carefully moulded as they might be, and have not that high degree of polish which is expected in candles of first-class manufacture in other respects.

ROSSI and SCHIAPPARELI, Turin (Sardinia, 6, p. 1302). Honourable Mention. Though the Jury did not find the stearic manufactures of these exhibitors quite equal to the best examples, they consider the stearic acid and candles to be carefully made, and therefore accord them an Honourable Mention.

SAINTE and Co., Cossypore (India, p. 922). Honourable Mention. The Jury have much satisfaction in making an Honourable Mention of the very good stearic candles manufactured in India by Messrs. Sainte and Co. The local manufacture of stearic candles deserves every encouragement, as they are peculiarly suitable to hot climates, on account of their high fusing-point, and as there must be a large quantity of fats of little value, which would answer well for their production.

SAPELKIN, V., Moscow (Russia, 309, p. 1376). Honourable Mention. The Jury accord to M. Sapelkin an Honourable Mention, in consideration of the great care bestowed on the manufacture of wax-candles for church-service; many of these are tastefully ornamented with a simple spiral of gold, and have a very elegant appearance. The equality in size of the candles, as compared with one another, and likewise of their diameter throughout their whole length, are points deserving commendation. It appears that in the Greek Catholic Churches only wax or vegetable oil is allowed to be burned.

III. PROTEAN STONE, OR ARTIFICIAL IVORY.

Under this title there are exhibited, in Class XXIX., a number of articles, such as door-handles, finger-plates, inkstands, and letter-weights. These very beautiful objects are composed of a new material, derived from gypsum (native bi-hydrated sulphate of lime), which, by numerous variations in the method of treating it, is made to resemble ivory, granite, and various kinds of marble. From the specimens exhibited it appears to be very hard, and capable of taking the highest polish, which, it is said, is perpetuated by use. It is translucent and brilliant in colour, and, being tinted throughout the mass, the marbling and mottling are not liable to be rubbed off. It appears to be applicable to many purposes for which ivory and marble are at present used; but it is not fitted to be made into knife-handles, on account of its brittleness.

In order to illustrate this very ingenious manufacture, we must recal to the recollection of the reader the very familiar phenomenon of the solidification of a mixture of plaster-of-Paris (de-hydrated sulphate of lime) and water, which arises from the circumstance that the *anhydrous* sulphate of lime recombines with water equivalent in quantity to that of which gypsum is deprived by heat in the formation of plaster: but, as under the conditions of this solidification the plaster is diluted with far more water than it can recombine with, it results that a portion must be left in a free state in the interstices of the mass, which is consequently opaque, and, on drying, becomes porous; and although it is the same in chemical composition, it differs greatly in its physical aspect and properties from the native compound gypsum or alabaster, which is crystalline and translucent.

In reflecting on the cause of this difference, it occurred to Mr. Cheverton that if the combination of water and anhydrous sulphate of lime could be slowly effected, whilst the latter was in a state of compression, an artificial stone might be produced, compact and crystalline in texture, and translucent in appearance. This view was fully confirmed by a series of experiments.

The process by which these results are obtained is described in the specification of Mr. Cheverton's patent, obtained in June 1850, as consisting in the de-hydration and subsequent re-hydration of native bi-hydrated sulphate of lime, either in a compact form, as alabaster, or in the state of a fine powder. In the first instance the alabaster is wrought into the required form; and in the second, the material, in the state of a very fine powder, is compressed into a mould of the proper shape.

In either case, after the object has been fashioned, it is exposed for 48 hours to a temperature of from 121° to 177° C. (250° to 350° F.), by which means the water originally combined with the sulphate of lime is driven off. The substance thus becomes very friable, but still retains the form into which it has been wrought. Sometimes plaster-of-Paris itself is compressed into moulds, but the article so formed is still subjected to the operation just described, notwithstanding the previous baking of the gypsum.

If a translucent appearance is required to be given to the surface of the figure, it is, before re-hydration, immersed into "white hard varnish," olive-oil, or other "oleaginous matter," until the surface is saturated; but if an opaque surface is desired, then this operation is omitted.

To effect the hardening, the object is plunged for an *instant only* into water heated to a temperature of from 38° to 65½° C. (100° to 150° F.). This operation is repeated at intervals of from 10 to 15 minutes, until the sulphate of lime is completely saturated. The mass then becomes crystalline and much harder than alabaster; a circumstance which induces a belief that the new substance contains a quantity of water in combination different from that in the native body: or, in other words, that it is a new hydrate of sulphate of lime. The success of this part of the process depends in a great measure on the very gradual manner in which the combination with water is managed; for without due care the material decrepitates, and the article is then destroyed.

The colouring is effected by dissolving the requisite colours in water, and either sprinkling the object here and there with the coloured solution, so as to produce a mottled appearance, or else by immersing it altogether in the dye, which produces an uniform stain. This operation is performed previous to that of dipping in oil or varnish.

To the only exhibitors of this branch of manufacture,

D. STAIGHT and SONS (252, p. 802), a Prize Medal is awarded.

IV. BLACKING.

Although the compound which we now call blacking (French, *Cirage*) is, in all probability, of very recent invention, nevertheless it appears to have been customary to imbue shoes with an oily mixture before the time of Pliny, since it is stated by him that Cato recommended the dregs of the olive (after the expression of the oil) to be used for anointing bridle-reins, leather-thongs, and shoes, in order to render them supple.* It must, however, be remarked, that a mixture somewhat similar to modern blacking is also described by the same author,† and it appears quite natural to infer the occasional use of it for renovating the black colour which we are also informed was given by shoemakers to leather, by means of vitriol;‡ two kinds of substances of this name being known, namely, blue-vitriol (sulphate of copper) and green-vitriol (copperas, or sulphate of iron).

The mixture alluded to was chiefly used for ink, whence it was commonly called *atramentum*. It was composed of lamp-black, gum, and vinegar, and would, therefore, only have required the addition of oil and honey to make it into a tolerable blacking. This inference is rendered the more probable from the discovery of the remains of leather found in the Roman gravel-pit discovered in digging the foundation for the New Royal Exchange, which appears to have been covered with a sort of blacking. They are thus described by Mr. Tite, the architect.[*] "The fragments, in general, are of black leather, similar to that of the other articles; but there are some pieces which may possibly have been once of another colour. It is most probable that the upper surface was almost always shining, and several instances may be noticed where it still retains a dull gloss, which appears usually to have protected that particular side."

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* *Nat. Hist.*, Book xv. chap. viii.

† *Ibid.*, Book xxxv., chap. i.

‡ *Ibid.*, Book xxxiv., chap. xii.

The French word "*Cirage*," however, renders it extremely probable that modern blacking was originally composed chiefly of wax and tallow, and probably lampblack; and somewhat similar, therefore, to harness-blacking. That ordinary liquid-blacking was first imported into France from England, is probable, from the circumstance that blacking was termed *Cirage Anglais*, at all events to the year 1830, and it may still be known by that name.

When or how the English mixture now employed was first discovered, the Reporters cannot pretend to decide; but, according to the statement of Mr. William C. Day (nephew of Mr. Charles Day), the recipe for its preparation was communicated to Mr. Richard Martin whilst he was travelling on the Continent. Mr. Martin afterwards became associated with the late Mr. Charles Day; and in 1801 they commenced the manufacture of blacking. Mr. Martin having retired in 1808, the business was still carried on under the names of Day and Martin, by Mr. Day, until his death, in 1836, by which period he had acquired a colossal fortune.

To give some idea of the extent of the operations still carried on at "Day and Martin's," it may be stated, that on the average 150 casks, containing a quantity of blacking equal to 900 dozen pint bottles, are sent out per day. The price of the stoneware bottles, for containing the blacking, varies with their size, the usual sizes costing 6*s.* 9*d.* and 12*s.* per gross; and the corks (bungs) costing 1*s.* 4*d.* per gross. There is also a large outlay required for labels and sealing-wax.

Besides the establishment of Messrs. Day and Martin, there are, in London, two other very important blacking-manufactories. One of these was founded by Mr. Robert Warren, who commenced about the same time as the firm already noticed, and retired some years back; but the business is still carried on by his successors; and the other was founded, at a subsequent period, by Mr. Everett, who commenced business in King's Head Court, Holborn, and afterwards transferred his manufactory to Fetter Lane, where it still exists; Mr. Everett died in 1840, not, however, before he had realised a considerable fortune. Only the last-named of these large blacking-works contributes to the Exhibition, and unfortunately its manufactures were not brought under the notice of the Jury.

Blacking, it may be remarked, consists essentially of two principal components, namely, a black colouring-matter and certain substances which will acquire a gloss by friction. Each maker has, of course, proportions and methods of mixing peculiar to himself, but the chief materials used are the same in most cases. In England[†] they generally consist of:—Bone-black, sugar or molasses, sperm-oil, sulphuric acid (oil of vitriol), and strong vinegar. These, according to Mr. W. C. Day, are mixed in the following order:—The bone-black, in the state of a very fine powder, and the sperm-oil are first thoroughly incorporated; the sugar or molasses, mixed with a small proportion of vinegar, is now added and well stirred with the mass; strong sulphuric acid (oil of vitriol) is then gradually poured into the vessel. Much heat is generated at this stage of the process, and an effervescence ensues, owing to the action of the acid on the carbonate of lime contained in the bone-black. The object of the sulphuric acid (which should not be in excess) is to cause the decomposition of the tri-basic phosphate (and the carbonate) of lime, contained in the bone-black, so as to produce on the one hand sulphate of lime, and on the other a soluble acid phosphate. Sulphate of lime, when produced under such circumstances, gives rise to a very tenacious paste, by mixing with the finely divided carbonaceous matter of bone-black disintegrated by the same reaction; which paste (or lake) is capable, when spread out, of assuming a very smooth surface. To this the sugar and the oil impart the property, not only of adhering to the leather, but also of taking a high degree of lustre under the frictional (or burnishing) action of the brush; the oil is moreover very useful in rendering the leather pliable.

The mixture, after the action of the acid has ceased, is diluted with an additional quantity of vinegar, and is bottled whilst it is still warm. By bottling the liquid in this state, and corking and sealing it immediately, a rarefied space is formed; and there is no liability afterwards that the blacking (if it wet the cork) will exude by the expansion of the air contained in the bottle, as it is not likely to become again heated to the same temperature under the influence of any climate to which it may be subjected. The vinegar employed should not be too weak, otherwise the blacking will not keep.

Paste-blacking is now made in precisely the same way as Liquid-blacking, excepting that the last portion of vinegar is not added. The employment of such blacking appears to have preceded that of liquid-blacking. It was usually stuck on to a small shovel-shaped board, having a very short handle; and it was wetted with water (or saliva) as required. The old Cake-blacking differed in composition from that of the present day, and appears to have contained lamp-black, treacle, and oil.

America.

Two exhibitors send both Liquid and Paste-blacking, the former being contained in glass bottles and not stoneware as in England. The blacking was found to be nearly of the same quality from both; but not so good as that commonly used in England. The contributors are—E. Steere (290, p. 1453), W. R. Baker (401, p. 1462). T. Turner (425, p. 1463) sends Edge-blacking for shoemakers.

British Colonies.

C. Ward (Van Diemen's Land, 186, p. 995) contributes a specimen of Blacking, but it calls for no especial notice.

France.

In 1847 there were, in Paris, One hundred and thirty-seven manufacturers of blacking and varnish for shoes, who employed 140 workpeople, and produced goods to the value of 38,800*l.*; France is, however, represented by only one exhibitor in this trade, M. Hébert (869, p. 1221), who sends a specimen of varnish for boots and shoes, which was not submitted to the Jury of Class XXIX.

Prussia.

The only contribution is from C. Teichmann (p. 1088); it consists of Paste-blacking, which, though of fair quality, is not equal to the English blacking.

Sardinia.

B. Bourgoin (75, p. 1305) exhibits specimens of Paste-blacking for shoes, and paste Harness-blacking, which call for no particular comment.

United Kingdom.

The contributions of Two Exhibitors only were brought under the notice of the Jury of Class XXIX., namely, 272 and 281 (p. 816): of these the best is that of S. B. Alcock and Co., of Dublin (272, p. 816), whose productions are here favourably noticed, although no Award was made. The wholesale prices of their usual size bottles of liquid-blacking are 3*s.* 6*d.* and 9*s.* per dozen.

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[*] *Antiquities of the Royal Exchange*, 1848, p. 56.

[†] According to the information which Baron Liebig has kindly furnished to the Reporters, it appears that, in Germany, blacking is made in the following manner: powdered bone-black is mixed with half its weight of molasses, and one-eighth of its weight of olive-oil; to which are afterwards added one-eighth of its weight of hydrochloric acid (muriatic acid), and one-fourth of its weight of strong sulphuric acid. The whole is then mixed up with water to a sort of unctuous paste.

The manufactures of the other exhibitors who contribute to Classes:—II., 22, p. 190; IV., 70, p. 200[*]; XVI., 39 and 322, pp. 519, 534; were not observed by the Reporters until the duties of the Jury were completed.

The number of Exhibitors from all parts is Thirteen. There were no Awards.

The classification according to the various countries is as follows:—

America, United States of	3
British Colonies:—Van Diemen's Land	1
France	1
Prussia	1
Sardinia	1
United Kingdom	6
Total	13

V. CHEMICAL MATCHES.

The manufacturers of chemical matches are placed in an anomalous position with regard to the other contributors in the Great Exhibition, inasmuch as that they were not permitted to send their *actual produce*, on account of the precautions deemed advisable to be taken for the security of the Exhibition Building against fire. Hence they were compelled to rest satisfied with contributing uninflammable imitations of their articles; and under such circumstances it is evident that it was quite impossible for the Jury to make any equitable Awards in this branch of industry. This result is the more to be regretted as the manufacture of chemical matches, although comparatively a very recent art, has been of late years developed in a most remarkable manner; and notwithstanding the high degree of perfection to which it has already attained, it is still undergoing further improvements consequent on the rapid progress of chemical science. Had it been possible to have foreseen and provided against all contingencies, an out-building might have been constructed for the reception of these goods, which would have afforded a secure as well as a most valuable opportunity of comparing the relative merits of the matches prepared in various countries.

In another part of this Report will be found some descriptive notices of several conveniences for travellers and others contained in the hollow heads of walking-sticks. One of these consisted of an apparatus for procuring instantaneous light, and the contrivance appears almost to realize the fable of Prometheus, who concealed the fire which he stole from Jupiter in his *narthex*, ferula, or stem of fennel, on which he leaned in travelling.

> "I am he who sought the source of fire,
> Enclosing it hid in my narthex-staff;
> And it hath shown itself a friend to man,
> And teacher of all Arts."[*]

This invention, however, was in reality only the means of preserving fire unextinguished, somewhat like the German tinder of the present time, and not of causing instantaneous ignition. The giant fennel, of which the ordinary ancient walking-sticks were made, sheds its seeds about September, when the stem decays, and becomes a substance so easily ignited as to be employed in Sicily for tinder. The pith of the plant also is stated by Proclus to be an excellent preserver of flame, to which Pliny adds his testimony, that it makes excellent matches, the Egyptian sort being the best.[†]

There is, however, another form in which a staff may be metaphorically said to conceal fire, since one of the most primitive means of producing it was by the friction of two pieces of wood against each other until sparks were emitted, and flame was then easily communicated to dry leaves or decayed vegetable matter. This method of procuring fire has been found generally in use in several savage nations, though with some difference in the process; and St. Pierre describes one of the most common, as practised by the West Indian negroes:—"With the sharp edge of a stone," says his narrative, "Paul made a small hole in the branch of a tree that was sufficiently dry, which he fixed firmly between his feet, and he then employed the stone to shape into a point another piece of wood, equally dry, but of a kind different from the former. He next placed the pointed wood in the hole which he had provided, and made it to turn rapidly between his hands like a chocolate-mill, and in a few moments he saw smoke and sparks issuing from the place of contact, and then collecting dry plants and sticks, he lighted a fire at the foot of the palm tree."[*]

It appears that the same process was in ordinary use with the Romans down to a late period, even when the flint and steel were well known. "This experience," says Pliny, "was first discovered in camps and by shepherds, when a fire was wanted and a fitting stone was not at hand; for they rubbed together wood upon wood, by which attrition sparks were engendered, and then collecting any dry matter of leaves or fungi, they easily took fire. For this purpose nothing is better than to rub the wood of the ivy with that of the laurel, and a wild vine, different from the labrusca, which grows upon trees in the manner of ivy, has been also proved to be good."[†] The same authority, in enumerating the different kinds of wood fit for kindling a light, denominates them *igniaria*, or those trees out of which fire may be produced. *Pyridicula Igniaria* appears to have been the usual name of a Roman tinder-box, but Solinus calls the fire-box *Ignitabulum*, and assigns its invention to Pyropolis, in the island of Delos.[‡] In those receptacles the apparatus probably consisted as well of a small iron bar and a fragment of flint or pyrites, as of pieces of those woods which were the most readily ignited. Virgil notices "the hidden fire in the veins of flints,"[§] as being one of the benefits anciently bestowed on man at the commencement of the reign of Jupiter; and pyrites are described by Pliny as being well known and esteemed for producing sparks. "Certain of them," he says, "have much fire in them, whence we call them *living*, and they are very heavy. They are sought for because they are most valuable in camps; for when they are struck hard with an iron spike (*clavus*), or another stone, they will emit sparks, which being taken by sulphur or dry fungus or leaves, will cause them to catch fire even with the rapidity of speech."[‖]

There does not appear to be any information extant relating to the material anciently employed for tinder, unless it may be presumed to be indicated in that passage of the Prophet Isaiah (chap. i., v. 31) which declares that "the strong shall be as tow and the maker of it a spark, and they shall both burn together, and none shall quench them." It is probable that a very small degree of experience would suggest the thought that flax or the linen wicks used for lamps would easily receive sparks and become ignited, but of this there has not been any certain information preserved.

For many centuries the apparatus of a stone struck against a piece of iron continued, with but little improvement, to be the only means of procuring light. By the Saxons the flint or the pyrites was used under the general name of *fyr-stan*; and any piece of iron that was sufficiently substantial was the substitute for the modern steel. A writing-stylus is known to have been used for the purpose by the Abbot Bertin in Burgundy, early in the seventh century; an instrument, however, which should be at once more substantial and more convenient for striking, must have been soon required, and was probably as speedily invented in the form of the *fusil*, a thick rhomboidal piece of steel, having the faces cut into many angles. This was in use at a very early period of the Middle Ages, when it is frequently to be found mentioned under a variety of names, all of them being derived from the same original. In 1429 Philip the Good, Duke of Burgundy, established the Order of the Golden Fleece, in the collar of which the flint and steel of the time formed the principal device. The latter was therein represented as a short and stout fusil, sharpened to a pointed edge on one side, and on the other having two small curved handles, with a vacant space between them for the hand; and a modification of this shape for the steel continued to exist to the close of the history of the old-fashioned tinder-box.*

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[*] Æsch., *Prometh. Vinct.*, 110.

[†] Proclus, *Comment. in Hesiod, Opera et Dies*, i. 52. Plinii, *Hist. Nat.*, xiii. 22.

[*] *Suite des Etudes de la Nature: Paul et Virginie.*

[†] *Hist. Nat.*, xvi. 40.

[‡] *Polyhistor*, c. xi.

[§] *Georg.*, i. 135.

[‖] *Hist. Nat.*, xxxvi. 19.

It was not until after the middle of the seventeenth century that the discovery of phosphorus indicated a quicker or more certain means of procuring light or fire. In 1677, Dr. Hook, in one of his Cutler Lectures, described the effects of phosphorus, as they had been recently exhibited in England to the Hon. Robert Boyle and several other Fellows of the Royal Society, by Daniel Krafft, "a famous German chemist." Even after all the earliest experiments, however, the new matter appeared to be regarded only as a curiosity, which Boyle entitled the "*Noctiluca*," and "a factitious self-shining substance," procured but in very small quantities, and with great labour and time; the principal value of which was to supply a light in the night or in dark places, when exhibited in glass vessels. It can scarcely be doubted but that some trial was made as to whether an ordinary match could be inflamed by the substance, but Boyle's recorded experiments refer only to the strength, the diffusion, and the continuance of the light.

After these notices of the older apparatus devised for procuring light, it will be an interesting inquiry briefly to glance at the history of chemical matches. And here it may be first remarked that the transition from the tinder-box, with its flint and steel, to the elegant friction-match, was not so simple as a superficial consideration of the subject might lead one to infer. In the daily enjoyment of a luxury, we but too often forget the persevering efforts which are always necessary to render available the discoveries of the experimental philosopher, and take but little heed of him whose disinterested labours are constantly bringing to light new truths from the hidden but inexhaustible stores of nature.

The perfecting of chemical matches has been accomplished chiefly during the last thirty years, for before 1820 scarcely any other method of producing fire was employed than that of the well-known trio before alluded to, with which the ordinary sulphur match was inseparably associated.

Soon after this period Doebereiner made the remarkable discovery that finely-divided platinum (*spongy platinum*) is capable of inflaming a mixture of hydrogen gas and atmospheric air, and he founded on this property of platinum the invention of the Instantaneous Light Apparatus, first known by the name of Doebereiner's Hydrogen-Lamp. This was greatly admired at that time, and is even now frequently employed, it having been again recently applied to light an ordinary gas burner required to be ignited at intervals during the day-time for the purpose of sealing parcels and other similar objects. Although it was without any immediate influence on the development of the manufacture of chemical matches, which had before this time been repeatedly attempted, Doebereiner's discovery appears, nevertheless, to have attracted attention more generally to the subject, and thus, at least, to have contributed indirectly to their perfection.

A method of producing ignition, proposed about the same period, has never been generally adopted. It depends upon the property which certain compounds of phosphorus and sulphur possess of inflaming when slightly rubbed, in contact with the atmosphere. For this purpose about equal quantities of phosphorus and sulphur are fused together in a glass tube, which is to be subsequently closed with a cork.† Upon opening the tube, if a splinter of wood be dipped into the mass, so that a small quantity of the composition may adhere to the wood, it will become ignited when slightly rubbed on the cork used to close the phial. This apparatus, however, has become almost entirely obsolete.

The first important and permanent improvement in the means of obtaining light consisted in covering the sulphurized end of a match with a mixture of sugar and chlorate of potash; which being deflagrated by immersion into concentrated sulphuric acid, communicated the inflammation to the underlying coating of sulphur. Many persons will call to mind the small glass phial containing asbestos moistened with concentrated sulphuric acid, which was usually fixed in a paper or tin box having two compartments, one of which held the prepared matches. These matches were in all probability invented in France, whence at least they were certainly first introduced into England; but prior to their introduction Captain Manby had been accustomed to employ a similar mixture for firing a small piece of ordnance for the purpose of conveying a rope to a stranded vessel; and indeed the composition was also described by Parkes in his "*Chemical Catechism*"* amongst the experiments illustrative of combustion and detonation at the close of the volume.

Exactly the same principle was involved in the preparation of the matches invented by Mr. Jones, of the Strand, and used for some time in England under the name of "Prometheans," but which do not appear to have found their way to the Continent. These were made of a roll of paper, into one end of which was placed a small quantity of a mixture of sugar and chlorate of potash, with a small tube (hermetically sealed), similar to those in which the leads of ever-pointed pencils are preserved, containing a minute quantity of strong sulphuric acid. By compressing the match with a pair of pliers, sold for the purpose, or between two hard substances (between the teeth, for example), the tube was crushed, and the sulphuric acid came into contact with the mixture, and ignited it. These matches, though very convenient, were so expensive that they were not very generally employed; but they certainly formed, as it were, the stepping-stone to the production of the friction-match.

The first true friction-matches, or congreves, made their appearance about the year 1832. They had a coating of a mixture of two parts of sulphide of antimony and one part of chlorate of potash, made into a paste with gum-water, over their sulphurized ends, and were ignited by drawing them rapidly *between* the two surfaces of a piece of folded sand-paper, which was compressed by the finger and thumb.

The Reporters have not succeeded in learning with certainty by whom the substitution of phosphorus for the sulphide of antimony was first suggested; the mixture of the sulphide with chlorate of potash required so much pressure to produce the ignition that it was frequently pulled off from the match, and this substitution was therefore an important improvement.† The phosphorus matches or lucifers appear indeed to have been introduced contemporaneously in different countries about the year 1834. In Germany they were first manufactured on a large scale in the Grand Duchy of Hesse, and especially in Darmstadt, where Dr. Moldenhauer, in particular, contributed much to the improvement of this branch of industry.

From Darmstadt the manufacture was gradually extended throughout Germany; but its progress was at first very slow, on account of the lucifer-match being prohibited, until the year 1840, in Bavaria, Brunswick, Hanover, and various other states, on account of the alleged increased risk of fire consequent upon its employment. At present, however, there are manufactories established in Vienna, Prague, Triesch, Schüttenhofen, and Goldenkrön, Berlin, Nuremberg, Ludwigsburg, Ulm, Gmünd, Warnemünde, and numerous other places.

According to Dr. Moldenhauer and Professor Schrötter

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* Du Fresne, *Glossarium*, 1736, vi. col. 562, voce Sol. 3.

† To those who would repeat this experiment, we would remark, that the fusion should be performed with great caution, inasmuch as the mixture frequently detonates at the moment when the components enter into chemical combination.

* Third Edition, 1808, p. 563.

† Detonating mixtures of chlorate of potash with either sulphide of antimony or phosphorus, are described in Parkes's *Chemical Catechism*, 10th Edit., published in 1822; and the latter in the 3rd Edition (1808).

(to whom the Reporters take this opportunity of expressing their thanks for most of the statistical and other information respecting the progress of the art in Germany), there are in the province of Starkenburg, Grand Duchy of Hesse Darmstadt, no less than eight manufactories, producing weekly about 500,000 boxes of matches, which are valued at 3000 florins (257*l.*), yet the Grand Duchy is unrepresented in the Great Exhibition as to the production of (artificial) chemical matches.

In Austria, the manufacture of chemical matches has been of late developed to so great an extent, that it supplies not only what is required for home consumption, but also enough to form an important article of exportation; indeed it appears that the most important item of Austrian commerce with Chili consists of matches.

The matches manufactured in Austria amounted in 1849 to 50,000 cwt., of which four-fifths were consumed in the country, and one-fifth was exported. From Trieste 3,787 cwt. were shipped, viz., to

	Cwts.
Turkey - - - -	1,226
Greece - - - -	596
Malta - - - - -	492
Egypt - - - - -	382
Ionian Islands - - -	336
Naples - - - -	225
Other Countries - -	530
Total - -	3,787

That the export trade of Austria in matches is rapidly increasing, appears from the following statement of the quantities shipped on the Elbe during the last three years:—

Quantities shipped on the Elbe in	Cwts.
1848	286
1849	790
1850	1,860

As matches are not always specified in the Official Report on Commerce, it is not possible to give a detailed statement of all the quantities exported.

It is estimated that of the total production of matches in Austria, one-third is manufactured in Bohemia, and two-thirds in the factories of Vienna and its vicinity. The number of factories in Bohemia is ten; of these there are two in Prague, one of which exhibits; one at Schüttenhofen, which also exhibits; one at Budweis, one at Teplitz, one at Taus, one at Tschernoschin, one at Schönthal, one at Nahoschitz, and one at Hohenelbe. These establishments give employment to about 1,000 workpeople.

In Austria Proper there are twenty-two factories, namely, sixteen at Vienna, two of which exhibit, three at Fünfhaus, one at Schärding, one at Tulle, and one at Pottenstein; there is also one in Moravia, which likewise exhibits. The number of workpeople employed is about 2,000.

In illustration of the quantities of the different materials employed, it may be stated that a Bohemian manufactory employing 100 workpeople produces annually about 200,000 boxes, each containing 5,000 matches. It consumes annually 25 cwt. of nitre, 6½ cwt. of phosphorus, and 300 cwt. of sulphur. Calculating on these data the total amount of materials consumed in all Austria, the following numbers are obtained:—

	Cwts.
Nitre - - - - -	1,250
Phosphorus - - -	325
Sulphur - - - -	15,000

The quantity of soft wood consumed annually amounts to 5,000 *klafters* or fathoms; and it is worthy of notice that a large portion of it is manufactured into splints in Budweis, and thence sent to Vienna. About 50,000 millions of single matches are produced annually in Austria. These are made with astonishing rapidity, in consequence of the employment of a simple plane of peculiar construction; with this instrument a single workman cuts off 1,814,000 splints in a day of twelve hours.

From other parts of Germany there are Four Exhibitors; namely, one from Prussia, two from Wurtemburg, and one from Mecklenburg-Schwerin; the Reporters, however, have not been able to ascertain how far they represent the manufacture in all those places; but they are enabled to state that there were twenty-one manufactories, employing five hundred and sixty-one workpeople, in Prussia in 1846.

According to a statement of M. Payen, the quantity of phosphorus consumed in France for lucifer-matches amounts to 30,000 kilogs. (590 cwt.), whilst 100 kilogs. (2 cwt.) suffice for all the other purposes for which it is used. In 1850* 220 kilogs. (4$\frac{3}{10}$ cwt.) were exported to England. From these numbers, it would appear that the quantity of lucifers manufactured in France must exceed that of Austria in the ratio of 590 to 325, or as 18 to 10. Yet France is unrepresented in this art, the only contributor exhibiting sliding-boxes to contain the matches.

The Reporters have not been able to collect any information respecting the extent of this manufacture in the United Kingdom. In 1850 there were 50,000 gross of matches imported into the port of Hull; but the Reporters are unable to state the total number imported into the United Kingdom, as chemical matches are entered in the Customs returns under the general head of "Goods non-enumerated."

Formerly large quantities of phosphorus were imported into the United Kingdom for the purpose of chemical-match making; but it will be seen by the following table, that this substance must now be made within the British dominions in sufficient quantity to supply the entire demand.

VALUE of the IMPORTS of PHOSPHORUS into the United Kingdom.

From 9th July.	From Denmark.	From the Hanseatic Towns.	From Holland.	From France.	From all Parts.
	£.	£.	£.	£.	£.
1842†	1	45	14	1,102	1,162
1843	—	1	20	2,349	2,370
1844	—	—	83	2,484	2,567
1845	—	—	25	1,474	1,499
1846	—	12	—	619	631
1847	—	22	52	498	572
1848	—	16	15	149	180
1849	—	29	60	33	122
1850	—	2	—	1	3

Although lucifer-matches are made to some extent in the United States, there is no exhibitor of them in the American Section.

In continuing the narrative of the progress of this manufacture, we may next observe that, as it extended, all the processes were much simplified and, as a consequence, the prices of the articles produced were lowered. Nor was this the only improvement, for a whole series of inflammable compounds was successively tried; and at last, by substituting, entirely or partially, saltpetre for chlorate of potash, the detonation attendant on the earlier matches was avoided. It was also found that the sulphur-coating of the match could be to a great extent, or even entirely, dispensed with, and the cause of the unpleasant odour previously accompanying ignition in a great measure removed. Besides the ordinary match of wood, numerous other materials were devised, which could not have been made with the original composition of sulphide of antimony and chlorate of potash; as, for instance, wax-taper matches, fusees of Amadou (German tinder) and brown paper, Vesuvians for insertion into a cigar, &c. The roughly formed wood-matches, also, which had been previously cut by hand, were superseded by others carefully rounded by machinery.

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[*] Previous to 1850, phosphorus was comprised among the "*Produits Chimiques.*"

[†] Previous to the 9th of July 1842, the imports of phosphorus were entered under the general head of "Goods non-enumerated."

The match having reached this point of perfection, some attention was given to the embellishment of the boxes by the various manufacturers, who tried to excel each other in the elegance, convenience, and security of the case, for which various materials were employed—for instance, card-board, wood, and metal—the latter being usually ornamented with coloured lacquers, and engine-turning.

With regard to the composition for the matches now in use, Dr. Ure, in the *Supplement* to his *Dictionary of Arts and Manufactures*, p. 153, gives the following recipe of Dr. R. Boettger:—

	Parts.
Phosphorus - - - - -	4
Nitre - - - - - -	10
Fine glue - - - - -	6
Red ochre, or red lead - -	5
Smalt - - - - - -	2

The glue is to be converted into a smooth jelly with a little water, and put into a warm mortar to liquefy; the phosphorus is then to be rubbed down with the gelatine, at a temperature of from 60° to 65½° C. (140° to 150° F.), after which the nitre is to be added, then the red powder, and, lastly, the smalt, the whole being carefully mixed until it becomes an uniform paste.

Lucifer wood-matches that inflame without sulphur are prepared, according to Dr. Ure, by the ends being rubbed against a red-hot iron plate, and then dipped for a moment into melted white wax, contained in a shallow flat-bottomed pan.

In March 1842, Mr. Reuben Partridge obtained a patent for forming wooden splints by pressing, with suitable machinery, a block of wood against a steel plate perforated with holes, placed together as closely as possible. The wood is thus forced through the perforations, being first split as it advances, by their cutting edges, and comes out on the opposite side of the plate in the form of a multitude of distinct splints. Much attention has also been paid to the improvement of the apparatus for dipping the matches.

Before closing this short sketch of the manufacture of chemical matches, the Reporters wish to draw scientific and public notice to the terrible disease to which it sometimes gives rise. Dr. Lorinser, of Vienna, in 1845, first called the attention of men of science and the public to the fact, that individuals working in lucifer-match manufactories were subject to pain and swelling of the jaws, followed in many instances by exfoliation of the bone. This was repeatedly confirmed by other observers, and induced several Governments to institute inquiries into the matter. The results of all the investigations made into this interesting question have been collected by Doctors von Bibra and Geist, in a publication entitled *Die Krankheiten der Arbeiter in Phosphor-Zündholzfabriken*, Erlangen, 1847.

The disease has been observed principally in Germany, but it is also met with elsewhere, and especially in England.* The Reporters had the opportunity of obtaining some information on the subject from Dr. Sieveking, who has examined the disease with much care as it occurs in the London manufactories. According to his observations, the affection assumes the same character as it has done in Germany, and attacks those only who are engaged in dipping the matches into the inflammable compound, and who are, therefore, more immediately exposed to the phosphorus vapour. Dr. Sieveking saw several of these workmen (dippers) who had lost almost the entire lower jaw. After these painful statements, it is important and consolatory to know that the same physician has not found the disease to be equally prevalent in all manufactories; and that if cleanliness be enforced, and the dietary of the workpeople well attended to, and especially if a complete and continuous ventilation of the workshop be kept up, no evil consequences ensue. Dr. Sieveking met with parties who had been engaged in dipping matches for more than ten years, without exhibiting the slightest tendency to the complaint.

The importance of attending to the precautions indicated by these investigations can scarcely be sufficiently impressed upon the manufacturer. Much has been already done by several firms, especially in regard to ventilation, but much remains to be accomplished if this frightful scourge is to be entirely removed. For this reason manufacturers should direct their attention to an important discovery made by science, in the shape of the so-called red or amorphous phosphorus. Some few years ago Professor Schrötter, of Vienna, observed the curious fact, that if ordinary phosphorus be exposed during a certain period to a temperature of from 250° to 260° C. (482° to 500° F.), it is converted into a red modification, which no longer possesses the main characteristics of phosphorus, viz.,—volatility, fusibility, and inflammability at comparatively low temperatures. The poisonous qualities have also entirely disappeared in this modified condition of the substance. The amorphous modification of phosphorus, which but a few years ago was a mere curiosity in chemical laboratories, can now, however, be manufactured, according to a method proposed by Schrötter, in large quantities, and is likely to become an important article of commerce. The Chemical section of the Exhibition (Class II., 119, p. 199) contained a fine specimen of this substance, sent in by J. E. Sturge, of Birmingham. The red phosphorus being perfectly innocuous when handled, and not giving off fumes in the atmosphere, whilst it is as well adapted to the manufacture of matches as the ordinary phosphorus, it is fair to assume that its general adoption by lucifer-match makers will prove a further guarantee against the disease of the workpeople. It is right also to mention that Dixon, Son, and Co. have exhibited matches made with Schrötter's phosphorus (Class II., 126, p. 199). These manufacturers state that they are as cheaply and as easily made as the common matches, and are not so liable to fire in the making.

The number of exhibitors of imitation matches and other means of obtaining light is fourteen. The classification according to the several countries is as follows:—

Austria - - - - - - - -	5
France - - - - - - - -	1
India - - - - - - - -	1
Mecklenburg-Schwerin - -	1
Prussia - - - - - - - -	1
United Kingdom - - - - -	3
Wurtemburg - - - - - -	2
Total - -	14

List of Exhibitors.

Bell and Black, Bow Lane (Class XXIX., 243, p. 802). Imitation vestas, congreves, and wax-matches; camphorated round wood congreves.

De Majo, S., Triesch (Austria, 50, p. 1009). Imitation lucifer-matches in great variety.

Dixon, Son, and Co., Manchester (Class II., 126, p. 199). Matches made with Professor A. Schrötter's phosphorus.

Furth, B., Schüttenhofen and Goldenkron (Austria, 43, p. 1009). A large display of imitation lucifer-matches, in a variety of boxes.

Harrass, P., Suhl (Prussia, 798, p. 1094). Imitation lucifer-matches.

Hoffmann, C. and G., Wisoczan, near Prague (Austria, 49, p. 1009). Imitation lucifer-matches.

Kuhn, J., Ulm (Wurtemburg, 102, p. 1119). A variety of imitation lucifer-matches.

Lefrançois, —, Paris (France, 301, p. 1191). Sliding boxes for lucifer matches, and taper-stands for lucifer-matches, and amadou, in great variety.

Meyer, W., Warnemünde (Mecklenburg-Schwerin, 6, p. 1134). Splints for lucifer-matches.

Pollak, A. M., Vienna (Austria, 47, p. 1009). Imitation lucifers of several kinds.

Preschel, F. and Co., Vienna (Austria, 48, p. 1009). Various descriptions of imitation lucifers.

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* *British and Foreign Medico-Chirurgical Review*, vol. I., p. 446 et seq.

Rajah of Jesselmere (India, Class XXII., p. 919). Several steels for striking light, which are interesting as connecting the present with the past in the art of obtaining fire.

Sandell, E., Putney (Class XXIX., 97, p. 796). Odoriferous lighters made of embossed card.

Sutorius, C. F., Gmünd (Wurtemburg, 100, p. 1119). Lucifer-matches without the combustible material.

VI. CONFECTIONARY.

The articles belonging to this species of preparations submitted to the Jury of Class XXIX. consisted firstly, of fruits preserved with sugar; and secondly, of confections, comprising sweetmeats made both from sugar and from chocolate. Of preserved fruits, the Exhibition contained many examples; including some which had been prepared with sugar and subsequently dried, and others preserved and kept in syrup.

In the most ancient times, honey constituted the principal and nearly the only sweet substance used for those purposes for which sugar is now almost universally employed; and the Egyptian department in the Exhibition furnishes evidence that its use for the preservation of fruit is still continued in the valley of the Nile. Many interesting specimens of the most simple forms of conserves are also contained in the Turkish and Tunisian collections, consisting of the desiccated pulp of prunes or juice of the grape. It is possible that the former preparation may somewhat resemble the "cakes of figs" of the ancient Hebrews, which, from the two passages of Scripture wherein they are mentioned (1 *Samuel*, xxv. 18, xxx. 12), were evidently regarded as agreeable and nutritious food. That the Jews had some kind of artificial sweet preparation at a very early period of their history, is indicated by the statement that the taste of the manna "was like wafers made with honey" (*Exodus*, xvi. 31), though the parallel passage in *Numbers*, xi. 8, expresses it to have been like "fresh oil." The word Confection, and the term Confectionaries, as they occur in the Scriptures, have two distinct significations in connection with this particular subject. In the first instance, the strict original sense of the expression as derived from *con* and *facere*, to make up together, is intended; as in the words "thou shalt make it a perfume, *a confection* after the art of the apothecary, tempered together pure and holy," *Exodus*, xxx. 35. When, however, Samuel says to the elders of Israel concerning their king, that he would take their "daughters to be *confectionaries*, and to be cooks and to be bakers" (1 *Samuel*, viii. 13), there is a special and a distinct employment of the makers of some kind of conserves or sweet preparations referred to, of which no decided information is extant. From two well-known remarkable passages in the Prophets, there can be little doubt that the Hebrews were acquainted with the existence of the sugar-cane, probably as it was found in China.* They both prove, however, that it was a very costly rarity; and the three words which in the Scriptures denote sweet substances, are all rendered honey in the Authorized Translation, though possibly they indicated several kinds of it. The passages which are supposed to refer to sugar are very different from these. "Thou hast bought me no *sweet-cane* with money," says the remonstrance in *Isaiah*, xliii. 24; and "To what purpose cometh there to me incense from Sheba, and *the sweet-cane from a far country?*" is the complaint in *Jeremiah*, vi. 20. In both these places the allusion is to an offering to the Almighty, which, presented in a right spirit, would not have been rejected. This, therefore, could not have been honey, because in *Leviticus*, ii. 11, the positive command is given, "Ye shall burn no leaven, nor any honey, in any offering of the Lord made by fire." The substance referred to must therefore have been either the sugar-cane, or the aromatic sweet-rush. The word rendered Calamus in *Exodus* xxx. 23, in the direction for making the anointing-oil for the furniture of the tabernacle, is also *Keneh Bosen*, or sweet-cane, in the original; but this is generally supposed to mean the Indian *Calamus Aromaticus*.

Although the cane-sugar of Asia must have been well known to the classical ancients, yet they seem to have regarded it as a kind of factitious honey. In this form Herodotus* appears to refer to it, when he says that the Gyzantes have bees "which make a great quantity of honey, and it is said that *confectioners make much more*." The original words of the historian in this place have the general signification of compounders, or workers, for the people.† From the context, however, it is evident that the terms are to be understood as implying preparers of confections, as they are also in another passage of the same author, wherein it is stated that the confectioners of the city of Calletabus "make honey with tamarisk and wheat." It may be observed farther, that the same word is likewise used in the title of the fragment of an epigram attributed to Menander relating to the making of a bride-cake. It consists of a short conversation, in which the operator represents that he has watched the preparation all night, but that there is yet much to be done. Such a person as this, who understood the art of confectionary as retained by the wealthy Romans, was called *Pistor Dulciarius*, or a baker of sweet things; and several of the bronze moulds which the pastrycooks of the time employed for the making of their sweetmeats, representing hearts, striated shells, animals, and a variety of elegant devices, have been discovered at Herculaneum. About the same period, also, Apicius, Columella, and Pliny prove that some fruits at least were preserved in syrup. The last author recommends that quinces should be boiled in honey, and directs that other sorts should be enclosed in wax. The latter process Beckmann states to have been likewise employed for preserving the apples carried every year from the southern districts of Russia into the northern parts of Siberia.

But though the value of sugar as a luxury was not unknown to the ancients, it was, from its first introduction to a comparatively late period, more commonly employed by physicians for the disguising of disagreeable medicines, and in the pharmaceutical preparation of syrups, electuaries, and confections. This practice appears to have led to the intimate connection which so long existed between the preparation of conserves and the compounding of drugs. Actuarius, who is considered to have flourished between the twelfth and fourteenth centuries, is said to have been the first physician who substituted sugar for honey in medicinal compositions; about which time also it was frequently used in cooking in England.‡ Dioscorides, in the first century, is the earliest author by whom it is mentioned by name, and he also notices its medicinal properties.

The art of making sweet compositions being thus early associated with the occupation of the apothecary, and his productions being known under the general title of confections, the same name appears, for a time at least, to have been used for the preparers both of sweetmeats and of medicine. In the thirteenth and fourteenth centuries there were certain officers, called apothecaries, retained by princes and great personages, who prepared various preserves for the table, especially fruit encrusted with sugar; but it is quite possible that these individuals were sometimes ecclesiastics, who also possessed the knowledge of medicine and pharmacy. Beckmann has recorded many curious notices illustrative of the connection existing between the professions of the apothecary and the confectioner, as they were publicly established in Germany from the middle of the fifteenth century. From these statements it is evident that the term *apothecarius* was then understood to signify the keeper of a storehouse or magazine for articles belonging to the Materia-medica, where also medicines might be properly compounded, and confections and cooling liquors prepared for the sick. These establishments were licensed by authority, and the persons who kept them endued with exclusive rights and municipal privileges; in return for which they were sometimes required to supply the court or the town-council with confectionary or sugar, as well as to vend their medicines at appointed rates.

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* The earliest records of China make mention of the culture of the sugar-cane and the extraction of the sugar; the application of which as food appears to have been known in the most remote ages of Chinese history.

* Melpomene, cxciv., cited in Pereira's *Elements of the Materia Medica*, 2nd edit., ii., p. 805. *Herodotus, a new translation*, by the Rev. H. Cary, 1848.

† Δημιουργοὺς ἄνδρας. Ἄνδρες δημιουργοί, *Polymnia*, xxxi.

‡ The *Forme of Cury* edited by the Rev. S. Pegge, p. 26.

It is probable that in such a stipulation of furnishing confections and sugar to public authorities, originated the practice which became common in England in the sixteenth century, of presenting rich boxes of sweetmeats or lozenges to great personages on their journeys, or at certain seasons; or pastry of elaborate ornament as royal new year's gifts.* Many curious instances of the latter custom will be found in the lists of new year's gifts made to Queen Elizabeth, of which the two following may here be adduced in illustration, as they include sweetmeats, preserved-fruits, and pastry:—"1562. By Revell, surveiour of the works, a marchpane, with the modell of Powle's churche and steeple in paste. By John Hemingway, *poticary;* a pott of oringe-condytt, a box of pyne-comfytts, musked, a box of manus-christi, and lozenges."

Before this period the practice of the confectionary art had ceased to be confined solely to the compounders of medicine, and its productions had long since been regarded as belonging rather to festivals and banquets than to the dietaries of the sick. The delicacy and rarity of the articles used in confections, and the neat dexterity required in preparing them, probably suggested it as a most graceful female employment; hence we find that, in the seventeenth century, the art of making sweetmeats became established as a fashionable feminine accomplishment, and was publicly taught both in France and England.

Manufacture of Comfits and other Bonbons.

The following is a description of the processes employed at the manufactory of Mr. Schooling (114, p. 796), one of the Exhibitors, of Bethnal-green, the workmen being chiefly French.

Smooth-Comfits.—The preparation of comfits is very simple. If seeds, such as almonds or carraway-seeds, are to be made into comfits, they are placed together with a cream made of sugar-syrup and starch, into a flat ellipsoidal copper pan, suspended by chains over a charcoal fire. By tilting the pan up and down, and at the same time giving it a circular swinging motion, the seeds are made to roll one over the other, and thus gather the pasty mixture as it dries. This operation is repeated as often as may be required for the seeds to accumulate a sufficient thickness. The form of the seed governs that of the comfit.

Pearled-Comfits.—Cinnamon, coriander-seed, and celery-seed are usually "pearled" by placing the mixture of syrup and starch into a copper funnel, suspended over the pan containing the comfits or seeds. This funnel is, in shape, like the small half of an egg, and has a round hole in the bottom, which is more or less closed by a long conical stick, suspended to the handle of the funnel, and passing through a guide to keep it central. By allowing the plug to descend sufficiently, it may be made to close the hole. The aperture is regulated in such a manner as to allow the mixture merely to fall in drops; at the same time a short jerking motion is given to the pan. The paste, as it dries, gathers on the comfits in little knobs, called pearls.

Machinery for making Comfits.—Mr. Schooling employs the following simple contrivance. An endless band, formed of strips of iron hoop riveted on two leather straps, traverses over four rollers, so placed that their axes, when seen on end, form an irregular square; the top roller at that end towards which the band travels being much higher than the top roller at the opposite end. The metallic band is not drawn tight, but left loose in order that it may form a sort of bag to contain the materials, by drooping between the top rollers; the frame of the machine forming the ends of the bag. A coil of steam-pipes, following the curve of the band, serves to dry the comfits, which are gathered with a rolling motion up towards the highest side, and then rolled over in a contrary direction.

Another Exhibitor, Mr. Wotherspoon, of Edinburgh, (106, p. 796), employs an apparatus consisting of a steam-pan, open at one end, and revolving in a vertical direction on a hollow axis, through which the steam passes in, and the condensed water passes out. This pan is in shape like an orange, supposing a horizontal axis to be placed in the eye, and a disc of about a third part of the diameter of the orange to be cut out of the rind at the side opposite to the axis; and in order to complete the simile, supposing the rind to be hollow so as to contain steam. The seeds and syrup are placed at the open end, and by the slow revolution of the copper-pan are gathered up and rolled over in the same manner as on the endless band.

Messrs. Oudard, Son, and Bouchерот, of Paris (1374, p. 1242), also manufacture comfits by steam-machinery, and have done so since 1844: before this period a skilful workman could make from 45 lbs. to 55 lbs. per day, but at present he superintends six pans, each of which produces 112 lbs., so that in a day he manufactures 6 cwt., or twelve times as much as he could produce by hand. This machinery having been adopted by other Parisian confectioners, has caused a reduction of 30 per cent. in the price of comfits in France.

Sugar-Pastilles are made of a paste of powdered sugar and syrup, combined with such flavouring and colouring matter as may be required. A small quantity of this paste is heated over a charcoal-fire, and then placed in a spouted ladle. By inclining the ladle a small quantity oozes out at the spout, and is cut off with a wire; the drop, as it falls on a tin-plate, forms a flattened semi-ellipsoid; as soon as the tin plate is covered it is removed to the drying-stove. A single workman, in this way, can make three or four hundred-weight of pastilles in a day.

Jujubes are composed of a mixture of gum-mucilage and syrup, which is run into flat tin trays, and consolidated by evaporation in a chamber heated by steam. As soon as the cake has been sufficiently dried, it is allowed to cool, and is then cut into long strips by passing it through a pair of rollers, the bottom one being a plain cylinder, and the top one composed of a number of discs placed on an axis and kept apart at the required distance by collars; the strips are afterwards cut transversely with scissors.

Motto or *Surprise-nuts* are made by drilling out the thick end of the nut with a rose-cutter running in a lathe; the kernel is then removed, and the shell filled with mottos and comfits, and lastly stopped up with chocolate. Many tons are made annually by Mr. Schooling.

Liqueur-Bonbons.—The manner of making liqueur-bonbons is nearly the same, whatever may be their shape. A syrup is made with water and sugar, and is then taken a little at a time by the workman, who evaporates it to the proper consistence, and adds alcohol or some alcoholic liquor. In the mean time his assistants have prepared several moulds, by filling shallow trays with powdered starch, and impressing plaster-of-Paris models of the required form into it, so as to produce corresponding depressions. Several models are fastened on a rod, and thus a number of matrices are made at one operation. The workman then takes a portion of syrup, and runs it into the moulds either from the egg-shaped funnel, before spoken of, or from ladles having several spouts, according to the nature of his work; the latter being used for small drops, the former for large bonbons. The cohesion of the syrup being greater than its attraction for the starch, it runs away from the latter as water does from an oily surface; and the upper surface thus takes a spheroidal form. A little starch is now sifted over the surface of the mould, and it is then set aside in a warm closet. Crystallization commences on the outside of the bonbon, and forms a crust which encloses the syrup: this gradually yields more and more of its sugar, and becomes itself more dilute.

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* This custom is still kept up in France, as regards the presentation of boxes of sweetmeats on the first day of the new year; and will be noticed in speaking of the contributions from that country.

In this way a man and two boys will run off about 3 cwt. of bonbons per day.

Liqueur-Almonds. — Almond-shaped liqueur-bonbons, which contain a syrup, are enveloped with the white mixture in the same way as smooth-comfits; but in order that they may not be destroyed in the operation, they are first covered with gum-mucilage, and then thrown into a mixture of gum-arabic and sugar reduced to a fine powder: they are afterwards dried, and again submitted to the same operation as often as is necessary to produce a coating of the desired thickness.

Solid Sugar-Bonbons are cast in the same way, but with a much stronger syrup.

Gum-Drops.—Gum raspberries are made of syrup and gum-mucilage; they are cast in the same manner, and dried to an elastic solid.

Fondants, which melt like ice in the mouth, are likewise run into starch-moulds; they are composed of a syrup, which is first evaporated to a certain point of concentration, and then beaten until it forms a frothy paste.

Crystallized Bonbons.—All the different kinds of sweetmeats hitherto described are sometimes covered with a crystalline coating of sugar, by putting them into a strong syrup contained in shallow trays placed on shelves in a drying-chamber heated by steam. A piece of linen is laid on the surface of the syrup to prevent its forming a crust; and by lifting this linen from time to time, the progress of the operation is ascertained: this usually occupies from one to two days. The excess of syrup is drained off in the same room, as soon as the sweetmeats are sufficiently covered with crystals of sugar; they are then removed and air-dried.

Flowers, Piping.—All piped ornaments are composed of a mixture of white of egg and sugar, which is called "glazing." For the modelling of flowers the workman uses a series of supports which, at the upper part, are of such a shape that they would nearly fit the under side of the flower; a depression being made in the summit to suit the shape of the calyx. The modelling-tools consist of a series of small funnel-ends not much bigger than a thimble, with openings of various shapes; as for example, narrow slits of different breadths, and round and other shaped holes of various sizes. These funnel-ends are fastened with gum to the bottom of paper funnels, into which the workman places the glazing, and then closes the funnel by doubling over the paper. By pressing the paper funnel with the thumb, he squeezes out just what he requires; and by dexterous manipulation, curls and twists it into any form he chooses. This operation is called piping, and is much employed in ornamenting bride-cakes.

Painted Bonbons.—Bonbons intended to be painted are covered with a layer of glazing, and are then ornamented with coloured piping. The last finish is given by painting them with body-colours, mixed with gum mucilage and syrup. The nature of the colours will be described hereafter in speaking of the contributions from France.

Manufacture of Chocolate—Confectionary.

The following is the method practised by the **Paris Chocolate Company** (France, 873, p. 1221), who in Class VI. have exhibited their machinery, which was made by M. G. Hermann, of No. 92 Rue de Charenton, Paris.

The cocoa, or cacao-nuts, are first screened to remove any dust, and are then roasted in a cylindrical or globular vessel, which revolves over a fire; the operation of roasting being one requiring much care and attention. After roasting, the husk is beaten off by means of a winnowing-machine. The roasted nuts are now placed in a triturating or mortar-mill, encased with an outer jacket, and heated to 50° C. (122° F.) by means of steam; by the action of this machine they are reduced to a thin paste, on account of the large quantity of oil which they contain. Sugar previously separately ground in a similar, but cold, mill, is now added, and the action of the hot-mill continued until it is well mixed with the cocoa-paste; vanilla is also added if the chocolate is to be flavoured with it.

The thick paste of sugar and cocoa is then levigated to the utmost degree of fineness, by means of a mill formed of three rollers working in a horizontal plane; the second cylinder revolving at twice the speed of the first, and the third at twice the speed of the second. The chocolate-paste is put into a long funnel or "hopper," fixed over the two first rollers, which draw down a certain quantity on their surfaces, and by their mutual pressure, and difference of speed, spread it into a thin and even coating. The third roller, by working at a still quicker speed, produces a farther grinding of the paste, which is scraped off by a ductor-knife and returned once or twice to the mill. A coil of steam-pipes placed under the machine prevents the cooling of the paste during the operation.

The manipulations of chocolate for confectionary are very similar to that already described for sugar-confectionary.

United States of America.

The preservation of soft fruits in brandy is an art of some importance in the United States, and one which every year is becoming better understood. The peach is the favourite conserve, large quantities of which are annually prepared, chiefly for home-consumption; but from the experience which the Exhibition has afforded of the possibility of sending them to England in a state of perfect preservation, there is but little doubt that they will soon traverse the Atlantic. The white Heath-peach is that deservedly most esteemed. Two American Exhibitors have sent Brandy-peaches.

British Colonies.

Canada sends an unimportant contribution of confectionary, consisting of Horehound-candy, reputed in Canada to be a most excellent specific for a cold; a merit which an experiment did not confirm: and also another of Raspberry-vinegar.

From the *Cape of Good Hope* there is a collection of several kinds of conserved Fruits, which for the most part were found to be in a good state of preservation. Some are in syrup, and others partially dried. *Van Diemen's Land* has contributed Raspberry and Currant-jam, Green gooseberry-jam, Red gooseberry-jam, and Quince-jam.

China.

The only description of confectionary in the Chinese section is the Finger-citron (*Citrus sarcodactylus*) preserved in syrup. Large quantities of sugar conserves of various kinds are, however, made in China, and it would have been interesting to compare them with those from other countries: jams, jellies, dry-conserves and syrups, are such as most resemble those of Europe; but besides these, are preserved seeds, as the Millet seed; roots, for example, the root of the *Nelumbium*, and the young tender shoots of various plants, as the bamboo.

The trade in these preparations is very extensive, both at Canton and Ningpo; and from the town of Foo-tcheou 44,000 lbs. were exported during the first half of the year 1846.*

Egypt.

The contributions from Egypt are very interesting, as representing not only the confectioner's art in Egypt at the present time, but also as offering to our view conserves probably identical with those of ancient history: they consist of Dates preserved in honey, from Two Exhibitors: one description is a preserve in clarified white, the other in dark-coloured honey. Besides these, there is a small quantity of Sugar-candy.

France.

The preservation of fruit in sugar, and the manufacture of sugar- and chocolate-confectionary, are highly important branches of industry in France; important, not only from the number of workpeople immediately employed in these manufactures, but also on account of several tributary arts connected with them, which occupy even a far greater number. The artist, the lithographer, the colourer, the varnisher, the paper-maker, the pasteboard-maker, the die-sinker, the embosser, the fancy-braid-maker, the gold-and-silver-beater, and even the silk-weaver, are all more or less dependent on the demand for fancy boxes and "*cornets*" to contain bonbons and fruit: indeed, the trade of fancy-box-making owes its existence to the wants of the confectioner, who is still its chief patron. Other trades, appreciating the convenience and attractiveness of a pleasing envelope, have adopted boxes for most of their small wares; and "*Cartonnage*" has now become quite gigantic in its development, employing upwards of two thousand artisans, both male and female. Paris is the chief centre of the manufactories, which, for many months towards the close of each year, are all busily employed in preparing the enormous quantities of boxes, mostly distributed in a single day, the first of the new year, to the ladies of France. Many of these boxes cost the confectioner from 12*s.* to 40*s.* each, and when filled with confectionary, sell at enormous prices. The greater part, however, cost from 2*d.* to 2*s.* 6*d.* The preservation of whole fruits in sugar is carried on chiefly in the southern parts of France, by small collectors, who forward their produce to their correspondents in Paris. The Parisian confectioners then re-select them, cutting some into ribands, rings, and other fanciful forms, and arrange them in boxes for sale. Paris, on the other hand, supplies boxes to the departmental collectors, who put up in them their fruits for exportation. It is mainly owing to the great taste which the French display, not only in the boxes, but also in the arrangement of the fruit, that they have gained almost a monopoly in supplying the world with conserves: the selection of the fruit and its perfect preservation, however, are points which are carefully attended to, so as to perpetuate the reputation of the goods which an attractive exterior first brings into notice. Eight Exhibitors have sent fruits preserved in sugar, chiefly in syrup.

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* *Etude Pratique du Commerce d'Exportation de la Chine,* par Natalis Rondot, pp. 69, 70.

Chocolate-Confectionary is entirely of French invention, and is the kind of sweetmeat most esteemed in France. Its manufacture, however, is chiefly concentrated in Paris, and gives employment to about four hundred workpeople, the value of the annual produce being 160,000*l.* It is owing to the great attention which the French machinist has bestowed on the construction of the machinery employed in its preparation for the triturating and grinding processes, that the art has been carried to its present high state of perfection. Other nations are adopting French methods, and employing French workmen to attain a similar end. The French confectioner also displays much ingenious skill in casting a great variety of subjects in chocolate, which are usually afterwards covered with preparations of sugar ("glazing"), and coloured to represent the natural objects. The moulds, in which the casting is effected, are made of sheet-copper hammered to the required shape. Fruit, vegetables, cockchafers, spiders, and other insects, are the most frequently produced.

There are Three Exhibitors of Chocolate-confectionary in the French section.

Sugar-Confectionary is manufactured in France even to a much greater extent than chocolate-confectionary, and is that which is chiefly exported. Paris, the great centre of this branch of industry, employs seven hundred workpeople, males and females. The wages of the men average 3*s.* 4*d.* per day, and those of the women 8*d.* The value of its annual produce is 280,000*l.* The French confectioner is not a mere manufacturer of shapeless sweets, he is an artist; he studies not only the elegance of form in each bonbon, but also pays the minutest attention to the attractiveness of the grouping, and the correct contrasting of the colours. His ingenuity and invention are inexhaustible; every season he produces some novelty, and for years this competition has continued between himself and his rivals; and yet there is no abatement in his ardour or his success: now his production consists of a new box; now of some intricate interlacing of fruits; now of some wonderful crystallizations; and now of some new mode of concealing the motto: but in most cases his art is exerted tastefully to introduce a looking-glass. No house enjoys a higher reputation in Paris than its single representative of this art in the Great Exhibition.

In 1850, the exports from France, of syrups, sweetmeats, marmalades, jellies, and fruits preserved in sugar amounted to 983,350lbs., in value 36,000*l.*

The French confectioner is not permitted to employ any substance he chooses, either in the manufacture of his sweets or the colour he uses to adorn them; the Minister of Agriculture and Commerce very properly interfering. He directs that the Prefect of each town shall carry out, in a proper manner, the instructions which have been laid down by scientific men; not only as to the materials employed, but also as to the coloured-papers used to envelope the sweets. These regulations, it will be observed, are very similar to those which were established for the government of the Apothecary-Confectioners of Germany in the fifteenth century; and it would be well if England took a lesson in this respect, and appointed a competent staff of chemists to examine from time to time the sweetmeats which are exposed for sale in the retail-shops.

The following list of colours, allowed by the French authorities to be used by confectioners, may be found of service to makers of sweetmeats in other countries:—

Blues.—Indigo dissolved in sulphuric acid; Prussian-blue; to which may be added Ultramarine, as preferable to Prussian-blue.

Reds.—Cochineal, Carmine, Carmine-lake (provided it contains no vermilion), Brazil-wood lake.

Yellows.—Saffron, French-berries, Persian-berries, Quercitron, Turmeric, Fustic, and the aluminous lakes of these substances.

Green is produced of different shades by mixing the various yellows and blues; but no kind of emerald-green must ever be employed, as it is a virulent poison.

Violet.—Logwood alone or mixed with bronze-blue (Chinese blue), in various proportions.

Pansy-colour.—Carmine and Prussian blue; or Carmine and Ultramarine mixed in various proportions.

Colours for Liqueurs.—Curaçoa is coloured with Brazil wood; blues are made with indigo prepared by adding alcohol to the sulphuric solution of indigo; and absinthe (wormwood) is tinted with a mixture of saffron and alcoholic indigo.

INDIA.

India sends a few Preserved-fruits, amongst them some pine-apples; but they have not arrived in good condition.

PORTUGAL.

There are as many Exhibitors of Conserved-fruit in the Portuguese as in the French Section, and the fruits leave nothing to desire in their preparation; but the Portuguese do not display the same taste in their arrangement, and lack for that purpose the charming paper-boxes which render the French fruit so presentable; hence the commerce in this article is much less flourishing than in France. The exports of Portugal are principally to Russia and Brazil; but a fair proportion comes to England. The preservation and arrangement of fruits are principally carried on in the nunneries, excepting only in the town of Evora-Elvas, which has lately taken a great start, and established regular manufactories. Eight Portuguese Exhibitors have contributed conserves; and One other a small quantity of comfits.

PRUSSIA.

One Exhibitor sends most excellent Preserves in Syrup. These conserves are an evidence that the art is perfectly understood in Prussia, and carefully practised. There is, likewise, an Exhibitor of Chocolate-confectionary, whose productions, however, are far behind those of France.

RUSSIA.

From this country there has been sent a small collection of various Crystallized fruits and marmalades, prepared in the government of Smolensky. The collection comprises oranges, green-gages, apples, cherries, bergamotte-pears, pine-apples, and marmalades of different kinds. Though no Award has been made for these conserves, which had somewhat suffered, there was sufficient evidence of their having been so well preserved as to warrant a favourable notice being given of them in this Report.

SARDINIA.

From the Duchy of Genoa, several preserved Fruits in Syrup, crystallized sugar conserves, and a small quantity of *Dragées*, are sent by One Exhibitor, G. ROMANENGO (Sardinia, 82, p. 1305); but, unfortunately, the bottles were so insecurely packed that the syrup had oozed out, which left the fruits in a bad condition; the fruits in boxes are, however, excellent. The comfits are well made, but not equal to those exhibited in the French department. The conserves of the Sardinian States are much esteemed, and form an important and increasing article of commerce. In the Duchy of Genoa there were, in 1843, 34 confectioners, who employed 146 workpeople, and produced 637,190 lbs. of sugar conserves, valued at 34,400*l.*; in 1846, 34 confectioners, who employed 150 workpeople, and produced 661,457 lbs. of sugar conserves, valued at 36,000*l.*; in 1847, the value of the conserves was 48,000*l.*; in 1848, the value of the conserves was 46,800*l.* In 1843 there were also twelve establishments for preserving fruits in the province of Nice.

SAXONY.

The contribution from this country consists only of a very large collection of Chocolate-figures, modelled with skill; several of the comic subjects are, however, of rather questionable propriety. The quality of the chocolate of which they were composed did not warrant an Award in favour of the Exhibitor, though he had made considerable exertions to produce a good display.

SPAIN.

Several kinds of Fruit, preserved with sugar and dried, and others in syrup, are sent from Spain by Two Exhibitors. These conserves are partly prepared in the convents, and partly in private manufactories. The quality of the fruit is unexceptionable; but in Spain, as in Portugal, there is felt the want of ornamental boxes, in order to set it off to the best advantage.

SWITZERLAND.

One Exhibitor sends a small quantity of Chocolate-lozenges of fair quality.

TUNIS.

The only contribution from this country is a small quantity of a sweetmeat, called *Kefta*, which is made of the dried juice of the grape, and is not unpleasant in flavour.

TURKEY.

No distinct Award has been made for the sweetmeats supplied from this empire, which are very numerous; for the reason before stated in speaking of soap and candles. The Turkish confectionary has, in many cases, the peculiarity of being flavoured either with musk or otto-of-roses. The most remarkable is a sweetmeat called *Rahatlocoum;* it is composed of 1 part of wheat-starch, 6 parts of sugar, and 12 parts of water; these are boiled together for some time, and when the mixture has lost so much of the water by evaporation that it will congeal to an elastic jujube-like mass, it is run into a flat tray and allowed to cool: sometimes blanched-almonds are mixed with it. This preparation, which is of agreeable flavour, is in great repute amongst the Turkish ladies, from its alleged property of developing those proportions of figure which, in their country, are deemed a most essential attribute of female beauty. About 600 tons of Rahatlocoum are made annually in Turkey.

The following Conserves also find a place in the Turkish collection: *Kufta-anjou*, prepared from the dried juice of the grape; *Kufta-anjou* with blanched almonds; *Pastia*, which is also prepared from grape-juice dried quite hard in thin scales; the pulp of the Persian prune (this has by no means an agreeable flavour); pistachio-nut-comfits; roots preserved in sugar and flavoured with musk; very good marmalade of plums; sugar-candy, pink and white; liquorice-syrup; and, lastly, dried liquorice-juice. Of all these the most agreeable is, without doubt, the Rahatlocoum.

UNITED KINGDOM.

England derives her supply of fruits preserved in sugar from countries more favoured than herself in climate, large quantities being annually imported from France (chiefly), Spain, Portugal, and her various colonies. The weight of fruits preserved in sugar or brandy, imported from all parts, during the year 1850, was 155,895 lbs., and yielded in duty 3,754*l.* There is one Exhibitor of foreign Preserved-fruits in the British Section. English jams, jellies, and orange-marmalade, which are prepared very largely throughout the United Kingdom, are not exhibited, probably under the idea that no interest would be attached to them.

Confectionary is manufactured, in enormous quantities, throughout the United Kingdom, and more particularly in Scotland. It is not possible to arrive at an exact knowledge of the quantity annually produced, nor even to make a tolerably accurate estimate as to its extent; but it is certain that two or three tons per week of lozenges are not an unusual produce for one house. From the result of inquiries amongst the sugar-brokers and confectioners, it may be safely stated that upwards of 150 tons of sugar are converted, every week, into sweetmeats; at 47*l.* per ton, the raw material used in one year, therefore, amounts to 366,600*l.*, to which must be added labour, flavouring, and a wholesale and retail profit. Besides this, 31,977 lbs. of Confectionary are annually imported, and pay a duty of 840*l.*

The manufacture of Chocolate-confectionary is only of recent introduction into England, and is carried on by Frenchmen and Italians, Two of whom exhibit their apparatus at work in Class VI. There are Three Exhibitors of Chocolate-confectionary in the British Department, One of whom exhibited chocolate quite equal to that made in France.

Crystallized Liqueur-confectionary, similar to that of France, is now made largely in England, and is quite equal in quality, but at a considerably less price than the French. This arises, to some extent, from the difference in the price of sugar, and also because the cane-sugar is more easily worked, or, as the workman expresses it, is stronger. For example, crystallized liqueur-beans, *dragées*, and "drops" of English manufacture are sold wholesale at 8*d.* per lb., the price in France being 1*s.* 3*d.* As wages are considerably higher in England, the difference in price is the more remarkable.

By far the larger portion of sugar annually devoted to sweetmeats is carried off by "pipe," lozenges, and comfits of different kinds. The latter description is made chiefly in Scotland, which has long been renowned for its confectionary. Machinery is employed, particularly in the manufacture of lozenges, acidulated-drops, and comfits, so that the wholesale-confectioner is enabled to sell these kinds at prices but little above those of the raw materials; notwithstanding this, an unfair competition seeks still farther to diminish the price by admixtures of powdered gypsum. The acidulated-drop is a production peculiar to this country, the foreign confectioners not understanding its manufacture.

Bride-cakes are not wanting in the World's Great Show, nor should they be; for they are characteristic of English tenacity with respect to ancient customs, and few are older than the use of bread or cake at marriage-ceremonies, which, with the wedding-ring, has been derived from the heathens. The sprinkling of wheat on the head of the bride is a very old custom, and is now occasionally perpetuated by the cutting of the cake over her head. Many other ceremonies are also still retained in connexion with the bride-cake; as the passing of very small pieces of it nine times through the bride's ring, in order that the bridesmaids may place a piece beneath their pillows at night, and dream of their lovers. No less than Three gigantic Bride-cakes adorn the counters of the North Transept Gallery, varying in value from 30*l.* to no less a sum than 150*l.* One, it is said, possesses the advantage of moveable ornaments, so that after the cake has disappeared, the sugar may be transmitted, like the silk-dresses of our ancestors, as an heir-loom from the grandmother to her grand-daughter! The Three Exhibitors are R. GUNTER (112, p. 796), MOORE and MURPHY (232, p. 802), and R. VINE (113, p. 797). Although these bride-cakes were not considered of sufficient importance in a mercantile point of view to warrant the Jury in making them the subjects of a distinct Award, they are here mentioned as being the best of their class. The sugar-ornament of the last-named is quite remarkable as a piece of "sugar-piping."

The number of British Exhibitors of Sugar-confectionary is Eleven. There are likewise Two Exhibitors of Confectioners'-ornaments, and Three Exhibitors of Biscuits.

Wurtemburg.

To judge by the contributions to the Exhibition, the forte of the Wurtemburg confectioners is rather in the production of non-edible ornaments than confectionary itself; there being Three Exhibitors of the former, and only One of the latter. The confectionary which is crystallized is, however, excellent.

The number of Exhibitors in this subdivision is Sixty-six; of these there are:—

17	Holders of a Prize Medal.
5	Who obtained Honourable Mention.
44	Unrewarded.
66	

The classification of Exhibitors, according to the various countries, is as follows:—

America	2
British Colonies:—	
Canada	2
Cape of Good Hope	1
Van Diemen's Land	1
China	1
Egypt	2
France	13
India	1
Portugal	9
Prussia	2
Russia	1
Sardinia	1
Saxony	1
Spain	2
Switzerland	1
Tunis	1
Turkey	1
United Kingdom	20
Wurtemburg	4
Total	66

Of these, Thirty exhibit Fruits preserved in syrup or brandy; Eighteen exhibit Sugar-confectionary; Nine, Chocolate-confectionary; and Five, Confectioners'-ornaments; the remaining Four exhibit sweet-biscuits.

List of Awards.

Alvargonzalez, R., Oviedo (Spain, No. 177, p. 1340), Prize Medal.—Fruit exceedingly well preserved in syrup; comprising Greengages, Peaches, Apricots, and Strawberries.

Auclerc (Widow), and P. Ledoux, Paris (France, No. 1059, p. 1229), Prize Medal.—For an assortment of French Comfits, Liqueur-bonbons, and *Pastillage*-figures (composed of sugar and white of egg, or sugar, gum, an starch). The bonbons are arranged with great taste in fancy boxes and *corbeilles*, and much skill is displayed in the modelling of the pastillage-figures.

Baur Brothers, Biberach (Wurtemburg, No. 87, p. 1119), Prize Medal.—For a very extensive collection of Confectioners'-ornaments, many of which are very humorous. They are composed of gum-tragacanth and starch, so that, if eaten, no ill effects would arise, but they are intended only as ornaments. The largest piece represents the cathedral of Cologne, and contains a musical-box. In Germany, storks are reputed to bring newly-born infants, and we find, accordingly, one of these birds carrying a child in a small box strapped on his back.

Castellar, F., Lisbon (Portugal, Nos. 422 to 425, 426, 428 to 433, 438, p. 1312), Prize Medal.—Figs, Plums, Peaches, and Pears as dry conserves; Sweet-plums, Apricots, Tangerine-oranges, Figs, Cherries, and Peaches preserved in syrup, with their natural flavour and perfectly sound.

Chevet, jun., Paris (France, No. 121, p. 1177), Prize Medal.—Cherries, Pears, Apricots, and other fruits preserved in syrup. These are of the highest class, both as regards the choice of fruit and careful preparation.

Coimbra, The Nunnery of (Portugal, No. 417, p. 1312), Prize Medal.—For a large and tastefully-arranged box of Conserved-fruits in great variety, and in the highest state of perfection.

Fortnum, Mason, and Co., Piccadilly (Class III., No. 55, p. 204), Prize Medal (*the same Award by the Jury of Class III.*)—A very extensive collection of the finest Preserved-fruits of various countries. For the care bestowed in the selection and arrangement of this (the largest) collection of costly conserves, the Jury has awarded the Prize Medal.

Louderback, M. J., Cincinnati (United States, No. 7, p. 1433), Prize Medal.—White or Heath-peaches preserved in brandy, of delicious flavour, and in a perfect state of preservation. The name Heath is derived from the surname of the grower who first introduced them.

Oudard, L., Son, and Boucherot, Paris (France, No. 1374, p. 1242), Prize Medal.—For the care in selecting, and taste in arranging, in ornamental forms and in boxes, a great variety of Preserved-fruits; and for Comfits and Sugared-almonds of excellent quality.

Paris Chocolate Company, Regent Street (Class III., No. 30, p. 202), Prize Medal.—Awarded for most excellent Chocolate-confectionary, in a great variety of forms, all of which was found to be carefully prepared and well-flavoured; and also for an assortment of Syrups, which on dilution form very agreeable and refreshing beverages.

Perron, E., Paris (France, No. 343, p. 1193), Prize Medal (*the same Award by the Jury of Class III.*)—Chocolate-confectionary, prepared in granite mills, and torrefied by steam. This preparation is exhibited in a great variety of forms; amongst other matters, there is a Basket made of chocolate, filled with Chocolate-bonbons, which are well flavoured and of most excellent quality.

Philippe and Canaud, Nantes (France, No. 956, p. 1225), Prize Medal.—Excellent Fruits preserved in syrup, and comprising Peaches retaining the delicacy of their flavour, Pears, Raspberries, and Cherries, all of which are free from any signs of fermentation.

Rodel and Sons, Bordeaux (France, No. 992, p. 1226), Prize Medal, for a collection of the following fruits, perfectly preserved in syrup, viz.:—Cherries, Pears, Apricots, Greengages, Raspberries, Peaches, and Strawberries, which have retained their natural flavour, and are free from fermentation.

Roth, W., jun., Stuttgart (Wurtemburg, No. 89, p. 1119), Honourable Mention accorded for a large collection of well-manufactured Liqueur-bonbons, both crystallized and smooth.

St. Pelayo, The Nunnery of, Oviedo (Spain), Prize Medal.—For a collection of Marmalades of excellent flavour. They are of firm consistence, and are packed in thin round boxes.

Schooling, H., Bethnal Green (Class XXIX., No. 114, p. 796), Honourable Mention,* for Liqueur-bonbons agreeably flavoured and in every respect well made, crystallized and smooth, generally known as French sweetmeats. Some of these are flavoured with artificial essences. (See page 637.)

Troglen, G., Ulm (Wurtemburg, No. 91, p. 1119), Honourable Mention is accorded to this Exhibitor, for a Confectioners' Ornament, representing a Lion-hunt, well modelled in gum-tragacanth, sugar, and starch, and coloured with vegetable-colours.

Turpin, F. A. (Widow), Paris (France, No. 1046, p. 1228), Prize Medal (*the same Award by the Jury of*

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* But for a misstatement contained in a label attached to these productions, by which it was made to appear that they were manufactured in France under the immediate inspection of the proper authorities, a Prize Medal would have been awarded to Mr. Schooling. The Reporters are now enabled to state that the employment of this label has been discontinued.

Class III.), for a large collection of very excellent and carefully prepared Chocolate-confectionary, made up into *dragées*, and representing fruits and roots; for instance, potatoes, nuts, chesnuts, turnips, radishes, dates, black currants, hips, and plums; all of which are imitated with skill.

Volsteedt, J. P. (Cape of Good Hope, No. 35, p. 950). Honourable Mention is accorded for the following conserves, which are exhibited both in syrup and in the candied state, viz.: Nartjes (a small orange), the Bitter-orange, Green-figs, and Citrons.

Weatherley, H. (Class III., No. 27, p. 202), Honourable Mention.—Sugar-drops, flavoured with artificial essences or compound-ethers, designated by names derived from their resemblance to the savour of various fruits; as essence of pear, of pineapple, &c. (see page 637). The major part of these drops are flavoured with a single compound-ether, but in some cases a combination of several is used.

Weill, C., Berlin (Prussia, No. 20, p. 1049), Prize Medal (*An Honourable Mention accorded by the Jury of Class III.*).—Whole Pine-apples, Peaches, Apricots, Pears, Plums, and Walnuts in the husks, preserved in syrup. The soft fruits have retained their natural flavour, and are quite free from fermentation.

Wotherspoon, J., and Co., Glasgow (Class XXIX., No. 106, p. 796), Prize Medal.—Very excellent Scotch-confectionary, manufactured by steam machinery, and consisting of eighteen kinds of Lozenges and several descriptions of Comfits, which were found to contain no other material than sugar, starch, and vegetable-colouring.

.—MANUFACTURES RELATING TO NATURAL HISTORY.

I. Artificial Flowers and Fruit.

Under this general designation two very distinct classes of articles have to be separately considered, namely, Imitative Flowers and Fruit, modelled in wax, and the same subjects formed from other materials. The Wax-flowers, from their fragility, are chiefly restricted in their application to purposes of decoration, and require less difficult manipulations for their successful production than those made of cambric, feathers, or similar materials, and destined for more general application. Wax-flowers are, however, occasionally used as articles of toilet.

In examining the Wax-flowers, which are usually intended to form isolated ornaments, we require truthful imitations of Nature, and taste in the selection of forms or grouping, the manufacturing skill required resolving itself almost wholly into the execution of form and the application of colours.

In the latter class, however, are included those productions to which the term "Artificial Flowers" is usually more especially applied; and it presents other qualifications besides those offered by the flowers modelled in wax, the artistic merits being more closely connected with the process of their manufacture. Accuracy of form and colour, and taste in the choice of examples and in the grouping, are of equal importance in the work: and there is usually more skill required for the imitation of the natural texture: but in addition to these qualities we have also to consider other peculiar excellencies of the articles produced, such as durability, the advantageous application of varied materials, and, finally, cheapness of production.

Such are the principles by which we have been guided in the examination of the several specimens of Artificial Flowers submitted to the Jury of this Class.

Austria.

The contributions from Austria are sent by two Exhibitors, both of whom display small collections of cheap Miniature-flowers, in which the trifling cost is the chief merit.

Brazil.

The contributions from Brazil are only four in number, and undoubtedly the most beautiful of them is that belonging to Class XXIX., consisting of a splendid Bouquet of Feather-flowers, including the Coffee, Cotton, and Tobacco-flowers, &c. The name of the manufacturing artist was not stated; but an Award has been made in favour of the Exhibitor, who is an Englishman resident in London.

British Colonies and Channel Islands.

Many of the examples exhibited by the Dependencies of Great Britain have an especial and a very high interest attaching to them, since they may be supposed to represent with sufficient accuracy a great variety of plants and fruits generally unknown in Europe. The Jury have not rewarded them as works possessing great artistic merit, but they nevertheless fully appreciate the laudable desire to impart information evinced by the numerous Colonial Exhibitors who have contributed the several specimens they record.

Bahama Islands.—The Misses Greig (p. 976) send a bouquet and a vase made of brilliant shells, and Mrs. E. Barnett (p. 975) an important and very interesting collection of Thirty-two Wax models of Fruits, which appear to have been made and coloured with minute attention to accuracy in the imitation of Nature. But by far the most important contribution of this description is displayed by Three Exhibitors in the *Barbadoes* department; though the whole of the specimens appear to have been executed by Mr. and Mrs. Braithwaite (1, p. 972), who are residents of that island. These examples, which are upwards of a hundred and fifty in number, comprise Bulbs, Roots, Plants, Flowers, Fruit, and Seeds, and reflect much credit on the modellers, for their attention to correctness of detail, a point of far greater importance than artistic grouping, when the intention, as in the present instance, is to convey a correct idea of the objects represented.

Guernsey sends a small stand of Wax-fruit.

India.—The examples which have been collected from Gokak, in the Mahratta country, Travancore, and Rohilkund, comprise models of about seventy varieties of Flowers and Fruits. Although possessing but little artistic merit, these numerous specimens form a most interesting and instructive display.

Jamaica.—Mrs. Nash (p. 971) contributes several ornamental groups of flowers made of the fibres of the Yucca or Dagger-plant.

Malta.—Antonio Gerada and his daughters (32, p. 946) exhibit a basket of rich Shell-flowers.

Mauritius.—The Countess Grey (1, p. 956) sends a Basket and Wreath of Flowers from the Sechelles Islands, made of Palm-leaves; and Madame Chapon and the Mdlles. Gancourt contribute several Bouquets in Shell-work.

France.

It must be conceded that the manufacture of Cambric-flowers is a purely French, or, to speak more correctly, a Parisian art; for although its origin is Italian, and that it is now carried on in other countries, the productions are usually copies from French models. Indeed, Cambric-flower-making as much belongs to Paris as the manufacture of silks to Lyons, or ribbons to St. Etienne: and, to extend the parallel even still further, as cotton to Manchester, or cutlery to Sheffield. The importance of the manufacture of cambric-flowers will be better appreciated when it is stated that the value of these productions, in 1847, was 442,226*l.*; and notwithstanding the high import duties of 25 per cent. in England, of 33 per cent. in the United States, and of 40 per cent. in Russia, that French-made flowers to the *declared* value of 68,000*l.** were exported in the same year, principally to those countries, namely,—to Belgium 12,400*l.*, to the United Kingdom 12,120*l.*, to the United States 17,600*l.*, to all other parts 25,880*l.* No branch of industry presents a more complete instance of the subdivision of labour than artificial flower-making. Few of the manufacturers carry on all the operations on their own premises. Beside the cambric, muslin, gauze, velvet, silks, &c., supplied from Lyons, St. Quentin, and St. Etienne, there have been distinct manufactories established for many others of the component materials of these graceful ornaments. Thus the Dyes and Body-colours are prepared expressly for this art by manufacturing chemists; the materials, as Coloured-papers, Buds, Leaves, Stamens, Pistils, Fruits, and similar articles, are usually made in workshops devoted exclusively to their production; and in some instances, as may be seen by the contributions to the Exhibition, only one description is made in one manufactory. In 1847 there were Forty-eight manufacturers of such materials in Paris, who employed 478 workpeople, and produced goods valued at 47,156*l.* The flowers are composed from their separate component parts in other workshops, some of which have a reputation for one kind only; and lastly, the grouping together of the various flowers is effected in the warehouses of the vendors, who are termed "*monteurs*," of whom, in 1847, there were 574 in Paris, who employed 5,675 workpeople, and produced goods to the value of 395,070*l.* It must, however, be stated, that there are some manufactories in which by far the greater number of these operations are carried on. In most cases, however, each workshop is restricted to the exercise of some particular branch. This will be more readily understood when it is stated that there are no fewer than Six hundred and twenty-two manufactories in Paris (including the forty-eight preparers of materials before named), which on the average annually produce goods amounting in value to 711*l.*, supposing the total production equally distributed between them; but this is far from being the case, for in 1847,—

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* It is estimated that the *selling* value is nearly double this sum.

12	returned	–	–	–	8,000*l.*
8	„	from	4,000*l.*	to	8,000*l.*
33	„	„	2,000*l.*	„	4,000*l.*
63	„	„	1,000*l.*	„	2,000*l.*
131	„	„	400*l.*	„	1,000*l.*
104	„	„	200*l.*	„	400*l.*
182	„	„	40*l.*	„	400*l.*
89	„	less than	–	–	40*l.*
622					

In 1847 there were 6,153 workpeople employed in cambric-flower making, namely:—

414	men.
5,063	women.
19	boys, from 6 to 16 years old.
657	girls ditto ditto.
6,153	

The men earn, on the average, 3*s.* per day, the women 1*s.* 7*d.* per day: the youths and girls, being mostly apprentices, receive, in most cases, no remuneration beyond their board and lodging.

Two of the Exhibitors, M. **CONSTANTIN** (94, p. 1175), and M^{e}. **FÜRSTENHOFF** (492A, p. 1201), contribute specimens which show to what a surprising degree of perfection the imitation of nature may be carried in this art. Indeed, the productions of M. Constantin are so perfect that they will allow of the scrutiny of a magnifying lens. In one instance, during the examination of his case, it was so doubtful, even with the aid of the glass, whether a real object had not been used, that the Exhibitor pulled a specimen to pieces to convince the Jury. Both M. Constantin and M^{e}. Fürstenhoff are, it appears, accomplished botanists, having followed regular courses of scientific study; and no higher proof could be afforded of the value of such training than the examples they display. It is productions such as theirs that have stimulated the manufacturers of articles of more general sale to improve their goods, by imitating, so far as is consistent with cheap production, the excellences brought before them from time to time at the French *Expositions.* These periodical displays, by producing a healthful rivalry among the "*monteurs,*" in the tasteful selection and grouping of the various flowers and leaves for articles of dress, have, in this respect also, been of most essential service in developing the capabilities of this important trade. For however meritorious and commendable the truthful imitation of plants may be, this excellence is insufficient of itself to induce a large home-consumption, or to create and maintain an extensive export trade. It is to the great talent of the Parisian "monteurs," in harmoniously grouping together a variety of stems, leaves, buds, and flowers, for head-wreaths, dress-trimmings, and bouquets, as much as to the skill of the makers of these flowers, that Paris owes its high reputation in this art; and so much diversity as to skill exists among the various artists, that it is known that the *same* flowers have a double value when arranged by one, to what they would have if by another of them.

HAMBURG.

The contribution consists of a frame of artificial flowers, which does not call for any especial comment.

HESSE DARMSTADT.

Flowers and fruit, modelled in wax, contributed by one Exhibitor, are average productions of their class.

MEXICO.

The contributions from Mexico comprise a few examples of wax-flowers and wax-fruit.

NASSAU.

A few specimens of wax-fruits form the only contribution from Nassau in this Department.

PORTUGAL AND MADEIRA.

The Portuguese Department contains some excellent specimens of cambric-flowers, partly contributed by M. Constantin, who, under his real name of **MARQUES** (1299, p. 1318), pays this tribute to his native country. From the Island of Madeira are displayed specimens of those very beautiful feather-flowers for which it is so justly renowned. They are executed principally in the Nunnery of Santa Clara, in favour of which an award was made. Other specimens are exhibited in the North-East Central Gallery, contributed by an English Exhibitor. There is also an extensive series of wax-fruits from H. **FERRAZ** and his sisters (2 Madeira, p. 1319), which deserve favourable notice.

SWEDEN.

Madame **FÜRSTENHOFF** (27, p. 1351), whose beautiful productions have been spoken of under the notice of France, adorns the department apportioned to her native country with a selection of her admirable imitations of nature.

UNITED KINGDOM.

As the French may be regarded as superior in the construction of Cambric-flowers, so the British surpass all other Exhibitors in the manufacture of wax-flowers. This is indeed as truly a British manufacture as the making of cambric-flowers is French. In many instances those who practise the art are ladies, who having first acquired it as an accomplishment, subsequently devote their leisure to its pursuit; but it is also executed by those who follow it as a profession. The remarks which have been already made respecting the productions of two of the French Exhibitors may with equal truth be repeated here in regard of the contributions of the **MINTORNS** (p. 795), and Mrs. **STRICKLAND** (p. 754). In their productions even the minutest details of the plants are represented with microscopic truthfulness; and in all there is evinced an amount of careful and patient study deserving of the highest praise. In respect also of the examples displayed by the other Exhibitors, it is not too much to say that there are but few which could be said to possess only an ordinary degree of merit.

In the making of cambric-flowers the aim of the British artists has not been so high, and although meritorious commercial articles are rewarded; still the generality of the contributions are below those of the same species in the French Department. At present a large quantity of the better description of cambric-flowers is imported annually into the United Kingdom. In 1850, for example, the imports amounted in value to 61,634*l*., and 15,409*l*. were paid for the duty upon them.

Shell-flowers, wax-fruit, and, lastly, feather-flowers, find a place in the British contributions to Class XXIX.

WURTEMBURG.

The contributions from Wurtemburg, which are creditable, are from two Exhibitors, one of whom sends materials for flower-making, and the other finished flowers made of cambric.

There are seventy-four Exhibitors of artificial flowers and fruit; of these there are—

1 Holder of a Council Medal.
16 Holders of a Prize Medal.
10 Who obtained Honourable Mention.
47 Unrewarded.
—
74
—

The classification according to the various countries is as follows:—

Austria	2
Brazil	1
British Colonies and Channel Islands:—	
Bahamas	2
Barbadoes	3
Guernsey	1
India	1
Jamaica	1
Malta	1
Mauritius	2
France	15
Hamburg	1
Hesse	1
Mexico	1
Nassau	1
Portugal (3), and Madeira (1)	4
Sweden	1
United Kingdom	34
Wurtemburg	2
Total	74

The Seventy-four Exhibitors admit also of classification according to the nature of the articles which they have contributed, in the following arrangement:—19 Exhibitors of Wax-flowers; 14 of Wax-fruit; 6 of Materials for Cambric-flowers; 17 of Cambric-flowers; 1 Exhibitor of Crape Mourning-flowers; 5 Exhibitors of Feather-flowers; 5 of Shell-flowers; 6 of flowers of other materials, as Braid, Rice-paper, Palm-leaves, Spun-glass, and Beads; and 1 Exhibitor of flowers for table decorations, cut out of turnips.

LIST OF AWARDS.

ADAMSON, O. G., Panton Street, London (Brazil, 1, p. 1429), Prize Medal, for a very large and elaborate group of Brazilian flowers, executed in Feathers obtained from the plumage of Brazilian birds. It exhibits wonderful brilliancy of colour, and much accuracy of form. The mechanical execution is very good, and much taste has been displayed in the arrangement of the bouquet.

BASTEAU, C., Paris (France, 1112, p. 1231), Honourable Mention, for Artificial Flowers, Plumes, &c. These decorative articles are of good quality, and well designed.

BÜRGER, J., Vienna (Austria, 700, p. 1043), Honourable Mention, for a collection of Miniature Artificial-Flowers. This collection is chiefly noticed as containing examples of a manufacture which is carried on rather extensively in Catholic Germany. The specimens do not possess any high artistic merit, since they are cheap products for commercial purposes.

CHAGOT, A., sen., Paris (France, 1139, p. 1232), Prize Medal, for Feathers, Bouquets, Artificial Flowers, and Vases. Manufactures of a more common class than most of the other collections, and intended to supply large consumers and the export market, for which they are good and well executed. The colours and grouping, as is usual in French articles, are of a superior character.

CHISHOLME, EMMA, Edward Street (Class XXIX., 78, p. 795), Honourable Mention for Wax-flowers botanically accurate, especially a group of *Orchidaceæ*; a Rose-tree is also executed with much skill. This is, on the whole, a very creditable collection.

CONSTANTIN, J. MARQUES, Paris, and Regent Street, London (France, 94, p. 1175), Council Medal, for a large case in the Area of the East Nave, and a case in the South-East Gallery. The productions of this maker are of the very highest quality, and the imitations of entire plants in the large case display not only great skill in construction, but so intimate a knowledge of their botanical character as to render them available for purposes of instruction as well as decoration. The material of which they are made is chiefly cambric, with which the imitation of texture is most successful. For general truth and natural character, especial attention may be drawn to the Prince's-feather, Sun-flower, *Aristolochia*, and other plants of intricate conformation, which are productions of the first order in this class of objects. Most deserving of commendation also, is the admirable skill with which are pourtrayed the several stages in the development of plants, from the budding blossom to the decaying flower, from the opening leaflet to the fallen and withering foliage: even accidental fractures are delineated with surprising truthfulness. The case in the Gallery contains a collection of Flowers, Wreaths, Bouquets, &c., of similar construction, but of less elaborate work, and more adapted for general purposes. These flowers are not only characterised by the same kind of excellencies as the others, but in their manufacture a solidity and durability of high importance has been secured. (See *Prefatory Remarks*.)

DORVELL, ELIZABETH, Oxford Street (Class XXIX., 77, p. 795), Prize Medal, for wax-flowers. The groups in this collection are most exquisite, from the tasteful selection of subjects and the arrangement of colours. The flowers are well made and very accurate. The model of the *Victoria Regia* is also good.

EWART, HENRIETTA, Bath Place, New Road (Class XXIX., 75, p. 795), Honourable Mention, for wax-flowers, deserving of commendation for the good selection and arrangement of the subjects of the groups, also for their mechanical execution and botanical accuracy.

FISHER, JOSEPH, Cripplegate Buildings (Class XXIX., 80, p. 795), Honourable Mention for imitation flowers in pots, &c. These articles are intented for decorations on a large scale, for rooms, &c., and, therefore, are of a somewhat rougher character than those intended for personal ornaments. There is a degree of stiffness about them, but they are, on the whole, very creditable; more particularly the Fuchsias.

FLORIMOND, —, Paris (France, 1224, p. 1236) Honourable Mention, for artificial flowers, &c. Artificial flowers as applied to head-dresses; fruits and flowers. These, though not of the highest class, are deserving of praise for the taste displayed in the grouping.

FOSTER, SON, and DUNCUM, Wigmore Street (Class XXIX., 74, p. 795), Prize Medal, for articles used in the manufacture of artificial flowers, feathers, &c. The materials are good, and brilliantly coloured. Interesting specimens of unfinished flowers are exhibited, illustrating the mode of manufacture. The finished flowers, as well as the feathers, &c., are very beautiful articles, taking a high place among the commercial productions of this class.

FÜRSTENHOFF, EMMA, Paris (France, 492A, p. 1201), Prize Medal, for artificial flowers, manufactured from muslin and crape, to facilitate the study of botany. There is much merit in this collection, but this depends chiefly upon their beauty and fitness for ornamental purposes; since, although botanically accurate, the examples are chiefly of double and cultivated flowers, which are of inferior value for the purpose mentioned by the exhibitor.

GATTI, A. and G., Coppice Row, Clerkenwell (Class XXIX., 73, p. 795), Honourable Mention, for artificial flowers and articles used in their manufacture, such as leaves, buds, and other components of flowers; chiefly of common material, but very good in regard to colour, some of the tints being exceedingly bright and rich. The flowers are extremely accurate in their imitation of nature, and are mostly well selected for the peculiar class of article. As cheap commercial productions, this collection deserves commendation.

Gaudet-du-Fresne, Paris (France, 842, p. 1220), Prize Medal, for manufactured leaves for artificial flowers. This collection contains a large assortment of leaves, executed in a peculiar manner; and though restricted to a special branch of the manufacture, is remarkable for the variety and beauty of the specimens, which exhibit a very fair amount of natural character.

Harand, E., Paris (France, 863, p. 1221), Prize Medal, for head-dresses, trimmings, &c. These are very good commercial articles, suited for superior markets, and exhibiting great taste and accuracy in design.

Lefort, —, sen., Paris (France, 1295, p. 1238), Prize Medal, for materials for artificial flowers. This maker has produced papers and stuffs of most brilliant colours, and in very perfect series of gradations of tint: the paper stained with carthamus-red (safflower) is especially remarkable for the purity and vividness of its colour. These, as well as the more advanced forms of the "materials," such as leaves, sprigs, buds, berries, or other fruits, for the construction of bouquets and wreaths, are excellent specimens of a class of manufacture carried on upon a large scale for the supply of a cheap market.

Lumsden, J., Trevor Terrace, Knightsbridge (Class XXX., 125, p. 829), Prize Medal for wax flowers. An exceedingly-graceful and truthful group, executed with much skill and artistic feeling. The colours are chosen with excellent taste, and the effect of the whole is very beautiful.

Makepeace, Eliza, Manor Place, Clapham (Class XXX. 185, p. 831), Honourable Mention, for wax flowers, distinguished by their accurate representation of nature, and the delicacy and beauty of the colouring. They are exceedingly well adapted for scientific illustration.

Mintorn, John H., Horatio, Elizabeth, and Rebecca, Soho Square (Class XXIX., 70, p. 795), Prize Medal, for a very large and beautiful collection of wax flowers. The plants in the large case are very accurate and life-like, and well-adapted for scientific museums, to which they are especially suited from the truthfulness with which they represent the botanical characters of the various plants. The *Victoria Regia*; the ferns, showing all their minute fructification; the mignonette; and the orchids, are among the numerous instances deserving of the highest praise. The small groups and single flowers are also very elaborate imitations of nature, and present a beautiful appearance; the colouring, texture, and mechanical finish being of the first class.

Paroissien, A., Paris (France, 945, p. 1225), Honourable Mention, for a collection of waxed leaves, prepared with considerable attention to accuracy in the imitation of nature.

Perrot, Petit, and Co., Paris (France, 952, p. 1225), Prize Medal, for artificial flowers, feathers, &c. Bouquets and wreaths, composed of various materials; the feather flowers are very beautiful; and the whole collection, including the feather ornaments, is very excellent and affords an evidence of much taste on the part of these Exhibitors, whose productions hold a high rank in the French Department.

Randolph, Wilhelmina, Marsham Street (Class XXIX., 66, p. 792), Prize Medal, for plants imitated in undyed feathers. This collection displays much ingenuity and industry. The field to which the maker has restricted herself is somewhat narrow; probably from the difficulty of obtaining brilliantly-coloured feathers; but so far as her attempt extends, she has succeeded remarkably well in representing the natural characters both of flowers and foliage. The roses, carnations, and wall flowers are highly creditable.

Russel, Vincente, Lisbon (Portugal, 1295, p. 1318), Honourable Mention, for an artificial orange-tree. A very creditable imitation of a small orange-tree, distinguished by more than common truth of general character.

Santa Clara (Funchal), The Nunnery of (Portugal,) Prize Medal, for a case of feather flowers from Madeira, in the Portuguese Department. A very beautiful specimen of this manufacture, which is extensively pursued in Madeira.

Strickland, Maria, New Bond Street (Class XXIX., 63, p. 792), Prize Medal, for a collection of wax flowers. The flowers of this collection deserve the highest praise for their artistic merits. They are exceedingly accurate in form, colour, and texture; in which latter respect a group of roses may be especially noticed, an uncommon amount of delicacy having been attained in the petals. A bunch of heaths is equally good. The model of the *Victoria Regia*, in its various stages of development, is excellent and most life-like.

Sugden, Borras, and Co., Aldermanbury (Class XXIX., 62, p. 792), Prize Medal, for artificial flowers, feathers, and head-dresses. The flowers in this collection are especially worthy of notice, as being very superior commercial products for general use. Much ingenuity is displayed in the imitation of textures by various materials, such as waxed cloth, velvet, muslin, cambric, &c., and for general accuracy of form and colour, brilliancy of tint, and tasteful selection of subject, they merit strong praise. The feathers are also exceedingly good.

Tilman, —, Paris (France, 698, p. 1212), Prize Medal, for artificial flowers, head-dresses, &c.; small groups, bouquets, &c., in great variety, of very superior quality as intended for general commercial purposes, combining a fair amount of natural character with good mechanical execution, and much taste in the selection and grouping of the component leaves and flowers. The collection of this exhibitor is one of the best contributed by the French flower-makers.

II. Taxidermy.

The art of stuffing animals is generally supposed to be an invention of modern date, and to have originated about the period when the various museums of Natural History were founded in Europe. But traces of the art are to be discovered in the earliest records of antiquity, although the methods then employed differ much from those now practised. The procedure of the ancient Egyptians in embalming human remains and dead animals, in some measure resembles the manipulations of the taxidermist, inasmuch as in both the parts peculiarly subject to decomposition are removed and replaced by more durable materials. But whilst the Egyptian embalmer desired rather to preserve the substance of the body than its form, the taxidermist sacrifices all, except the skin, to the obtaining of a natural representation of the aspect of the living animal. The ancient Greeks and Romans, however, endeavoured to preserve the form as well as the substance of the body, but their methods fulfilled the object very imperfectly. The ordinary proceeding consisted in immersion in melted wax, or in honey; this necessarily disguised the shape, even though it remained unimpaired. Perhaps the best of the ancient methods for the preservation of animal substances consisted in placing them in a solution of common salt; this is still done, though for very different purposes. In this manner the sow, which by bringing forth a litter of thirty pigs, afforded a happy omen to Æneas, was preserved by the priests; and it kept so well that it was said to have been in existence at Lavinium in the time of Varro. In the same way were preserved two hippocentaurs (probably monstrous births), and also an ape, which, having been sent by the Indians to the Emperor Constantius, happened to die on the road.

It appears to have been the business of the priests to preserve rare animals, or rare natural specimens generally, and this was so prevalent, that we are almost tempted to refer the origin of museums of Natural History to the temples of antiquity; indeed Beckmann, in his *History of Inventions*, quotes a number of instances which support this view. And although it cannot be positively[*] asserted, from the notices in the Greek and Latin authors on the subject under review, that methods resembling those now used by the animal-stuffer were employed by the ancients; still the circumstance that animals were frequently suspended in the temples, shows that they were not invariably preserved in salt or honey. The ancients must consequently have possessed methods of preserving animal substances in the dry state; but they appear to have been ill adapted to the purpose, for the head of the celebrated Calydonian boar, which Pausanias saw in one of the temples of Greece, had evidently suffered by time, or the ravages of insects, and had lost the greater part of its bristles.

The art of preserving animals appears to have been but little, if at all, practised during the middle ages; for we only now and then meet with a notice of natural objects being kept as curiosities in the treasuries of emperors, kings, and princes. It is only in the records of the period when the study of natural science was resuscitated that passages are to be met with indicative of a knowledge of taxidermy. Sportsmen had undoubtedly practised it much earlier, in a rough manner,[†] for the purpose of making effigies of call-birds, in the absence of the living bird, while they imitated the note of the bird with their own voice, or some artificial contrivance.

The first records of collections of objects of natural history relate to the second half of the sixteenth century, and it appears from them that such museums existed chiefly in Italy, in relation to which the name of Francesco Calceolari deserves especial mention (Verona, 1584). These collections, which were commenced by private individuals from purely scientific motives, increased in number and importance in the seventeenth century. This period gave birth to the collection of the Tradescants (father and son), which was purchased in 1659, by Elias Ashmole, who presented it in 1683 to the University of Oxford, and thus founded the Ashmolean Museum; and also to the collection of James Petiver, which was much enriched by Sir Hans Sloane, and, on the death of this distinguished naturalist, became the nucleus of the British Museum. It is from this epoch, in which the majority of continental collections took their origin, that the art of preserving skins must be dated; and from the moment it became subservient to science, it kept pace with the growth and requirements of these institutions.

It is a point of extreme interest to compare the admirable productions in taxidermy contributed to the Great Exhibition, with the old specimens of the art of animal-stuffing to be met with here and there in the museums of natural history. Nothing more dissimilar can be imagined; for while the successful productions of modern times present Nature to our eyes, and show that the artist has closely studied her hidden secrets, the animals of the old stuffers resemble anything but that which they are intended to represent. It would appear that the study of nature was not deemed to be essential, and that imagination took its place, and was allowed great latitude in the putting up of the stuffed effigies; so much so, that the living prototype would have recoiled in horror from the contemplation of its defunct representative.

The older taxidermists had, evidently, to direct their entire attention to overcoming the difficulties presented by the material, the preservation of which was the main point. At first they contented themselves with removing the intestines and the brain, especially in birds; they attempted to prevent the putrefaction in the remaining parts, by exposing the bodies to a gradually increasing temperature for the purpose of expelling all the water. But however carefully the drying was attended to, it is evident that these productions were of an ephemeral character, as they presented a tempting bait to many descriptions of insects. An improvement was next effected by removing the large fleshy muscles, the entire skeleton still remaining. At present, the skin alone is employed; all parts that rapidly undergo putrefaction being carefully removed. By this means, and by the aid of modern chemistry, which has yielded a series of useful preparations to the taxidermist, the putrefaction of the stuffed animals was prevented. The operator was consequently enabled to direct his attention to other points of great importance; and from the moment he was freed from anxiety respecting the preservation of his subject, he strove to perfect his mode of representing nature, and thus completely altered the range of his art. The skin of the animal has now become, in the hands of the taxidermist, a crude material to be endowed with form, and life-like attributes, as the marble under the chisel and mallet of the sculptor; and unless, like him, he prepares his mind by anatomical studies, and a close observation of nature, he will surely fail to realise a satisfactory production. The Works of Art exhibited—for to many of the specimens the term may be well applied—prove that animal-stuffing has been cultivated with unequivocal success in this direction.

United States of America.

The exhibitors are two in number, one of whom sends a black-eyed squirrel, and the other a case of animals, birds, and fishes; but neither of these contributions calls for especial notice.

Belgium.

The contribution, which comprises a case of stuffed birds indigenous to Belgium, and also a case of stuffed foreign birds, requires no especial notice.

British Colonies.

British Guiana.—Mr. A. F. Ridgway, British Guiana (160-61, p. 987), exhibits a case of stuffed birds, comprising:—the toucan, blue parrot from Essequibo, and the yellow-bellied Trojan. *Nova Scotia.*—Mr. A. Downs (p. 970) contributes some well-prepared specimens of birds from that colony. *New Zealand* (37, p. 1002) sends specimens of insects. *South Africa.*—Captain Faddy, R.A. (Western (for South) Africa, 19, p. 954), exhibits specimens of the hartebeest, the striped koodoo, and the waterboc, from the Cape of Good Hope. The manner in which these have been preserved and set up cannot be commended; but it is alleged that the two last-named animals are the first of their kind that have reached this country: and if so, they are of interest. *Van Diemen's Land.*—Mr. F. Cox (280, p. 997) exhibits a case of Tasmanian insects; and Mr. Bonney (281, p. 997) one of Tasmanian birds, which are interesting specimens. Mr. W. H. Ince, of Chelsea (349, p. 1000), exhibits a case of birds formerly belonging to the late Captain J. M. R. Ince, who died at Hong-Kong whilst commanding H.M.S. "Pilot." They formed part of the rare and interesting specimens of Natural History collected by that officer when Lieutenant of H.M.S. "Fly," during the survey of the Great Barrier Reef and Coasts of Australia. These specimens are of great interest, not only from their number (forty-two) and the beauty of the examples, but also from the evidence they afford of the cultivation of science by the officers of the British Navy. *Western Africa.*—**HER GRACE THE DUCHESS OF SUTHERLAND** (16, p. 954) exhibits a case of birds from the river Niger.

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[*] In one of the *Epistles* of Horace (Epist. lib. I., Epist. 2, l. 65), addressed to Lollius, a passage is met with, which has been generally construed into a knowledge of Taxidermy among the ancients. The words are—

> Venaticus, ex quo
> Tempore cervinam pellem latravit in aula
> Militat in silvis catulus.

Many interpret *pellis cervina* as a stuffed stag, placed in the hall, and barked at by the dog. This explanation assumes that the ancients decorated their halls in such manner: like a modern hunting-box. The passage is, however, intelligible if we translate *pellis cervina* as the mere skin of the stag.

[†] Although the foregoing sketch suffices to show that the art of taxidermy can only have been very gradually developed, still it will not be inappropriate to introduce in this place the often told, but improbable, anecdote of a rich gentleman of London named Lever, who is said to have possessed a valuable collection of living birds. These all died in one night, owing to the stove used in the aviary having cracked, and the vapours suffocating them. The intensity of Mr. Lever's grief at the loss of his favourites induced him to make an effort at preserving their dead bodies, and he is said to have succeeded in this by the aid of his physician, who invented animal stuffing for the occasion. These birds are reported to have given rise to the Leverian Museum, specimens from which may yet be met with in the British Museum.

FRANCE.

It is much to be regretted that no contribution has come from France. The attention and the chemical and scientific research bestowed upon this art by French naturalists, Bécœur of Metz, the inventor of the metallic-soap,* Fontenelle, Dufresne, and others, and the value of their writings is well known to naturalists; and it would have been interesting to compare the present condition of the art in that country, with the progress which has been made elsewhere.

SARDINIA.

The only contribution is an elk from the Zoological Museum at Turin. This specimen is most remarkable. It exhibits to perfection the art of representing the living animal, not only in its general form and character, but marking also the fine and delicate undulations of the flesh and muscles, and all the anatomical details which are externally traceable. The difficulty of effecting this is so great that generally it is scarcely attempted; but in the present instance the artist has been most successful. The process adopted by Sig. **COMBA** (83, p. 1305), the exhibitor of this specimen, has been that of modelling the animal in clay, and from that model forming a mould; this mould enabled him to construct a figure of a material resembling papier-maché, retaining all the fidelity of the original model; upon this figure the skin is stretched.

UNITED KINGDOM.

The number of British exhibitors is thirteen. Of these the following deserve especial notice. **A. D. BARTLETT** (291, p. 817) exhibits an ingenious example of the art in the constructed figure of the Dodo—a bird which was once a native of Mauritius, and found there in considerable numbers at the beginning of the last century—but now, as far as is known, entirely extinct. The drawings of Savery, preserved in the Belvedere at Vienna, and in the Royal Gallery at Berlin, and some remains of a skeleton formerly in the collection, already alluded to, of Elias Ashmole, consisting now but of the head and one foot—are the data from which the figure has been compiled. The process is of course very different from that of preserving a real animal, the skeleton and skin of which are entire: an artificial body has to be constructed, and then covered, feather by feather, with such plumage as is most in accordance with our knowledge of the bird. This has been very skilfully executed; and the result, by the testimony of Mr. Strickland, and of Mr. Gray, of the British Museum. "represents with great accuracy the form, dimensions, and the colour of the Dodo, as far as these characteristics can be ascertained from the evidences which exist," whilst it "does great credit to Mr. Bartlett's skill, and to his practical acquaintance with the structure of birds."

There are other specimens exhibited by Mr. Bartlett, which are, perhaps, more attractive, inasmuch as they represent nature with a fidelity of which all can judge. The pair of Impeyan Pheasants, entitled "*Courtship*," and the Sleeping Ourang-outan, "*Repose*," are especially deserving of notice. The fleshy parts of the latter have been very skilfully treated; and the dried and shrivelled appearance which they so often assume is entirely avoided.

The skeleton of the ourang-outan has been preserved, and also the viscera; the whole furnishing an example of the manner in which rare specimens should be dealt with, in order to secure accurate information to the naturalist, and to promote the advancement of science.

J. A. HANCOCK, of Newcastle (320, p. 818), exhibits, in the North Transept, some beautiful examples, not only of a faithful and spirited adherence to life and nature, but of a skilful and harmonious combination of forms and colours. The three illustrations of Hawking, and the scene in the Tropics, will go far towards raising the art of taxidermy to a level with other arts which have hitherto held higher pretensions. The first of the three objects, illustrating the ancient sport of falconry, is the Hooded Hawk, looking lean and hungry, with the strap attached to his leg, by which he is held on the falconer's fist. In the second group, the falcon has struck to the ground, and is in combat with the *Quarry*, a powerful heron, who is struggling in vain against the attacks of his enemy; whilst the eel, which, but for the interposition of the hawk, would have been soon devoured by the heron, is quietly making his escape. The third tableau exhibits the gorged falcon: what a contrast is here presented! the blood-thirsty enemy of the heron is scarcely to be recognized in the drowsy figure: standing on one foot, the other being drawn up under his breast, the eye half closed, he is the very image of gluttony. The tropical group comprises cockatoos and parrots, disporting in a rich tropical vegetation, glittering (perhaps too much so) with brilliant butterflies and beetles, lizards, and other reptiles. The stolid, heavy, self-satisfied expression of the parrots is well brought out by comparison with the anxiety and trepidation of the Mate of the Dead Gull, in another group; or, with the restless gaze of the Lämmergeyer of the Alps. The contrast between life and death is also well kept up, by the display of a group of dead game, the ruffled state of the feathers being exceedingly truthful.

C. GORDON (202, p. 801) exhibits a representation of an owl "mobbed by small birds," in which the action of the owl and of his tormentors is given with great liveliness and fidelity.

Dr. **BEEVOR**, of Newark (204, p. 801), exhibits a dog, prepared much in the same way as the elk contributed from Sardinia, and although not included in the awards hereafter to be enumerated, it is deserving of favourable notice.

J. LEADBEATER (221, p. 801) exhibits a curious and instructive collection of Indian gallinaceous birds; and an extensive collection of humming-birds, comprising about 300 or 400 varieties, in the North Transept, which are very carefully set up.

T. M. WILLIAMS and **J. GARDNER** (219 and 223, p. 801) exhibit a brilliant assemblage of richly-plumaged birds from various parts of the world. The productions of these artists are apparently of a class rather for the drawing room than the cabinet of the naturalist. They have selected chiefly those denizens of the air most distinguished for the brilliant colouring of their plumage. So far as the careful preservation of the plumage is concerned, they deserve commendation, but in respect to a delineation of the habits of the birds by appropriate scenery, they fall short of the excellencies attainable in this art.

WURTEMBURG.

The collection of **H. PLOUCQUET**, Wurtemburg (107, p. 1120) consists of, 1st. A series of scenes taken from Kaulbach's illustrations of the well-known German story of Reynard the Fox (*Reineke Fuchs*), and executed with great skill. In these the exhibitor does not of course claim the merit of conception; but the humour with which the design of the artist is carried out, and the expression thrown not only into the attitude, but into the countenance of each animal, is admirable.

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* BECŒUR'S ARSENICAL SOAP.

Camphor - - - - - -	5 ounces.
Arsenic (*arsenious acid*), in powder	2 pounds.
Curd Soap - - - - - -	2 pounds.
Salts of tartar (*carbonate of potash*)	12 ounces.
Lime, in powder - - - -	4 ounces.

The soap is first cut in small slices, and melted gradually with water over a slow fire, stirring all the time. When melted, the salts of tartar and lime are added and well mixed. The mass is then taken from the fire, and the arsenic triturated with it in a mortar; and, lastly, the camphor is added, after having been separately triturated to powder with the aid of a little spirit of wine. The mixture has the consistence of stiff flour-paste.—The *Art of Taxidermy*, by Peter Boswell, p. 2.

2nd. Groups of birds and small animals in action, designed as well as executed by the exhibitor. Some of these also are humorous, and show considerable ingenuity, as, for instance:—a love-scene, illustrated by weasels; a parting-scene between a cat and a polecat; a literary polecat, &c. Others represent the movements or habits of birds in the care of their nests or of their young; the appearance of the broods at different ages, and the action of the parent birds in defending them against attacks from other animals. All are remarkable for spirited and life-like execution.

3rd. The representation of two large hunting scenes, such as form the subjects of Snyders' pictures: one, an attack of dogs upon a wild boar; the other, a stag pulled down by hounds. These evince great spirit, and a close study of nature; although, in one or two instances, the action of the limbs and muscles are not minutely correct. These inaccuracies, however, are so few and so slight, that they cannot detract from the very great merit which belongs to the whole of M. Ploucquet's exhibition. The process employed by M. Ploucquet in preparing some of his smaller specimens, has been to mould the figure of the animal in plaster-of-Paris, and to stretch the skin upon the model; and it has been most successful. The groups of M. Ploucquet attract by far the largest share of public attention.

There are twenty-six exhibitors of taxidermy, of these there are:—

4 Holders of a Prize Medal.
1 Who obtained Honourable Mention.
21 Unrewarded.

26 Total.

The classification, according to the various countries, is as follows:—

America, United States of	2
Belgium	1
British Colonies:—	
British Guiana	1
Nova Scotia	1
New Zealand	1
South Africa	1
Van Diemen's Land	3
West Africa	1
Sardinia	1
United Kingdom	13
Wurtemburg	1
Total	26

LIST OF AWARDS.

Bartlett, A. D., Great College Street, Camden Town (Class XXIX., 291, p. 817). Prize Medal for a model of the dodo, and several excellent examples in the higher branches of taxidermy.

Comba, F., Turin (Sardinia, 83, p. 1305.) Prize Medal for a stuffed elk, exquisitely modelled.

Gordon, C., Museum, Dover (Class XXIX., 202, p. 801). Honourable Mention for a group of stuffed British birds.

Hancock, J., Newcastle (Class XXIX., 320, p. 818). Prize Medal for several single specimens and groups of stuffed birds and animals, most truthful as to the representation of the habits and appearance of these creatures; and in every respect of the highest merit.

Ploucquet, H., Stuttgart (Wurtemburg, 107, p. 1120). Prize Medal for several humorous groups of stuffed animals; groups illustrative of the habits of birds; and two large hunting pieces.

C. ARTICLES CONNECTED WITH EDUCATION.

I. EDUCATIONAL MODELS.

There is perhaps no subject more deserving of the attention of enlightened persons, nor any means more conducive to the intellectual and physical advancement of a people, than the dissemination of *accurate* practical knowledge among all its classes; and it is one of the most gratifying circumstances of the present age to find many philanthropic individuals endeavouring to smooth the path to knowledge for those whose position in society does not permit of their engaging in a long course of study.

Beyond the mere rudiments of education, no branch of learning is more valuable to the working classes than applied physics and mechanics; and in those departments there are no means better calculated to impress the mind of the student with the great unchangeable laws of nature, and with the construction of the mechanical contrivances by which man renders them available for his wants, than working-models. Under ordinary circumstances, however, these useful aids are unobtainable by the majority of students, on account of their expense. In order to remove as far as possible this impediment, Edward Cowper, Professor of Manufacturing Art and Machinery at King's College, London, has contrived a series of *cheap* models to illustrate his courses of lectures, with the view of stimulating his students to imitate them, in consequence of their extreme simplicity. Finding that they fully answered their intended purpose, he has since allowed them to be copied by the Society for the Promotion of Christian Knowledge, for the purpose of their introduction into National-schools. The Society is thus enabled to supply them at a few pence only above their prime cost; and at the same time it also furnishes pamphlets explanatory of the various parts of each model and their functions, so that the teacher may readily acquire and easily impart a knowledge of the subject they are intended to illustrate. For example, a sectional-model of "the working-parts of a steam-engine," 20 inches by 10 inches, is furnished for 7*s.* 6*d.* All the parts are moveable, and the name of each is indicated by a printed label pasted on it; as cylinder, piston, piston-rod, connecting-rod, crank, fly-wheel, valve-box, slide-valve, steam going *into* the cylinder, steam going *out* of the cylinder, &c. It would be impossible to estimate how many of the millions of visitors to the Great Exhibition there are who would be thankful for the information obtainable in the North-East Gallery from this and similar *rough* but valuable models.

Besides the model of a steam-engine, the following are also exhibited:—An orrery, or stellarium, price 10*s.*, showing the revolutions of the earth round the sun, and of the moon round the earth; also the rotation of the earth on its axis, the inclination of the axis to the orbit, illustrating the cause of the seasons and the inclination of the orbit of the moon to that of the earth. A working-section of a pump, 24 inches by 10 inches, price 7*s.* 6*d.*; a six-inch sphere, for showing the phases of the moon, 2*s.*; a box of cubes, bricks, &c., for teaching tangible arithmetic, 8*s.* 6*d.*; a series of measuring-rods of 1 foot, 2 feet, and 6 feet in length, at 2*d.*, 4*d.*, and 6*d.* each; specimens of levers, also a scale-beam and steel-yard, 3*d.* each; a loom for weaving tapes, garters, &c., 7*s.* 6*d.*; a door-lock, 20 inches square, 7*s.* 6*d.* The only exhibitor of educational models which have come under the consideration of this Jury, is

Professor **Edward Cowper**, Kensington Park Villas (Class XXIX., 245, p. 802), to whom a Prize Medal is awarded.

II. ETHNOGRAPHICAL MODELS.

Under this title will be described a few collections of small figures illustrative of foreign costumes and manners, which have come under the notice of the Jury of Class XXIX., although they were arranged as belonging to Class XXX. These, apart from their excellence as works of art, possess a very high interest, as conveying, through the eye, a vivid representation of the customs, occupations, and habits of the natives of distant countries, not so easily apprehended from any written description, however well illustrated by drawings. These models are confined to the Court of the Fine Arts, with the Maltese, the Indian, and the Spanish Courts. Those contained in the first-named department attract by far the largest share of public attention; although in respect of the particular excellence which is here contemplated, they possess, perhaps, less interest than the very diversified and most extensive series in the Indian Court. It is to be feared that this latter collection will be dispersed with the other splendid contents of the department, before its value can be fully appreciated.

United Kingdom.

The Fine-Art Court contains a collection of very beautiful, life-like, and spirited figures, modelled in wax with most surprising minuteness and artistic feeling, both in the position and grouping. They represent the natives of Mexico, and also the American Indians (p. 833), habited in their proper costume, and displaying their characteristic customs in the several phases of civilized and savage life, with a truthfulness in the varied expressions and anatomical development of the different effigies, which is most remarkable. An Indian, rejoicing in triumph over the despair of a white victim, whom he has bound and is about to scalp, but whose sufferings he is prolonging with savage cruelty, may be especially cited in illustration of this particular excellence; and the group of three figures, entitled "a confessional," as an instance, displaying a rich vein of humour. The "*Aguador*," or water-carrier; the "*Remendon*," or street-cobbler, in his tattered garments; the group of civilized Indians laden with produce; the group of savage Indians, called "*Mecos;*" the *Fandango*, a national dance, illustrated by two Indian women dancing to the guitar, played by a male figure, with numerous other examples which might be adduced, are also all deserving of equal praise.

India.

The Figures in the Indian Courts, which have, it appears, been contributed by several Exhibitors, are either modelled in clay or plaster, or else carved in wood, and painted to represent the natural colours of the various objects. The largest group, which was contributed by Mr. Mansfield, of the East India Company's civil service, is contained in a model of the "*Jumma Bundi*," or the encampment of a government collector, whilst moving about on his annual tour through his district (pp. 926, 927). The figures are of plaster, and the buildings of wood. The double-poled tent of the collector is pitched at a short distance from the village; and he is represented as sitting within it, surrounded by the "*Mamletdar*," and other revenue-officers. Several petitioners are congregated around the door of the tent, soliciting a remission of part of the payments due from them. The figures of men and animals are about three hundred in number, and present a lively representation of Indian life and character. Some are indolently lying under the trees, some are gazing at the performance of a snake-charmer, and some feeding an elephant; whilst others, more intent on the business of the day, are having their petitions written out by the village accountants, or "*Coolkurnees*." The village, near which the encampment is formed, is represented inside a fortified wall, which surrounds it, and which is shown in section. There are also to be seen the numerous shops and rows of houses in the village, with the inhabitants engaged in their various pursuits.

The best executed and most instructive models, however, are those of clay, manufactured in Kishnaghur (p. 926), representing the various castes and professions of the Hindoos, which collection comprises upwards of sixty illustrations, some consisting of several figures. Here, almost in the closest juxtaposition with the splendid cotton-carding, spinning, and weaving machinery exhibited in Class VI., there is to be seen a Bengal woman cleaning cotton with the strung bow, and another spinning with the most primitive of apparatus; and the weaver preparing his thread on his roughly-made loom. Not far from Nasmyth's steam-hammer, the "*Khamar*," or Bengal blacksmith, is represented with his simple bellows, forge, and anvil; and within a very short distance from the latest refinements in agricultural implements and machinery, are illustrations of ploughing and harrowing with apparatus which no European could use; and rice-grinding that must require all the patience of an Indian to perform. On a line with the locomotive-engines which convey our correspondence with a celerity not dreamed of a few years since, and even now insignificant in comparison with the lightning speed of the electric-telegraph, are effigies of the *Dawk-runner*, or Bearer of the Government Mail-bags; and the *Dawk-bandy-burdar*, or messenger who carries Post-office Parcels; and closely watched by the unarmed policeman are the *Bro-jobassee*, or armed watchman, and the *Chowkeedar*, or village watchman. These are only a few of the groups of this most suggestive and well-executed collection. It will recompense the most attentive study; and the visitor cannot fail to be astonished at the very simple implements used by the Hindoos to effect operations for which costly and ponderous machinery are generally employed with us. An instance in addition to those already cited may be pointed out in the primitive pair of wooden cylinders for crushing the sugar-cane, which are turned by a single individual with a cross-handle, whilst two others are engaged, the one in feeding the machine, and the other in taking away the juice and the crushed cane. This simple machine, although not comparable with the gigantic three-roller crushing-mill with its attached steam-engine, seen in Class VI., nevertheless shows that the Indians were acquainted with the principles involved in its construction.

Less perfect in point of execution than the Kishnaghur clay-figures, but still most interesting, are the models manufactured at Gokak (p. 926), which it appears are not made as articles of export, but only to order. This collection comprises about forty illustrations, out of which may be especially noticed, as representing trades, the Cotton-printer, the Potter, the Woman grinding meal, the Bengal Water-carrier, or *Bheestee*, and the Washerwoman, or *Dhobie*.

The Models illustrating the practices of the Thug murderers excite the most painful interest, and represent the following incidents:—A traveller, induced to sit down and smoke, has his attention directed to the heavens, when the fatal handkerchief is applied by a Thug who stands behind him; but in another group a horseman is successfully defending himself from an attack on the part of the Thugs, one of whom he has slain. The mutilation of the bodies of the murdered, and their concealment in a well, and the strangling of travellers on horseback and on foot, are also represented. It is stated that some of these Thug murderers, after having been arrested and reclaimed, and domiciled in a school of industry, were the manufacturers of the carpets exhibited in the Indian tent.

The other Models contained in the Indian Court comprise thirty-five figures in wood from the Rajah of Jodhpore; a model of a European court of justice, and also one of a native court; models of a silk-factory and an indigo-factory, of a native oil-mill, and of a farm-establishment (p. 927). A series of male and female figures, exhibited by T. E. J. Boileau, (p. 927), represent the principal Sects in Cochin China and Travancore.

Malta.

The Figures from Malta, which are modelled in wax, have not the same claims to merit as those before described, but have still a certain amount of excellence. They represent the Grand Master Valetta, the Grand Master Lonzadari, with the Master of the Order of Malta, and a Knight, in their proper costume (p. 946).

Spain.

Three Exhibitors contribute models illustrative of the manners and dresses of Spain. Two of these send figures in painted terra-cotta representing the inhabitants of Andalusia and Malaga; but the examples are not numerous, though they are remarkable for the beauty and correctness of the modelling (p. 1347). The other Exhibitor has sent a model of one-half of the interior of the arena for Bull-fights at Madrid, made in wood, and containing, it is said, about 4,000 figures, exhibiting the various incidents proper to the place (No. 289, p. 1347).

There are eleven Exhibitors in this section; of these there are—

4 Holders of a Prize Medal.
1 Who obtained Honourable Mention.
6 Unrewarded.
—
11 Total.
—

The number of Exhibitors from the various countries is as follows:—

British Colonies:—		
India	6	
Malta	1	
		7
Spain		3
United Kingdom		1
		11

List of Awards.

Cubero, J. (Spain, No. 282, p. 1347). Prize Medal for Three Terra-cotta Figures, representing the Costumes of Malaga.

East India Company, The Hon. (India, Class XXX., p. 926). Prize Medal for a series of upwards of Sixty Clay Figures manufactured at Kishnaghur, representing the various occupations of the Hindoos.

Gutierrez de Leon, R. (Spain, No. 281a, p. 1347). Prize Medal for Three Terra-cotta Figures, representing the costumes of Andalusia.

Mata Anguilera, J. (Spain, No. 289, p. 1347). Honourable Mention for an interesting Model of a Bull-fight, illustrated by 4,000 figures.

Montanari, N., Upper Charlotte Street, Fitzroy Square (Class XXX., No. 224, pp. 833, 834). Prize Medal for his very beautiful and interesting series of Statuettes illustrating the customs of the Mexicans.

III. Collections of Produce.

Under this general title there are to be noticed four very important and instructive collections. Two of them consist of the Imports of Raw Materials and Manufactures into Liverpool and Hull respectively; one of the Inorganic and Organic produce of India, and one of Unwrought Materials and Manufactures from the State of Maryland, in the United States. The two most important are those of Liverpool and India, both from their extent and careful arrangement.

United Kingdom.

The Collection of Imports into the Port of Liverpool (pp. 803—816), exhibited by the Liverpool Local Committee, contains about five hundred and fifty different substances; but as in most cases several varieties of each kind are exhibited, it comprises a far greater number of specimens than is indicated by this estimate. The numerous articles included in this collection are arranged systematically under the following heads:—

Class A.—Organic Substances.

Section I. *Animal Products.*

1. Mammalia.
2. *Aves* (Birds).
3. *Reptilia* (Reptiles).
4. *Pisces* (Fishes).
5. *Mollusca.*
6. *Insecta* (Insects).
7. *Radiata.*
8. Articles produced by Insects.

Section II. *Vegetable Substances.*

1. Oils and Balsams.
2. Fruits, Nuts, &c.
3. *Materia Medica* (Medicinal products).
4. Vegetable Juices and Vegetable Extracts.
5. Dyeing Materials.
6. Tanning Materials.
7. Spices.
8. Oil Seeds.
9. Agricultural Seeds.
10. Dietetic Articles.
11. Vegetable fibres.
12. Timber and Hard Woods.
13. Miscellaneous (Hops and Rushes).
14. Tobacco.
15. Feculas.

Class B.—Inorganic Substances.

Section I. *Metallic.*
Section II. *Non-Metallic.*

To each article are appended the Commercial and Scientific names, and the name of the Class or Order to which they belong, with the quantity imported into Liverpool; the locality whence they were exported, and the use of each substance in the Arts are also indicated.

A glance at the numerous divisions and subdivisions just cited will immediately suggest how valuable and interesting such collections would be to the principal seats of British manufacturing industry, especially if they were made so comprehensive as to comprise all raw materials; and not only such as are usually imported, but those also which are known to be useful in the arts, or are likely to prove so, from the quantities in which they can be obtained. These Museums of Raw Produce would, however, be rendered even still more useful by the appointment of energetic curators, fully qualified by previous studies to impart accurate scientific and commercial information concerning their contents.

It appears from the statement of Mr. Thomas C. Archer, by whom the Liverpool collection was arranged, that the cost of it was about 400*l*., which must be regarded as a very small expense in comparison with the importance of the results to be derived from it. Ten months were occupied in making the collection; but it appears that the greater part of each day was consumed in obtaining the necessary funds, in soliciting samples from the produce-brokers, and in overcoming the hostile prejudices which existed concerning it. The evenings only were devoted to the classifying and naming the specimens which were obtained by gift or purchase. The time consumed was, it was stated, one of the principal items of cost, as the Liverpool Local Committee had to reimburse to Mr. Archer his salary from the Government, which he ceased to receive during the ten months he was engaged in making the collection. About 200*l*. were thus expended; but a large portion of this outlay is attributed to loss of time in soliciting subscriptions; for had sufficient funds been placed at the disposal of the Liverpool Local Committee in the first instance, Mr. Archer conceives that a collection ten times as extensive might have been formed, at a cost but little above that of the present one. This, indeed, was collected under great disadvantages, a few cases being provided as they were required or could be afforded. Much credit is due to the Liverpool Local Committee, and especially to Mr. Archer, for the perseverance which they evinced in prosecuting their labours under such difficulties, as well as for having produced, notwithstanding, so extensive and valuable an exhibition for so small an expense. As a detailed list of the specimens comprised in this display is given in the *Illustrated Catalogue*, pages 803—817, it is unnecessary to reprint it in this Report.

The Collection of Imports into the Port of Hull, exhibited by the Hull Local Committee, is of the same description as that of Liverpool, but far less extensive. This was to be anticipated from the relative commercial importance of the two towns, and from the nature of the trade of Hull, which is chiefly with the Baltic. Hence Flax, Iron, Tallow, Cereal-grains, Linseed, and Linseed-cake, form important items in it. Altogether there are about one hundred and twenty different substances exhibited, to which are appended the commercial and scientific names, and the quantity of each imported into Hull. A detailed list of the collection is given at pages 816 and 817 of the *Illustrated Catalogue.*

India.

The next of the series under review is the Miscellaneous Collection of Mineral, Vegetable, and Animal Substances (pages 860—907), used by the natives of India in their various Arts and Manufactures, as well as in Medicine. They were principally gathered from the Bazaars of the Bengal Presidency, by Dr. J. Forbes Royle, during his residence in India; but they include also some additions obtained by Dr. Falconer, in Cashmere, and by Dr. Stocks, in Scinde.

In the arrangement of this collection for the Great Exhibition, Dr. Royle states that he is much indebted to Mrs. Royle for her assistance. It is important, from the vast number of substances contained in it, which amount to between eleven and twelve hundred in number, procured from a few only of the Bazaars of India. They are used by the natives for a variety of purposes; but though many of those which are said to be useful as Medicines may not possess active properties, others are known with certainty to be some of the most powerful and efficient drugs; and it may also be inferred that there must be many others possessed of useful properties, though they are but little known in Europe. But independently of their medicinal uses, there are among the various substances many which are useful as food, or in the arts; as, for instance, the different Cereal grains and pulses; Starch-yielding Seeds and Roots, Oil-seeds, Gums and Resins, Dyes, &c., as well as Animal and Mineral bodies. These substances show, at a glance, the resources which the natives of India possess, and have long possessed, for practising many of the arts in which they attained, at a very early period, a very high degree of perfection, with apparently very imperfect means.

The collection is further interesting, both in a literary and scientific point of view, because most of the substances, which are here gathered into a focus, have their properties described in the various works on the Materia Medica which are at present in use in India. In those works a variety of synonymes are given, with the names of the same substances as known in the Hindoo, Persian, and Arabic languages, and very frequently in the Greek also. The universal knowledge of these productions is accounted for by the circumstance that the medical works which are in use by the Mahomedan Hakims in India are translations from the Arabic into Persian, with which has been incorporated information from the writings of the Hindoos. The Arabs, at the Court of Haroun-al-Rashid, it is well known, made translations from the Greek authors, such as Dioscorides; and hence it will be understood why many of the substances, mentioned in such Persian translations as are now in use in India, have both the Arabic and Greek synonymes assigned to them. By means of this collection we are enabled to examine numerous specimens of Asiatic natural productions, which are all labelled with their synonymes; and hence it is frequently possible to ascertain the very substances which both the Arabs and the Greeks have described, and to which they assigned an Eastern origin. Thus the *Nardus* (Spikenard) of the Greeks may be shown to be the *Jatamansi* of the Hindoos; and Dr. Falconer has identified their *Costus* with the *Koot* or *Koost* of the Arabs, a product of the mountains of Cashmere, which in former times found its way to Europe, and at present forms an extensive article of commerce with China. Many of these interesting parallels have been traced out by Dr. Royle, in his *Essay on the Antiquity of Hindoo Medicine*, as well as in his *Illustrations of Himalayan Botany*. He has also been able to identify some of the plants mentioned in the sacred writings, from their Arabic synonymes, as he has shown in his paper, *The Mustard-tree and the Hyssop of Scripture*.

As a complete list of the articles contained in this invaluable collection is given in the *Illustrated Catalogue* (pages 893–907), it is only necessary here to state that it comprises Nine hundred and nine substances of vegetable origin, Thirty-two animal products, and Two hundred and two bodies derived from the mineral kingdom. To every specimen its scientific name and synonymes are appended, and also the locality whence it was obtained. The vegetable substances comprise 193 Roots, 10 Woods, 202 Barks, 445 Fruits and Seeds, 12 Galls, and 47 Gums, Resins, and Gum-resins. If a collection of all those products which are but little known were rendered available, under certain restrictions, to the investigations of the scientific chemist, it would undoubtedly do much to advance our knowledge in organic chemistry, and could not fail to be productive of material benefits, not only to the science of medicine, but also to the arts.

United States of America.

The Collection of some of the Products and Manufactures of the State of Maryland (United States, 371, p. 1459), which is contained in an ornamental cabinet made of the principal woods of that State, comprises about Eighty different substances. The chief of them are ores, chemicals, and woods; and the cabinet itself illustrates the uses to which the woods may be applied. The Jury of Class IV. having also awarded a Medal to this interesting collection, it is to be expected that the various objects exhibited will be discussed in detail in their Report; but as the *Illustrated Catalogue* does not contain a list of them, the following summary will not be regarded as misplaced:—

Minerals.

Anthracite Coal—2 *kinds*.
Bituminous Coal.
Building-sand.
Copper-ore—3 *varieties*.
Free-stone.
Gold-ore.
Granite—2 *varieties*.
Iron-ore—8 *kinds*.
Lead-ore.
Marble—3 *varieties*.
Soap-stone—*Steatite*.

Metals.

Copper rods.
Copper sheets—3 *kinds*.
Pig-iron.
Wrought-iron.
Yellow-metal.

Metallic Manufactures.

Iron Nails.
Shots.
Stereotype-plates.
Types.

Chemical Manufactures.

Alum (*Double sulphate of alumina and potash*).
Bichromate of potash.
Blue vitriol (*Sulphate of Copper*).
Chloride of lime (*Hypochlorite of Lime*).
Chrome-yellow (*Chromate of Lead*).
Chrome-green (*Chrome-yellow and Prussian-blue*).
Copperas (*Proto-sulphate of Iron*).
Epsom-salts (*Sulphate of Magnesia*).
Glue (*Gelatin*).
Magnesia.
Magnesia, Carbonate of.
Prussian blue (*Sesqui-ferrocyanide of Iron*).
Red lead (*Red oxide of Lead*).
Saltpetre (*Nitrate of Potash*).
Soap.
Stearic acid.
White zinc (*Oxide of Zinc*).

Building Materials.

Bricks—3 *kinds*.
Fire-bricks.
Lutch-bricks.

Vegetable Substances.

1. *Woods*.

Ash.
Beech.
Cedar.
Cherry.
Hickory.
Holly.
Lime.
Locust.
Maple—2 *kinds*.
Mulberry.
Oak.
Pine.
Poplar.
Walnut.

2. *Cereal Seeds and Meal*.

Barley.
Buckwheat.
Buckwheat-meal.
Indian-corn, yellow and white.
Indian-corn-meal.
Oats.
Rye.
Wheat, white and red.
Wheat-flour.

3. *Tobacco.*

Chewing Tobacco.
Leaf Tobacco.

4. *Vegetable Manufactures.*

Cotton Goods.
Flax Thread.
Paper.

5. *Animal Products.*

Belt-Leather.
Calf Leather.
Cloth, of mixed cotton and wool.
Felt.
Morocco Leather.
Silk.
Woollen Cloth.

The number of Exhibitors in this section is Four, to all of whom Prize Medals have been awarded.

The following is the classification of the contributors, according to their respective countries:—

America	1
British Colonies (India)	1
United Kingdom	2
	4

List of Awards.

Archer, Thomas C., Liverpool (Class XXIX., No. 270, pp. 803–817), Prize Medal, for the collection of the samples of Foreign Articles imported into Liverpool within the last five years, of which he was the Collector and Arranger.

Hull Local Committee (Class XXIX., No. 290, pp. 816, 817), Prize Medal, for the collection of Staple Imported Articles of the port of Hull.

Maryland, Committee of (United States, No. 371, p. 1459), Prize Medal (*the same Award being given by the Jury of Class IV.*), for a cabinet containing specimens of some of the products and manufactures of the State of Maryland.

Royle, Dr. J. Forbes, India (p. 893), Prize Medal, for a collection of Mineral, Vegetable, and Animal Substances, useful in Medicine and the Arts.

To which may be added, the Award of a Prize Medal to the Sultan of Turkey, for numerous examples of Soaps, Candles, Confectionary, and Pipes, which have been noticed in the respective articles on those subjects also included in the present Report.

D. MANUFACTURES FOR PERSONAL USE.

I. Dressing-Cases, Writing-Desks, Work-Boxes, &c.

Although Writing-desks are comprised in the list of articles allotted to Class XXIX., yet, as they are also included in that of Class XVII., to which they appear more properly to belong, they are displayed in both. The latter class, however, contains the greater number of examples; and, likewise, the most important of those which are covered with Russia and other leathers, and either "chequered" or ornamented after the manner of the bookbinder. Work-boxes are not nearly so numerous, and are chiefly from Belgium. Dressing-cases, consequently, form the chief portion of the contributions in the branch of art now under consideration; and they are exhibited almost exclusively by British and French manufacturers, who appear to monopolise the supply of these articles. On account, therefore, of the prominent position of Dressing-cases in Class XXIX., they will be chiefly treated of in the subsequent remarks; Writing-desks and Work-boxes being, however, noticed, wherever they call for especial observation. The latter may, indeed, be regarded, in some instances, as modifications of dressing-cases, in which some of the contents are allowed to predominate over others; for those cabinets very frequently contain writing materials or apparatus for ladies' work: and, on the other hand, the fittings of writing-desks or work-boxes sometimes comprise a toilette-set, more or less complete. Of both of these kinds several examples are shown in the Exhibition.

Dressing-Cases.—The tasteful and compact arrangement of these most useful receptacles belong to a very modern period; but they have, probably, not even yet attained the high degree of elegant convenience of which they are capable. In their primitive character, however, which is simply that of containing some of the materials of personal adornment,—even the dressing-case is of considerable antiquity. There is a remarkable allusion to coffers of ivory, probably wrought into the forms of buildings, and containing perfumes, in Psalm xlv. 8; where the passage describes the dressing of a queen by her maids of honour, when preparing to receive her royal spouse.

At a later period, in the days of Roman luxury, the toilette-box of a Roman lady seems, at least sometimes, to have exhibited a methodical arrangement of its contents, and to have been elaborately decorated with the best art of the period. "In the spring of 1794," says Carl August Böttiger, "some labourers digging for a well in the garden belonging to the convent of the nuns of St. Paul, not far from the Suburra, at the foot of the Esquiline-hill, came upon a large subterranean chamber filled with crumbled ruins; from which, after some time, they succeeded in extricating a chest filled with an ancient Roman toilette-apparatus." The casket was of silver, as well as all the articles found with it, and the same authority continues to state that the dressing-box itself was 2 feet in length, 1½ foot in breadth, and 1 foot in height. It was quadrangular, and consisted of two truncated pyramids, joined at their bases, one of which constituted the box and the other the cover. The exterior ornament of this cabinet, represented a variety of most interesting sculptures relating to the adorning and bringing home of a bride; and the inscription "*Secunde et Projecta Vivatis,*" seems to confirm the supposition that the cabinet was a female dressing-case and a wedding gift.*

With this ancient casket was also discovered another receptacle, of the species which the Romans denominated *Capsula;* and which, by the chains attached to it, appeared to be intended for suspension from the arm. This vessel formed a box of sixteen sides on the exterior, having a circular cover; and greatly resembled a *Scrinium* for containing manuscript rolls, especially as it was decorated on the outside with raised figures of eight of the Muses, interchained with garlands; the remaining Muse being placed on the summit. The capsula measured 1 foot in height, and was about 15 inches broad at the base. Within the case was a flat top or tablet of copper, dividing it into one large central compartment, surrounded by four of a smaller size, probably originally intended to receive volumes of books. The contents, however, were boxes, essence-phials, small pateræ and ewers, several toilette-spoons, a taper-stand in the form of a closed hand, a beautiful little vase covered with arabesque figures, and some ornaments for a litter: all which furniture was of silver. The size, the extent, and the luxury, of these antique dressing cases will, however, be considered less remarkable, when it is remembered that the perfumes, the ornaments, the mirrors, and all the toilette-furniture of a female, was called by the Roman jurisconsults "*Mundus Muliebris,*" or a woman's world; and, indeed, they have their parallels in the Great Exhibition.

Cases for combs and mirrors, which were usually kept together, were common in England from the latter half of the sixteenth century; when the haberdashers and milliners, who dealt in foreign small-wares had increased to an extent unknown before in all the streets of the metropolis, and in the Upper-Pawn or gallery of the Royal Exchange. Some of the cabinets of this period also contained bottles of sweet waters; and pomanders, or perforated silver balls for perfume, for neutralizing disagreeable odours or infection. Such a toilette-case was presented, in 1562, to Queen Elizabeth, as a New-year's gift, from Sir John Alee; it being described as a coffer of wood, carved, painted, and gilt, with combs, glasses, and balls.

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* Böttiger's *Sabina oder Morgenscenen in dem Putzzimmer einer reichen Römerin*, p. 62, Leipsig, 1803; translated in the *New Monthly Magazine*, 1818, vol. x., p. 419.

In general, however, down to perhaps the middle of the eighteenth century, the most costly toilette-furniture seems to have consisted of a great variety of articles which covered the dressing-table. It is possible that the thought of fitting up a single receptacle with various useful contents, was suggested by the boxes brought from Japan towards the close of the seventeenth century. These were made to contain a number of smaller boxes for powder, patches, &c., of different shapes, and contrived neatly to fit each other. In the "Fop's Dictionary," contained in the very curious tract on female costume, published by Evelyn in 1690, entitled "*A Voyage to Marryland, or the Lady's Dressing-room Unlocked,*" a cassette of silver filigree is mentioned, and explained to signify "a dressing-box;" but from the description, it really appears to have been a case for perfumed waters. All the rest of the appointments consist of a profusion of scattered luxuries, like those which are also described in the commencement of Pope's "Rape of the Lock."

A lady's dressing-case of the present day would appear to have been originally contrived with a view of containing almost as many articles of convenience or luxury as were enumerated by Evelyn as belonging to a lady, towards the end of the seventeenth century; and however appropriate such may have been to that period, it is certainly ill adapted for travelling in the nineteenth century; excepting, perhaps, for long voyages in half-civilized countries, or unfrequented tracts where the ordinary necessaries of the toilette are not procurable. In travelling, however, through the polished cities of Europe, it is not more needless to be encumbered with a store of gold, when circular notes are obtainable, than it is to carry large quantities of perfumery or any other similar article which can be readily purchased. And if the many vessels usually introduced into a lady's dressing-case were reduced in number and size, it might become nearly as portable as that of a gentleman. Yet, although this is obvious, it is remarkable that not a single example of a lady's dressing-case is to be found in the Exhibition suitable for convenient package or for rapid travelling, when superfluous baggage is very undesirable. At the same time there are numerous instances of gentlemen's dressing-cases, extremely portable, mostly made of leather, which has been found better adapted for the purpose than wood.

The ordinary description of Dressing-cases, Writing-desks, and Work-boxes, admit of classification into two very distinct branches of manufacture, allied, however, by the contents of the cases, some of which are the same in both kinds. The first class is that in which the case is composed of hard-woods, and its ornamentation due entirely to the arts of the cabinet-maker and buhl-worker. The second class comprises all those examples in which the body of the box is made of soft woods, or moulded in pasteboard, and afterwards covered with leather of various kinds. The exterior is then ornamented, either in a simple style, with creasing-tools guided by means of a wooden straight-edge, or more elaborately with tools similar to those of the bookbinder. Besides wood and leather, it should be stated that papier-maché has been introduced into this manufacture, as indeed into many others; and frequently with more regard to a glittering appearance than to beauty of design, of which, however, this material is perfectly susceptible. The natives of India, China, and Japan, have employed their various arts in the manufacture of dressing-cases, desks, and work-boxes, suitable for the use of Europeans, and have adorned these respective productions according to their own peculiar styles of ornament.

The articles on which the Jurors of Class XXIX. were principally required to decide, are those belonging to the first two of the preceding varieties: yet, on consulting the Award-books, it would appear that other Juries have also investigated the merits of some of those productions. It is, however, satisfactory to find that they have, by their decisions, confirmed the Awards of the Jury to which they properly belong. Those Awards have been, in most instances, omitted in the list for Class XXIX., as no Exhibitor is entitled to more than one recompense for the same description of goods: they are, however, for obvious reasons, mentioned in this Report.

Austria.

The chief contributions in the Austrian Department are a Dressing-case, and a Dressing-table, covered with velvet and ornamented with pierced ivory, in which both the material and the ornament are evidently ill-adapted for the intended purpose. Besides these, there are some Ladies' Work-boxes of wood, and Dressing-cases and Work-boxes of papier-maché, both of which varieties are of an inferior description, and not remarkable for cheapness.

Belgium.

Five Exhibitors, from that once fashionable watering-place, the town of Spa, contribute numerous articles of the so-called Spa-ware, consisting of Work-boxes, Netting-boxes, Reading-desks, Portfolios, Glove-boxes, and other similar articles: these are made of sycamore or maple wood, which has been coloured by immersion in the natural ferruginous waters of the place. The iron compounds (probably chiefly tannate of iron), which are formed by the combination of the peroxide of iron with the vegetable juices, not only develop the minute structure of the grain, but also give an agreeable slate-tint to the wood, which then forms a pleasing background to the elaborate paintings with which the manufactures are embellished. After having been decorated, they are preserved from injury by several coats of varnish, which still farther increases the beauty of the wood, by bringing out the grain.

British Colonies.

The contributions from the British Colonies are numerous, but they must, in most cases, be regarded rather as curiosities than as articles of large sale. From *Ceylon* there is only one article, namely, a Desk of Porcupine-quills, arranged parallel to one another, and surrounded with a border of carved ivory, the sunken portions being filled with colour. The *Indian* Court contains numerous specimens of boxes made of a variety of materials, and ornamented with great taste in several different patterns. Amongst these may be enumerated a Desk and Envelope-box of ivory and sandal wood, and a Porcupine-quill box from Calcutta; a beautifully and elaborately carved Cutch-box, and several specimens of boxes from Bombay, ornamented with tasteful and minute inlaying. *New South Wales* contributes a Desk of polished woods of different kinds. From *New Zealand* there is a box which may be regarded as a native dressing-case, as it is used by the aborigines to contain their head-dresses. In the *South African* Section is exhibited an Olive-wood work-box, which has been sent from the **Groenkloof Missionary Station**. And lastly, from *Van Diemen's Land*, Mr. **McNaughten** contributes a Writing-desk and a Work-box, made of Musk-wood, and inlaid with pine, black-wood, she-oak, and myrtle.

China.

There are Three Exhibitors of Writing-desks and Work-boxes in the Chinese Department. Mr. **Charles Copeland** (p. 1421) sends a Writing-desk used by the Chinese, which contains pencils and other materials for writing, and also a *Swan-pan* or calculating board; and a Japanese Writing-desk, inlaid with mother-of-pearl. Two examples of Japan desks are also exhibited by **Hewett** and Co. (p. 1421), one of which is ornamented with a bouquet of flowers formed of mother-of-pearl, and the other with a landscape painted in relief with gold bronze. These specimens are interesting as belonging to a class of goods now much imitated by the papier-maché manufacturer, but must not be regarded as of the highest class of Japan-ware. The now most celebrated manufacturer of these goods, says our colleague M. Natalis Rondot, is Hip-qua of Canton, who has made for himself a beautiful, though small, collection of lac-ware caskets. M. **de Siebold**, of Leyden, also possesses many of the most beautiful examples extant; and the Museum of the Hague also contains many rich specimens. A Camphor-wood work-box, with carved ivory fittings, is sent by **Hancock** and Co.

EGYPT.

The Egyptian Court contains a Writing-case made of Alizier-wood.

FRANCE.

Although the Exhibitors in the French Department are few, their display, chiefly of Dressing-cases, is most gorgeous and costly, and the articles contributed are remarkable alike for their beauty, brilliancy, and variety. The cabinet-maker of Paris stands unrivalled for the elegant lightness of his designs and the exquisite finish of his workmanship; and the same is true of the French artist in buhl and marqueterie. Hence it will be readily credited that the plain French caskets are unsurpassed, and the more ornate unequalled. With regard to the fittings—whilst due praise must be given for the taste displayed in the designs, the spirited enchasing, the execution of the enamel, and the due balance of bright and frosted work, yet at the same time it must be stated that the French silver has not the high degree of finish usual in the fittings of an English dressing-case. This defect is in a great measure to be ascribed to the metal being polished without the workman having recourse to those numerous preparatory manipulations which give evenness to the surface. Hence the undulations of surface betray how much has been done by the burnisher and how little by the polisher. The cutlery and glass are also inferior. It must, however, be stated that these dressing-cases are relatively far cheaper than those of the English; and although each silver article is lighter, yet, as there are more fittings and their size larger—for an ewer and a washing dish are usually included—in the aggregate there is a much greater weight of silver given in proportion to the amount paid. This is in some measure due to the almost nominal duty on silver plate in France, which is only 11 fr. per kilogramme (3½*d.* per troy ounce of 480 grains). It contains 50 parts of alloy in 1000, with a toleration of a farther quantity of alloy, not to exceed 11 parts per 1000. The French have not yet succeeded in the manufacture of Russia and other better classes of leather dressing-cases, and but few examples are to be found in their section; these appertain to the class of goods belonging to Class XVII., the Jury for which has examined them.

In 1847 there were in Paris One hundred and fifty-eight dressing-case, work-box, and writing-case makers, employing Nine hundred and eighty workpeople (882 men, 30 women, 68 boys), who manufactured goods valued at 155,120*l.**

PERSIA.

The Persian Court contains examples of inlaid and japanned Work-boxes, and also a Pen-case, which are contributed by Mr. Mills, jun., who states that they were collected by his father during his residence in that country. They may, therefore, be considered as truly representing this description of manufacture in Persia.

PORTUGAL.

His Majesty the KING OF PORTUGAL (1237, p. 1318) contributes an elegant Ebony Writing-case, inlaid with ivory.

SAXONY.

One Exhibitor in the Saxon Department, W. ROCKHAUSEN (172, p. 1112), sends several creditable glove-boxes, made of rosewood and sycamore, some inlaid with mother-of-pearl. The prices of these are 42*s.*, 45*s.*, and 60*s.* per dozen. There is also a lady's dressing-case in his collection, valued at 60*s.*, which, from its simplicity, recalls the remark of Böttiger, after describing the Roman toilet-box before spoken of, when he says, "Our ladies are generally satisfied with boxes of atlas (satin) or rosewood, inlaid with brass or silver, while the ancient fair condescended not below silver materials, and the workmanship of a sculptor."

SWEDEN.

The Swedish Court contains a Writing-case which calls for no particular comment.

UNITED KINGDOM.

The Exhibitors of Dressing-cases and Work-boxes principally, but also of Desks in Classes XXIX. and XVI., are nineteen in number. Besides these, there are Fourteen Exhibitors in Classes XXII., XXVI., XXVIII., and XXX., whose productions did not come under the notice of the Jury of Class XXIX.; and the fact that writing-desks and writing-cases are exhibited chiefly in Class XVII. has been already adverted to. Confining the present remarks, therefore, to the two first-named Classes (XXIX. and XVI.), it may be stated, that the general display of British Dressing-cases, &c., is highly creditable to the numerous Exhibitors. Beside many examples of the more usual kinds of wood dressing-cases, remarkable for their cheapness and excellence, it comprises some examples of a more costly description, which, in comparison with those in the French Department, are, unquestionably, higher in price, even after making all allowances for the lower duty of silver in France. They are, however, exquisitely finished, in all the details of the case and fittings, which are unsurpassed for excellence of workmanship. Indeed, the silver-work is far higher in point of finish than the French, a circumstance which has already been commented upon. In Leather Dressing-cases the British have no competitors, either for cheapness or excellence of workmanship; and the numerous examples which are displayed were highly praised by the Foreign Jurors.

It is chiefly within the last twenty years that Leather Dressing-case making has attained its present high state of development; and this is principally to be attributed to the liberal support of the better class of workmanship given by the leading houses in the trade, and to the judicious encouragement of the individual efforts of their workmen by a due appreciation of their merits. The improvements which have taken place within the last ten years in the manufacture of dyed leathers in England, has also had a very beneficial effect on this branch of manufactures. The number of Leather-case makers in Great Britain is not large, there being only 468 workmen and 250 females. As the best description of work is produced principally in London, the greatest number of workmen are there employed, amounting to 368, the workwomen being only 20; whilst, in Sheffield, there are no less than 200 females, who are considered to be very skilful, and only 47 workmen, employed, who are chiefly occupied with the more common dressing-cases, and in making the better kinds of razor-cases. In Birmingham, there are 50 workmen and 30 girls, also engaged on articles of a second class. Beside these, there are many workmen employed in making wood dressing-cases and the various fittings; but the Reporters have not been able to ascertain their number. It may be remarked, that the glass trays and covers are made principally in London and Birmingham, whilst Sheffield produces the metal covers, and shares with London in the supply of the cutlery. The hinges, handles, and other metal work, are obtained chiefly from Birmingham.

One of the largest Exhibitors of Dressing-cases, Work-boxes, and Desks, in Class XXIX., is our colleague, Mr. J. J. MECHI (No. 45, p. 791), who is, by his position of Juror, precluded from competing for a recompense. In justice, therefore, to the excellence of his productions, the following resolution was proposed to the other Jurors of this class by M. Natalis Rondot, seconded by Viscount Canning, and carried unanimously, on the 23rd of July, 1851:—

"*M. J. J. Mechi a exposé une collection de Nécessaires-de-voyage, de Papeteries, de Tables et Coffrets-à-ouvrage dans laquelle on trouve une remarquable diversité de modèles et d'ornements.*

"*Membre du Jury de la Classe XXIX, M. Mechi ne peut en raison de cette haute position recevoir aucune récompense. Le Jury regrette qu'il ne lui soit permis, pour cette raison, d'inscrire le Nom de M. Mechi parmi les plus dignes; mais il est heureux de constater la belle, importante, et intelligente fabrication des ouvrages que M. Mechi a exposés.*"

WURTEMBURG.

Wurtemburg is represented by one firm, WEBER and Co. (No. 86, p. 1119), who exhibits stained Sycamore work-boxes. The sycamore is first coloured with an artificial ferruginous water, and, after staining, the block is cut up into veneers, which are used to cover the work-boxes. These are not ornamented with paintings like the Spa-wares of Belgium, already noticed.

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* *Statistique de l'Industrie Paris*, Part II., p. 821.

There are Fifty Exhibitors in this subdivision. Of these are:—

5	Holders of a Prize Medal.
5	Who obtained Honourable Mention.
40	Unrewarded.
50	Total.

The number of Exhibitors from the various countries is as follows:—

Austria		3
Belgium		5
British Colonies:—		
Ceylon	1	
Gibraltar	1	
India	1	
New South Wales	1	
New Zealand	1	
South Africa	1	
Van Diemen's Land	1	
		7
China		3
Egypt		1
France		6
Persia		1
Prussia		1
Portugal		1
Saxony		1
Sweden		1
United Kingdom (beside 14 in Classes XXII., XXVI., XXVIII., and XXX.)		19
Wurtemburg		1
Total		50

LIST OF AWARDS.

ASPREY, CHARLES, 166 New Bond Street (Class XXIX., No. 50, pp. 791-92). Honourable Mention, for a beautiful set of Twelve Malachite and Ormolu Table-ornaments, the price of which was stated to be 240*l.*; and also for some Dressing-cases and Writing-desks.

AUCOC, sen., Paris (France, No. 1052, p. 1229), Prize Medal (*the same Award by the Jury of Class XXIII.*) for a collection of very rich and elegant Dressing-cases; some with silver and others with *vermeil*, or silver-gilt mounts and fittings. The most remarkable objects are: a Dressing-case of Yew (*Bois d'If*), value 80*l.*, with chased silver mounts and fittings; and a Lady's ebony Dressing-case, value 400*l.* It is furnished with *vermeil* fittings, comprising, besides numerous trays and jars, a square washing-basin and ewer, also of *vermeil*. Taking the weight of silver and the amount of workmanship into consideration, the prices quoted were considered to be very reasonable.

AUDOT, L. D. J., Paris (France, No. 11, p. 1170), Prize Medal (*the same Award by the Jury of Class XXIII.*), for a collection of very excellent and tastefully ornamented Toilet-boxes, comprising a Lady's Dressing-case of ebony and buhl, with silver mounts, valued at 300*l.*, and containing 183 ounces troy of silver; a rustic ebony and buhl Dressing-case (180*l.*), containing 148 ounces troy of silver; and a Gentleman's ebony and buhl Dressing-case, with elegant silver mounts, the price of which was 57*l.* The prices of these and other articles were considered to be very reasonable.

AUSTIN, GEORGE, Dublin (Class XXIX., No. 36, p. 791). Honourable Mention, for a Lady's Dressing-case, with silver fittings, and a Gentleman's Dressing-case, made of Irish bog-yew, also with silver fittings; and for Writing-desks of Coromandel-wood, which are more remarkable for the goodness of the workmanship than for any excellence in the ornaments. The price of the Lady's Dressing-case is 90*l.*, and that of the Gentleman's 80*l.*

EDWARDS, T. J., King Street, Holborn (Class XXIX., No. 89, p. 795), Prize Medal, for Dressing-cases and Writing-desks, of the very highest class of workmanship, both as regards the box and the mounts, but very high in price. In the construction of the boxes a friction-hinge is employed, which excellent contrivance admits of the various compartments remaining open to any required extent, and avoids the necessity for numerous loose trays. The more remarkable objects supplied by this Exhibitor are a Lady's Dressing-case with silver-gilt fittings, value 160*l.*, a Gentleman's Dressing-case, and a Gentleman's Writing-desk, value 50*l.* The Lady's Dressing-case contains a tooth-brush-tray, 2 soap-trays, nail-brush-tray, a toothpowder-tray, a salve-box, 3 scent bottles, 2 large jars, 2 pairs of scissors, 2 button-hooks, a piercer, 2 cork-screws, 2 pen knives, tweezers, 2 bodkins, 2 pearl-backed hair-brushes, 2 tortoiseshell hair-brushes, 2 tortoiseshell combs, a shoe-horn, ink-bottle, a gold pen, a gold pencil-case, and a blotting-book.

LAURENT, F., Paris (France, No. 564, p. 1205), Prize Medal, for great excellence in workmanship and in the design of numerous caskets, the most remarkable of which are, an Ebony and Buhl Dressing-case, with silver mounts, value 127*l.*; a Buhl Jewel-box, 7*l.* 10*s.*; a Buhl Writing-desk and Papetière, 20*l.*; and a Shawl-box, 26*l.*

LEUCHARS, WM., 38 Piccadilly (Class XXIX., No. 44, p. 791), Prize Medal (*the same Award by the Jury of Class XXIII.*), for various Dressing and Travelling-cases, tastefully designed, and of excellent workmanship. The following are some of the articles deemed worthy of special notice:—A Lady's Dressing-case of walnut-tree, clamped with pierced silver plates and corner-pieces in the mediæval style, and fitted with a variety of silver-mounted toilette-bottles, with a looking-glass and candle-holders, the value of which was stated to be 300*l.*; a very convenient Sac-de-voyage for a gentleman, in plain morocco; and a cylindrical morocco case, containing a plated travelling Tea-equipage, including a tea-pot, an apparatus for boiling water, and knives and forks, the price of which is 18*l.*

MAKIN, JONAH STEPHEN, Spa (Belgium, No. 414, p. 1164), Honourable Mention (*Prize Medal awarded by the Jury of Class XXVIII.*), for a large collection of Spa-ware, comprising numerous examples, all well manufactured and embellished with fair copies of paintings, and original and tasteful groups of flowers. Work-boxes are exhibited, ranging in price from 2*l.* to 5*l.* 5*s.* each, and Blotting-cases from 3*l.* to 5*l.* each, according to the amount of work in the ornament.

MISSON, E. and L., Spa (Belgium, No. 412, p. 1164), Honourable Mention (*the same Award by the Jury of Class XXVIII.*), for several well-finished articles of Spa-ware, comprising Work-boxes, Netting-boxes, in nests of five sizes, &c., ornamented with paintings, for the most part very creditably executed. The pieces most deserving of notice are, a large Work-box, 3*l.* 8*s.*; one somewhat smaller, embellished with a representation of a Spanish bull-fight, 3*l.* 4*s.*; and Netting-boxes from 2*s.* upwards.

STRUDWICK, THOMAS, 14 New Bond Street (Class XXIX., No. 42, p. 791), Honourable Mention for Dressing-cases of the cheaper description, but yet of very good workmanship. As an example may be cited a Gentleman's Dressing-case, made of yew and clamped on the outside with ornamental German silver plates and corner-pieces, the mounts and covers of the trays and jars being of solid silver. It contains 3 scent-bottles, an ink-box, a light-box, tooth and nail-brush trays, a shaving-soap box, a square soap-box, a tooth-powder box, 2 salve boxes, 2 razors, 2 pair of scissors, a nail-file, a punch, a button-hook, 4 tooth instruments, and 2 penknives. The price of this case is only 38*l.*

II. PARASOLS AND UMBRELLAS.

1. *Parasols.*—The first employment of those portable protections from the sun and rain, called Parasols and Umbrellas, probably commenced with the former of those inventions, in a region where the intensity of the light and heat rendered a shade almost indispensable. In the contrivance of such a shelter, the pole and top of a tent seem to have originally suggested the well-known form, which in its general features of a dome or a canopy still remains unaltered. But as the materials of the ancient parasol rendered it a heavy instrument, it appears to have been always carried by an attendant over the head of the

owner. Hence it became an indication of high rank. The recent discoveries at Nineveh show that the Parasol "was generally carried over the king in time of peace, and sometimes even in war. In shape," continues Dr. Layard, "it resembled very closely those now in common use, but it is always seen open in the sculptures. It was edged with tassels, and was usually adorned at the top by a flower or some other ornament. On the later bas-reliefs a long piece of embroidered linen or silk, falling from one side like a curtain, appears to screen the King completely from the sun. The parasol was reserved exclusively for the monarch, and is never represented as borne over any other person." It will be remembered that this interesting statement refers to the Assyrian empire, between the years 1200 and 606 before the Christian era.

There appear to have been more than one species of sun-shade proper to Egypt, as represented in the sculptures and paintings of that country. Of these, one appears to have been either a fan of palm-leaves or coloured feathers, fixed upon a long handle; in other cases, the figure seems intended to represent the canopy of a parasol, drawn with the imperfect skill of an Egyptian artist. Sir Gardner Wilkinson has engraved a delineation of an Ethiopian princess, travelling in her chariot through Upper Egypt to Thebes, wherein the car is furnished with a kind of umbrella fixed on a tall strong staff rising from the centre, and in its arrangement closely resembling the chaise-umbrellas of the present time.

From the very limited regal use of the Parasol in Asia and Africa, it seems to have passed both as a distinction and a luxury into Greece and Rome, especially in the declining ages of those countries. The *Skiadeion*, or Day-shade of the Greeks, was carried over the head of the effigy of Bacchus; and the daughters of the aliens at Athens were required to bear parasols over the heads of the maidens of the city, at the great festival of the Panathenæa. At Rome, when the veil could not be spread over the roof of the amphitheatre, it was the custom for females and effeminate men to defend themselves from the sun with the *Umbrella* or *Umbraculum* of the period; and this covering appears to have been formed of skin or leather, capable of being raised or lowered as circumstances might require.

Although the use of the Parasol was thus early introduced into Italy, and had probably been continued there as a vestige of ancient Roman manners, yet so late as 1608, Thomas Coryat notices the invention in such terms as indicate that it was not commonly known in his own country. After describing the fans of the Italians, he adds, "Many of them do carry other fine things of a far greater price, that will cost at least a ducat (*5s. 6d.*), which they commonly call in the Italian tongue *Umbrellaes*, that is, things that minister shadow unto them for shelter against the scorching heat of the sun. These are made of leather, something answerable to the form of a little canopy, and hooped in the inside with divers little wooden hoops that extend the umbrella in a pretty large compass. They are used especially by horsemen, who carry them in their hands when they ride, fastening the end of the handle against one of their thighs; and they impart so long a shadow unto them, that it keepeth the heat of the sun from the upper part of their bodies."

It is probable that a similar contrivance existed at the same period in Spain and Portugal, whence it was taken to the New World. Defoe, it will be remembered, makes Robinson Crusoe state that he had seen Umbrellas employed in the Brazils, "where they were found very useful in the great heats which are there," and that he constructed his own instrument in imitation of them. "I covered it with skins," he adds, "the hair outwards, so that it cast off the rain like a pent-house, and kept off the sun so effectually, that I could walk out in the hottest of the weather with greater advantage than I could before in the coolest." In commemoration of this ingenious production, one species of the old heavy Umbrellas was called "The Robinson."

But the use of such a defence against the heat was not unknown in England, though probably only used as a luxury, even in the early part of the seventeenth century. Ben Jonson mentions it by name in a comedy produced in 1616; and in 1640 it occurs in Beaumont and Fletcher's "Rule a Wife and have a Wife," when Althea says—

> "Are you at ease? Now is your heart at rest?
> Now you have got a shadow, an Umbrella,
> To keep the scorching world's opinion
> From your fair credit."——

As a canopy of state, the use of the Umbrella appears to have been general in Southern Europe from a very early period: it is found in the ceremonials of the Byzantine Church; it was borne over the Host in processions; it formed part of the pontifical regalia; and about A.D. 1179, when Pope Alexander III. took refuge in Venice from the Emperor Frederick I., he bestowed on Sebastiano Zani, the Doge, and his successors, the privilege of placing the Pontifical parasol over their armorial ensigns.

Without, however, attempting to trace any further the frequent appearance of the parasol in the early history of Europe, we may be allowed to make a few statements regarding the Parasol of the Chinese. According to the statement of Dr. Morrison, Parasols and Umbrellas in the Celestial Empire appear to be first referred to in books printed about A.D. 300;* the tradition being, that the *San*, which signifies to cover or shade off the sun and rain, originated "in standards and banners waving loose in the air." This date, however, has been recently proved to be many centuries too modern, by the evidence of a very curious book of Chinese ceremonies, entitled *Tcheou-Li*, or the Rites of Tcheou, for the first time translated and published by the late M. Biot.† The author of the work was Prince Tcheou-Kong, brother of Wou-Wong, the first Emperor of the Tcheou dynasty, who wrote it at the beginning of the twelfth century before the Christian era. In this valuable work is contained a descriptive detail of the duties of the several officers belonging at the period to the Chinese Court; and it directs that the workmen making the wheels of the Imperial carriages should also place the *dais* upon the cars. The figure of this dais‡ contained in the Chinese edition of the *Tcheou-Li*, and the particular description of it given in the explanatory commentary of Lin-hi-ye, both identify it with an umbrella.§ The latter describes the dais to be composed of 28 arcs, which are equivalent to the whalebone ribs of the modern instrument, and the staff supporting the covering to consist of two parts, the upper being a rod 3-10ths of a Chinese foot in circumference, and the lower a tube 6-10ths in circumference, into which the upper half was capable of sliding.

It is probable that the most general use of the Parasol in France and England was adopted from China about the middle of the seventeenth century. At that period pictorial representations of it are frequently to be found, some of which exhibit the peculiar broad and deep canopy belonging to the *Lo San*, or large parasol of the Chinese officers of government, carried by attendants. In 1664, Evelyn states that a Jesuit showed him such a collection of varieties as he had never seen before, sent from the missionaries of Japan and China to their order at Paris, to be preserved in their repository, but brought for them to London by the East India ships. In the engraved title-page to his *Kalendarium Hortense*, published in the same year, a black page is represented as bearing a closed umbrella or sun-shade.

2. *Umbrellas.*—In the preceding notices these artificial shades have been regarded chiefly as protections against the light and heat of the sun, with but slight reference to their equally great value as defences against rain. Their adoption for this purpose appears to have been much later than their use in the former capacity, and to have been but very slowly established in England. It is, however, mentioned by Gay, in his *Trivia*, so early as 1712, in one of his many vivid descriptions of the manners at the beginning of the last century; and he appears to affirm that

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* Dr. R. Morrison's *Chinese Dictionary*, vol. i., part 2, p. 634, No. 8902.

† *Le Tcheou Li, ou Rites des Tcheou: Traduit pour la Première fois du Chinois par feu Edouard Biot.* Paris, 1851. 8vo. Vol. ii., p. 475.

‡ M. Biot's Translation, p. 488. § Ibid., p. 478.

any defence, excepting from the rain, could never be required in the streets of London. The verses in question are suggestive of two very curious observations connected with the history of the articles under consideration. From the beginning of the present century, the use of the parasol as a protection against the sun has been increasing in England until it has become universal amongst females, contrary to the declaration of the concluding lines. The Umbrella, on the contrary, though apparently well known in Gay's time, did not come into general use until the close of the last century. Jonas Hanway is stated to have been one of the first men who commonly carried one, for it was usually regarded as proper to females only;[*] and he, probably, brought the practice from Persia or from the continent. In the *Statistical Account of Glasgow*, by Dr. Cleland, it is related that about the year 1781 or 1782, the late Mr. John Jamieson, surgeon, brought with him an Umbrella on his return from Paris, which was the first seen in the city, and attracted universal attention. The earliest specimens of the English Umbrella were made of oiled-silk, which, when wet, were exceedingly difficult to open or to close: the stick and furniture were heavy and inconvenient, and the article generally very expensive.[†] Its transition to the present convenient portable form is due partly to the substitution of silk and gingham for the heavy and troublesome oiled-silk, which admit of the ribs and stretchers being made much lighter; and also to the many ingenious mechanical improvements in the frame-work which have been made from time to time, chiefly by English and French manufacturers, several of which have been patented. No change has proved a greater convenience than that from the old-fashioned ring and string, for securing the Umbrella when closed, to the clip and Indian-rubber braid; and yet, before this was accomplished, many transitions had to be passed through, which must be familiar to most persons: these outward improvements may be taken as the type of numberless others which are not appreciated, because they are not generally seen and understood.

We may now pass to the consideration of the various contributions from the different countries, first, however, premising that from England and France the largest quantities have been received.

AUSTRIA.

The Parasols and Umbrellas of Austria are gaudy, and not very well finished, and, indeed, evince but little skill or taste on the part of her two manufacturers who exhibit the finished articles.

Notwithstanding this, it appears that they are exported to some extent to several of the Mediterranean markets, for which it appears that they are well adapted. The prices at which they are sold are considerably higher than those for which goods of a better quality can be furnished by the English maker: in illustration may be cited the cheapest children's parasols of each of the two makers, which are sold wholesale at 1*s*. 1½*d*. and 2*s*. each respectively, and women's silk parasols of very ordinary finish at 7*s*. and 9*s*. each. The other Exhibitors send merely parasol and umbrella handles and sticks, which are generally reasonable in price, and of fair workmanship. The following are quotations of some of the cheapest as well as the dearest of these productions. **WEISS, J.** (Austria, No. 572, p. 1036), Umbrella-sticks with bone handles 9*d*. each; parasol sticks of white wood, and long bone handles 1*s*. and 1*s*. 3*d*. each. **TIFFE, A.**, carved bone Umbrella-sticks, with handles of bone, 2*s*. 6*d*. and 3*s*. 6*d*., with ivory handles fairly carved 10*s*. 6*d*. each. **LANDRA, J.**, Umbrella and Parasol sticks of carved wood 4½*d*., 5*d*., and 10½*d*. each; these latter were considered to be cheap. The ivory and bone carving, however, bears no comparison, in point of design and execution with the carving of the Meerschaum pipe-bowls reviewed in another article.

BELGIUM.

The contributions from Belgium consist of Parasols only, and were sent chiefly by one Exhibitor; for although parasols covered with rich lace are exhibited in the North-east gallery with other articles of lace, they cannot be regarded as appertaining to this branch of trade.

The Parasols exhibited (No. 432) are well manufactured, but are not in such good taste as those made in France; whilst at the same time they are dearer than similar goods sent by the English makers. The prices quoted vary from 20*s*. to 25*s*. each for plain parasols, covered and lined with silk.

BRITISH COLONIES.

The richer contributions from the East Indies and the Island of Ceylon consist of State Parasols or Umbrellas, many splendid examples of which adorn the Indian Courts. The most remarkable example is the gorgeous State-umbrella from Moorshedabad, exhibited by His Highness the Maharajah of **NAGPOOR**. This beautiful object is represented in the *Illustrated Catalogue*, p. 924. The ribs and stretchers, which are gilt, are sixteen in number, and divide the umbrella into as many segments, covered with silk exquisitely embroidered with gold and silver ornaments; the upper part of the design is complete in each compartment, but at the lower it is formed into a graceful running border, to which a fringe is fastened. The handle is hollow, and is formed of thick silver plates. Other examples contributed by his **HIGHNESS THE RAJAH OF DHOLEPORE** (p. 924) comprise the *Soorooj Mookee*, or native parasol, covered with rich damask silk, and having likewise a silver handle; and the gold umbrella with silver top and handle, and enriched with gold fringe. Of the more usual descriptions may be cited several specimens of Bengalee *Chattahs* or small umbrellas, conical in form, with manifold plaits, and consequently ribs and stretchers. These chattahs are composed of the leaves of *Licuala peltata*, and are the description used by the poorer classes of natives of Bengal during the rainy season. Of the same class is an umbrella made in Gowhattee, of the same material, but used by the higher classes of natives in Assam. There is also a conical umbrella of painted and varnished cloth, made in Calcutta; and, as if to illustrate how difficult it is for the native taste to adapt itself to European requirements, there is a very inferior imitation of an English umbrella, having ten ribs, covered with crimson calico, and lined and fringed with dark green. This umbrella, it appears, is generally used by Europeans throughout India.

CHINA.

In China the Umbrella is still a mark of high rank, but not exclusively so; it must not, however, be inferred that it is as commonly used amongst the middle classes of society as in England, for this is far from being the case, for it is not their custom to go out when it rains, and the poorer inhabitants of China depend chiefly on appropriate clothing to protect them from the sun and rain; for example, the Chinese boatman, thatched in with his coat made of straw, and hat composed of straw and split bamboo, may defy the heaviest shower. Coats made of skin, usually with the fur outside, likewise afford effectual protection, so that, unless the foot passenger desires to go short distances in his ordinary habiliments, the umbrella is unnecessary.[*] These remarks, taken from an entertaining paper in the *Penny Magazine*, vol. iv., p. 479, entitled "Umbrellas in the East," are evidence that the umbrella is not an article of such paramount importance in China as in England; and yet Umbrellas and Parasols are made in considerable numbers in the provinces of Kwang-tung, Fo-kien, and Hoo-kwang, and form an important branch of commerce. They are exported from Canton, Amoy, and Shanghae, to India, the Indian Archipelago, and even to South America; in 1846, 300,000 were sent out from these ports.[*] Almost all the parasols and umbrellas are covered with oiled paper, which is afterwards painted and varnished. At Canton umbrellas are termed *Kittysols*, from the Spanish word *quitasol;* the Chinese name is *Chi-yu-san*, or *Yu-che*. Two examples only are exhibited in the Chinese Court; they are contributed by Messrs. Hewett and Co., but present nothing remarkable beyond the great number of ribs, which amount to forty-two. These ribs are formed of wood; and instead of being embraced by the fork of the stretcher, as is the case in European umbrellas, they have a groove cut in the middle of their length, into which the stretcher is secured by a stud of wood. The head of each rib fits into a notch formed in the ring of wood, which is fastened on to the top of the stick, there being a separate notch for each rib. The slider is of wood, and has forty-two notches, namely, one for each stretcher, which, like the ribs, is formed of wood. The covering of the umbrellas exhibited is of oiled paper coarsely painted.

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[*] That the use of the Umbrella was once considered as too effeminate for men, is remarkably illustrated by the following passage contained in *The Female Tatler* of Dec. 12, 1709:—"The young gentleman belonging to the Custom-house, that, for fear of rain, borrowed the Umbrella at Will's Coffee-house, in Cornhill, of the mistress, is hereby advertised, that to be dry from head to foot on the like occasion, he shall be welcome to the maid's pattens."

[†] An advertisement published in 1787 by Thomas Folgham, 112 Cheapside, states that he has "a great assortment of his much-approved pocket and portable Umbrellas, which, for lightness, elegance, and strength, far exceed anything of the kind ever imported or manufactured in this kingdom. All kinds of common umbrellas prepared in a particular way, that will never stick together."

[*] In Alexander's *Costume of China*, Part 8, is a plate representing a group of Chinese, habited for rainy weather, which accords with this description.

FRANCE.

In the higher class of Umbrellas and Parasols, France undoubtedly stands pre-eminent. The tasteful designs and sharp and excellent carving of the ivory handles, and the artistic grouping of the colours of the various silks used in the manufacture of parasols, and the supple dressing of the silks for umbrellas, give to the French manufactures a decided superiority; added to which, the frames were much lighter and neater than those made in England until a very recent period. The French parasols and umbrellas have, in consequence of their lightness and elegance, acquired a high reputation in America and Italy, to which countries large quantities are annually exported, as well as to the French colonies. Taking an average of the annual exports of Silk Umbrellas and Parasols from 1827 to 1836 inclusive, their value was 36,360*l.*; between 1837 and 1846 it was 54,172*l.*; and in 1847 it had reached to 70,088*l.*; so that in twenty years the exports had nearly doubled in value. To obtain, however, the true exponent of the annual exports in umbrellas, must be added the average value of the uncovered frames exported in the same years; in the first-named period it was 7,160*l.*; in the second, 9,160*l.*; and in 1847, 9,280*l.*: so that the value of the umbrellas, parasols, and frames which were exported in that year was 79,368*l.* Whilst the foreign trade of France has been rapidly increasing as regards silk umbrellas, she has lost ground in those covered with gingham, in which her trade was never large, owing to the competition of the English makers. Thus, from 1827 to 1836 the mean annual value of the exports was 1,240*l.*; from 1837 to 1846 it was 960*l.*; and in 1847 it was reduced to 480*l.* According to the *Statistique de l'Industrie à Paris*, Part II., p. 825, etc., it appears that in 1847 there were in Paris 377 masters engaged in the business of umbrella and parasol making, and employing 1,429 workpeople (601 men, 742 women, 45 boys, 31 girls); who, according to M. Natalis Rondot's estimate produced goods to the amount of 296,320*l.* in that year; not much more than one-fourth part of which was exported, as will be seen by comparing the foregoing figures. In 1850 the exports were somewhat less than in 1847; thus the value of the silk umbrellas and parasols was 57,380*l.*, of gingham umbrellas 89*l.*, of umbrella and parasol-frames 9,095*l.*, making a total of 66,564*l.*

Besides the umbrella mounters and finishers, there were in 1847 in Paris 74 manufacturers, employing 304 workpeople (264 men, 6 women, 34 boys) engaged in the production of sticks, handles, and tips, whose returns were 30,400*l.*

Of the 377 parasol and umbrella mounters and finishers—

31	employed more than 10 workpeople.
163	,, from 2 to 10 ,,
122	,, – – 1 assistant.
61	,, – – no ,,
377	

			£.		£.
9	produced goods to the value of	–	–	–	8,000
8	,, ,,	from	4,000	to	8,000
14	,, ,,	,,	2,000	,,	4,000
32	,, ,,	,,	1,000	,,	2,000
75	,, ,,	,,	400	,,	1,000
65	,, ,,	,,	200	,,	400
138	,, ,,	,,	40	,,	400
36	,, less than	–	–	– –	40

Parasols and Umbrellas were formerly made by the corporate body of "*Boursiers*" (leather purse makers), who were at the same time breeches makers, cap makers, collar-makers, brace-makers, powder-puff, game-bag, and travelling-bag makers. In 1754, says M. Natalis Rondot, there were 250 master purse-makers in Paris; and quoting the *Journal du Citoyen* of that date, he remarks, that the folding parasol sold at from 12*s.* to 17*s.* 6*d.* each, and the common parasol from 7*s.* 3*d.* to 11*s.* 3*d.* each. Two questions naturally suggest themselves, what was the form of these instruments, and what their weight; fortunately both questions can be answered satisfactorily. In the well-known French Encyclopædias[*] there are plates representing the whole of the objects made by the "*Boursiers*," and the tools employed in their manufacture. The usual parasol or umbrella of that period which is there figured, closely resembles the ordinary gig-umbrella of the present day, and, slightly modified in form, is still used by the peasantry of France. The folding parasol was constructed with jointed ribs so as to fold back, and was likewise self-opening. The rod was a metallic tube, and contained a spiral spring which acted upon and pressed upwards an inner rod. To this inner rod were jointed the stretchers, which in this construction were placed above the ribs instead of below, as in the ordinary form; beside which they were much shorter so as to admit of their being concealed by the covering. By the elasticity of the spiral spring contained in the hollow stem, the inner rod was pressed outwards and lifted the stretchers, and by their means raised the ribs also, so that in its ordinary or natural state the umbrella was always open, and would continue so unless constrained to remain closed by a catch. On releasing the catch it consequently sprang open. In order that it might be easily closed, four cords were attached to four of the ribs and passed to the handle; and a loop embracing these cords passed down by the side of the handle, and enabled the possessor to close his umbrella without difficulty. From the authority already quoted we learn that whalebone was employed for the ribs, and that their number varied with their length: for example, when 24 inches long, the number employed was 8; when 25 inches, 9; and when 26, 28, and 30 inches, 10 were used. Calico was employed to cover umbrellas and silk to cover parasols. The use of parasols was common in Lyons at that period (1786); they were carried by men as well as women; "they were rose-coloured, white, and of other colours, and were so light as to be carried without inconvenience." In Vol. V. of the *Dictionnaire des Arts et Métiers*, published in 1788, and forming part of the *Encyclopédie Méthodique*, mention is made of parasols contained in walking-sticks, which fly out by the action of a spring as soon as a catch is released. The comparative "lightness" of Parasols may be judged of by the annexed statement, which relates to umbrellas of different periods, from 1645 to 1849, contributed to the last French *Exposition* in the latter year by M. Farge—

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[*] *Etude pratique du Commerce d'Exportation de la Chine.* Par Natalis Rondot, pp. 117, 118.

[*] Diderot and D'Alembert's *Encyclopédie ou Dictionnaire Raisonné des Sciences des Arts et Métiers.* Paris, 1751-1765. Recueil des Planches, Tom. I. *Encyclopédie Méthodique.* Paris, 1782-1830. Section Arts et Metiers, vol. vi. (1786).

Umbrellas of	Length of ribs. Inches.	Weight. lbs.	oz.
1645	31½	3	8½
1740	29	1	13
1780	28¾	1	8½
1840	27½	0	13¾
1849	27	0	8¾

Hence it appears that the Umbrella of the present day weighs only one-seventh of that of a century ago. From 1808 to 1848, a period of 40 years, there were 80 Patents of invention, 3 of importation, and 41 for improvements relating to the Umbrella-trade taken out in France. Some of these are for mechanical contrivances allied to those before described; some are for improvements in the ordinary frames, and others for the adaptation of machinery as a substitute for hand-labour. With all this, the productions of France must be characterised as high in price; the ordinary wholesale price of a good silk umbrella of the self-opening construction ranges from 20*s*. to 40*s*., and that of parasols from 13*s*. to 80*s*.; but then they are in every respect exquisitely finished. The French manufacturer is also famous for many ingenious contrivances: for example, with respect to Travelling-umbrellas, which may be removed from the stick and packed in a portmanteau or placed in the pocket; and others too numerous to mention in detail.

PORTUGAL.

The Umbrellas in the Portuguese Department, Nos. 1127 to 1143, and the Parasols, Nos. 1144 to 1150, comprising about 30 varieties, are contributed by one Exhibitor, and may be characterised as creditable, though not remarkable, productions. The umbrellas are both with whalebone and steel ribs, covered with black silk, and have ivory and wood handles. The parasols are also made with metal frames, some for ladies', others for children's use, and are covered with plain and striped silks.

PRUSSIA.

The contributions from Prussia are from only one Exhibitor, and consist merely of Umbrella and Parasol handles, which are sold at low prices. In 1846, Prussia possessed Seventy-seven manufactories of umbrellas and parasols, which gave employment to Five hundred work-people.

TUNIS.

The Tunisian Court contains many examples of Parasols, some of which are made of leather and silk, and others of silk adorned with ostrich feathers.

TURKEY.

Although we have not to cite any examples of umbrellas or parasols as having been sent, yet, in treating of these articles, it is desirable to allude to the very prevalent employment of these useful shelters by the *middle-classes* of Turkey as a remarkable instance of the introduction of European customs into that country. So much, however, still remains of the regal attributes of the umbrella, that, in passing before the palace of the Sultan, the custom is to lower it; a compliment which the sentinel on duty does not fail to enforce from the foreigner, who, unconscious of the forms of society, may happen to pass with his umbrella elevated.*

UNITED KINGDOM.

Whilst France stands pre-eminent for articles of the highest class, England is without a rival in the production of parasols and umbrellas of the plainer descriptions. This is to be attributed not so much to the introduction of new and expensive machinery (for it is still almost as simple as that figured a hundred years since in the French Encyclopædias before mentioned), as to the judicious subdivision of labour, and the importation *free of duty* of her colonial canes for the ribs and sticks; likewise whalebone for ribs, and lastly, *also free*, horn and ivory for the handles. Her cheap and abundant manufacture of ginghams and plain silks, also, gives her decided advantages over other nations.

It is not possible to determine with certainty the exact yearly produce in the parasol and umbrella trade, which, for finished goods, is chiefly centred in London; but some idea may be formed of its importance when it is stated that several of the large city houses dispose of from 250 to 500 dozens of parasols and umbrellas weekly. The prices of the commoner kinds is marvellously low, as will be understood when it is stated that children's gingham parasols are sold wholesale from 4*d*. each, and women's from 10½*d*. each. Silk parasols commence at 10½*d*. each, and gingham umbrellas at 7*d*. and 10*d*. each, according to the size. Alpaca umbrellas range from 6*s*. to 12*s*. each, and silk umbrellas from 3*s*. 6*d*. to 22*s*. each. To the price of the silk parasol there is scarcely an assignable limit, as any amount of expensive lace may be used to adorn it; the highest price quoted was 5*l*. 5*s*., but the example was far less elegant than most of the specimens in the French Department, and much higher in price. Our umbrella-manufacturers would, indeed, do well to profit by the example of their French brethren, by calling artistic talent to their aid in devising new models. For there are many English artists who are capable of furnishing excellent designs for the ivory carver, and of superintending the carving of the first model; with whose aid we should gradually find *good engraving* taking the place of its present substitute *high-polish*, whilst the cost on each individual article would be very slightly increased. A little artistic help is likewise desirable in the assortment of harmonious tints; and, at the next Exhibition, there will be no examples of crimson parasols with yellow fringes.

We are indebted for the cheapness of the commoner umbrellas to three causes:—

To the small cost of labour attributable to the dexterity and industrious habits of the artisan; to the low price of gingham, which is sold at less than 3*d*. per yard; and to the employment of split and dyed ratan canes for the ribs in lieu of whalebone. M. Meyers (XXIX., No. 140, p. 797), reports that his weekly sales of cane ribs average 12,000 sets, eight to the set; the wholesale price of which is 10*d*. per dozen sets, or a little more than three farthings for each umbrella. Although ratan-canes are used for some other purposes, the statement of the quantity imported into the United Kingdom, during the last ten years, will not be deemed out of place in the present Report.

RATAN CANES (not Ground-ratan).

Years.	Number imported.	Number entered for home consumption.
1841	6,784,379	4,949,609
1842	4,101,369	4,687,757
1843	4,181,050	4,865,195
1844	8,145,757	8,293,984
1845	10,667,036	Free, and therefore no account taken.
1846	8,794,776	
1847	12,324,768	
1848	7,974,413	
1849	4,723,864	
1850	12,760,726	

A large quantity of whale-fins is likewise imported, and is consumed principally in the manufacture of umbrella-ribs.

Whale-fins Imported during the last Ten Years into the United Kingdom:—

Years.	Imported. Cwts.	Entered for home consumption. Cwts.
1841	6,369	6,272
1842	4,348	4,368
1843	6.609	6.297
1844	8,041	7,160
1845	11,484	Free, and therefore no account taken.
1846	9,101	
1847	8,128	
1848	7,765	
1849	8,926	
1850	9,498	

It has been previously stated, that one element of cheap production is the low price paid for labour. This position we now proceed to illustrate, first remarking that the putting-together of umbrella and parasol frames with cane and whalebone ribs, is chiefly done by small masters in London, who employ lads to assist them; that the covering is performed by women and girls at their homes; and that in the lowest priced goods, the joint labour of an entire family is necessary to eke out a subsistence. The fixing of the handles and ferrules is often done at the warehouses.

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* *Penny Magazine*, vol. iv., p. 480.

In order that the reader may better appreciate the small amount of the wages paid for putting the frames together, the subjoined description of the various processes is given. The frame-maker requires a capital of from 3*l.* to 6*l.*, in order that he may erect a couple of very primitive-looking lathes with a circular saw; a rose-cutter for forming the tips, and several drills, all of which screw into the mandril of the lathes; also a paring-knife, a small vice, and three or four pairs of pliers; and lastly, a "weighing-board." The circular saw, rose-cutter, and paring-knife are comparatively modern improvements. He must rent a room or shop, and pay for fuel and candles. He has likewise to provide all the iron-wire and brass-plate out of what he receives in wages; but the stick, ribs, stretchers, and runners are furnished to him. In order to work economically he must employ two lads, but he usually finds it more to his interest to employ four, to whom he pays 4*s.* per week.

1. *Preparing the Stick.* The stick, which is usually of stained beech, is first sawn off to a length; one end is tapered with the paring-knife, to prepare it for receiving the ferrule; two grooves are cut in with the circular-saw in the direction of the length of the stick, in order to receive the two springs, one for sustaining the umbrella open, and the other for keeping it closed. The springs are then made out of iron wire, and fastened one in each groove, the fastening being effected by simply driving one end of the spring into the handle: the other is left free, but is prevented from flying out by means of a cross wire, the insertion of which requires two operations, viz., drilling a hole and inserting and rivetting the wire. A stopper is formed by bending a piece of wire like a staple, and it is then inserted into two holes drilled above the top spring, in order to prevent the slider from going too far; lastly, two holes are drilled near the top of the stick, through these the cross wire is inserted, and when finished it presents the appearance of a double staple, one loop being on one side of the stick and one on the other. In preparing the stick it has passed at least *nineteen* times through the hand.

2. *Preparing the Ribs.* Each rib is roughly tapered with the paring-knife at one end, and is rendered smooth and conical by holding it in the direction of its length in the groove of a wheel lined with fish-skin, which wheel is made to revolve rapidly in the lathe; the taper end of the rib is then held *across* a steel fly-cutter or "machine," likewise running in the lathe, which cutter has a circular groove of the proper radius of curvature formed on its periphery. By rotating the rib in the hand its "tip" is rendered spherical; the tip is then varnished, and has a hole drilled in it, to admit of fastening on the covering; and each rib is cut to the proper length by sawing off the opposite end: the "head" of the rib is lapped with thin brass-plate and rounded, and is then drilled, to admit of the "head-wire," on which it is afterwards hinged; the rib is also lapped near its centre with brass-plate, and drilled, in order to admit of fastening on the stretcher; and, lastly, the stretcher is attached by means of an axis of wire, the ends of which are riveted. Each rib passes not less than *thirteen* times through the hand; and, as there are eight ribs, the frame consequently passes *one hundred and four* times through the hand in this stage of the construction.

3. "*Weighing*" *the Ribs.* Unless every rib be of equal strength, the umbrella will not "set round," hence the necessity for the "weighing" process. This operation is somewhat analogous to that which engineers employ in ascertaining the deflection of a beam, and is effected by a very simple instrument. The weighing-board is about 3 feet 6 inches long and 2 feet deep, and is affixed to a wall, the longer side being parallel to the horizon; and there are in different parts of it a multitude of small holes for the reception of wire pegs. The rib to be weighed is placed *over* one peg close to its stretcher, and *under* another peg, so far distant from the first as to reach nearly to the head of the rib; a small leaden weight is then hung on to the tip, and of course deflects the rib; the amount of the deflection (indicated by graduations on the arc of a circle affixed to the board) gives the relative strength of the ribs, which are assorted out in sets accordingly. The weighing adds *eight* more operations to those already enumerated.

4. "*Threadling*" *the Ribs.* Each stretcher, which it will be remembered is attached to the rib, is taken up in turn and threaded on to a wire, and is then inserted, each one in its respective place, in the notches of the slider, and all are made secure by binding the wire round the top of the slider, which is grooved for that purpose. The head-wire is now inserted through four of the ribs, and is then passed through the two loops of the "cross wire," at the top of the stick; and now the four remaining ribs are threaded, and the head-wire secured by twisting its ends together with pliers. Reckoning that this adds four operations, the frame will have passed *one hundred and thirty-five* times through the hands of the workman or his assistants.

All this labour is performed for ½*d.* to ¾*d.* in the case of parasols, and for ¾*d.* to 1*d.* in that of umbrellas. A workman can, nevertheless, earn fair wages at these prices, provided he is supplied regularly with work; but he is frequently subjected to much loss by being kept waiting about in the wholesale warehouses, which sometimes occasions a loss of at least half a day to him. The prices just quoted are those paid for the lowest description of work, but for putting together the frame of an umbrella with whalebone-ribs the workman gets 2½*d.* Of the cheaper kinds of umbrellas, say those at 1*s.* per dozen, a workman and four lads can make four gross per week, for which he receives 48*s.* After deducting the wages of his lads, 16*s.*, and the cost of the materials he supplies, which is about 8*s.*, it leaves him 24*s.* for himself.

Covering of Umbrellas. This is paid for according to the description of work, the commonest at the rate of 1*s.* per dozen, and the best 4*s.* per dozen.

The frames, which are made of metal, are almost exclusively manufactured in Birmingham. The stick, ribs, stretchers, and ferrule, are all metallic, and require, after covering, merely the insertion of a long wood or ivory handle and the ferrule to complete the umbrella. These frames can be furnished at from 7*d.* to 10*d.* each, and although not so cheap as the cane-frames, they are consumed and exported in enormous quantities, in consequence of the small bulk which they occupy. Many improvements have of late years been made, not only in the machinery used for making the metallic frames, but also in the construction of the frame itself. Amongst those most deserving of notice, may be cited the improvements of Mr. HOLLAND (No. 131, p. 797) and Mr. BOSS (No. 146, p. 798). Either of their constructions adds about 2*s.* to the price of an umbrella. In conclusion, it may be stated that the umbrella-manufacture in the United Kingdom is in a very prosperous condition, and is rapidly increasing.

WURTEMBURG.

There are Four Exhibitors of Umbrella-handles from this country, the carving on some of which is very humorous: the most important collection has been rewarded for other ivory goods which were exhibited at the same time, and which formed the largest proportion of the contribution. (*See* TOYS).

The number of Exhibitors of Parasols and Umbrellas, or their components, such as handles, sticks, and mounted frames, is Thirty-three; of these, there are—

5	Holders of a Prize Medal.
2	Who obtained Honourable Mention.
26	Unrewarded.
33	

The number of Exhibitors from the various countries is as follows:—

Austria	5
Belgium	1
British Colonies (India and Ceylon)	2
China	1
France	3
Portugal	1
Prussia	1
Tunis	1
United Kingdom	14
Wurtemburg	4
	33

LIST OF AWARDS.

BOSS, ISAAC ABRAHAM, 6 Bury Street (Class XXIX., No. 146, p. 798). Honourable Mention is accorded to this Exhibitor for several Mechanical Improvements in the construction of umbrella and parasol frames. One contrivance is to facilitate the opening of a parasol or umbrella. This is effected by means of a pin working in a groove close to the handle. The pin is fastened to a wire (contained in the hollow handle) acting on the ribs, which overhang the joint so as to form short levers, so that by pulling the pin towards the handle the umbrella is opened. The price of the frames with this apparatus is *2s. 9d.*, one of ordinary construction being 10*d*.

CAZAL, —, (France, No. 108, p. 1176). Prize Medal. For Parasols and Umbrellas elegant in form and of excellent workmanship. The carved ivory handles evince much taste and are well sculptured; the framing, which is very light, in many cases presents novelties of construction. The self-opening umbrella, for instance, may be cited as a very ingenious contrivance; the desired effect being produced by simply making each stretcher double, and so arranging the parts that a tension is put on one of the sets of stretchers in closing the umbrella, which consequently flies open as soon as a catch is released. A travelling umbrella, so arranged that the stick may be conveniently removed and used as a walking-stick, is also worthy of commendation. The prices of the umbrellas are, however, high; they range between 32*s*. and 100*s*. each. M. Cazal likewise exhibits Canes made of rhinoceros-horn, white whalebone, and conglomerated horn.

CHARAGEAT, E., Paris (France, No. 1144, p. 1233). Prize Medal. For Umbrellas and Parasols of first-rate workmanship. The designs and sculpturing of the handles are in all cases of the highest class. The case of this exhibitor likewise contains numerous examples of ingenious mechanical contrivances, among which especially to be commended is an umbrella which closes of itself when a spring near the handle is touched. The specimens, although equal in manufacture, and, at the same time, more moderate in price than those last mentioned, must still be considered as costly; umbrellas, for instance, range from 20*s*. to 60*s*., and parasols from 13*s*. (very plain) up to 80*s*. for the more elegant class, wholesale.

HOLLAND, HENRY, Birmingham (Class XXIX., No. 131, p. 797). Prize Medal. For Parasol and Umbrella Frames of a novel construction, invented by him; the component parts of which were exhibited in various stages of progress, so as to illustrate the plan of manufacture. This description of frame is distinguished from others chiefly in having ribs formed of rectangular steel-tubing, and is so light that when covered with strong silk to form an umbrella the whole instrument only weighs 9 ounces. This frame is now in very general use for the better description of umbrellas and parasols, to the cost of which it adds about 2*s*.

MORLAND, J., and SON, 50 Eastcheap (Class XXIX., No. 306, p. 818). Prize Medal. For Parasols and Umbrellas of very excellent workmanship and at moderate prices. In the better class of goods Holland's frames are employed. The umbrellas exhibited range in price from 3*s*. 6*d*. to 22*s*. wholesale, and the silk parasols from 1*s*. 7*d*. (children's) up to 16*s*. each.

SANGSTER, WILLIAM and JOHN, 140 Regent Street (Class XXIX., No. 136, p. 797). Prize Medal. For Silk Parasols and Umbrellas of excellent quality, and for their application of Alpaca-cloth to the coverings of parasols and umbrellas. Alpaca-cloth is made of the undyed wool of the Peruvian and Chilian sheep, and is therefore not liable to fade, nor is it acted upon by salt-water; hence Alpaca parasols and umbrellas are much used at watering-places, and are also largely employed as a cheap substitute for those covered with silk. Alpaca parasols sell at 5*s*. each, and umbrellas at from 6*s*. to 8*s*., wholesale.

The consumption of Alpaca-cloth in the umbrella-trade, notwithstanding its recent introduction, is very considerable, for it appears that the production for this purpose amounted, during the last year, to the value of 25,000*l*.: its price is about 2*s*. per yard.

WIGDOR, M., Berlin (Prussia, No. 257, p. 1063). Honourable Mention. This Exhibitor contributes a great variety of Parasol and Umbrella Handles, manufactured from horn, bone, and ivory, which are deserving of Honourable Mention.

III. WALKING-STICKS.

Whensoever the heroic period may be supposed to have existed, the staff, as employed for the support of old age, was then well known, since it is referred to in the enigma put forth by the Sphynx, and solved by Œdipus. "There is a Being," said the questioner, "which has four feet, and it has also three feet, with only one voice; but its feet vary, and when it has the most it is the weakest." "This is man," was the hero's answer, "who, when he is an infant, crawls upon his hands and knees; when he is a man, he walks uprightly; and when he is old, he totters with a stick."

The use of a staff for support in walking appears to be so natural and inartificial as not to require any illustration; and yet the Pilgrim's staff of the middle ages, and the *Alpenstock* of the present time, have a certain amount of historical interest. The *Bourdon*, or *Pilgrim's* staff, was a strong and stout stick, apparently about five feet in length, armed at the lower end with an iron spike, and intended to supply a support and balance to the body, when the traveller was climbing up slippery paths or steep acclivities. About a foot from the top of the staff was generally found a large protuberance, either artificially or naturally formed around the staff, on which the pilgrim's hand securely rested, without danger of sliding downwards. The lower part of the staff was altogether solid, but the upper joint was a hollow tube, capable of containing small articles, like a long circular box. It is probable that these articles were originally reliques of saints, or the "signs," as those emblematical figures were usually termed, which were commonly sold at the shrines to which pilgrims travelled, as proofs that they had really visited those sacred spots. In the later ages of pilgrimage, however, this part of the staff was sometimes converted into some kind of pipe or musical-instrument, such as sticks have frequently contained in modern times. Above the tube the staff was surmounted by a small hollow globe, and it was also furnished near the top, on the outside, with a kind of crook, for the purpose of safely sustaining a gourd-bottle of water. After the pilgrim had completed his votive journey, and returned from Palestine, he commonly brought with him a branch of palm, fastened into the top of his staff, as the proof of his travel into Palestine or Egypt. It is, however, unquestionable that the pilgrims' staffs frequently became the receptacle of secular articles. It is recorded by Holinshed, that in the hollow part of a pilgrim's staff the first head of saffron, afterwards so successfully cultivated at Saffron-Walden, was secretly brought over from Greece, at a period when it was death to take the living plant out of the country. The silk-worm also found its way to Europe in the hollow of a pilgrim's staff. So late also as the time of Cervantes, certain Spanish pilgrims existed, who had collected upwards of a hundred crowns in alms, which, being changed into gold, they concealed in the hollow of their staves, or the patches of their clothing. It seems to be a natural observation in this place, that the ancient contrivance of making a repository in the hollow of a walking-stick is not yet obsolete. In the Great Exhibition, Dr. GRAY, of Perth, displayed a medical walking-staff, containing a variety of instruments and medicines; and the same principle has been also frequently employed for the portable conveyance of telescopes, instantaneous-light-apparatus, and many other important articles.

Several varieties of sticks were likewise exhibited enclosing in them swords, dirks, and spring-spears. The principle of construction of the sticks last mentioned being, that they required a heavy blow to be given with the armed end before the strong spring could be overcome which held back the spear-head. Sword-sticks, and dagger, or tuck-sticks, are of a more recent period; but this kind of weapon walking-staves is not of later invention than the last century; though that which contained fire-arms existed in the early part of the reign of Henry VIII.

The *Alpenstock* is another ordinary travelling-staff requiring to be noticed, of modern use, though of great antiquity. It is a stout pole of about six feet in length, provided with an iron spike at the lower end, and surmounted with a chamois' horn as an ornament. It is almost indispensable in mountain journeys, and may be procured for two francs throughout Switzerland.

Another order of walking-sticks comprises those light wands to which the name is now exclusively attributed; and these also are descended from a time of considerable antiquity. The stem of the giant-fennel the *Ferula* of Pliny, is the chief progenitor of this family, and he derives the origin of the name of the plant either from *fero*, from the stalk being employed in walking, or from *ferio*, because schoolmasters used it for striking boys on the hand. It would seem as if the latter interpretation had become established at an early period, since Martial terms the ferula *sceptrum pedagogorum*; and even down to the present day the word popularly conveys no other meaning. The tough lightness of the fennel-wood rendered it especially fitted for a support to aged persons; whilst the imposing length of the staff gave an air of importance to those who carried it. Hence it became the prototype of those lighter wands, which have continued as the sign of seniority or gentility to the present time.

In Oriental countries the substitute for the ferula was naturally some kind of native reed; and the employment of such a plant as a support, and also as an emblem of Egypt, is noticed, in probably a proverbial form, by the Assyrian general Rabshakeh, in his speech to the servants of Hezekiah, in the eighth century, B. C. "Now behold," says he, "thou trusteth upon the staff of this bruised reed, even upon Egypt; on which, if a man lean, it will go into his hand and pierce it." (2 *Kings*, xviii. 21). The supposition that the ferula was supplied by some local plant must be also equally true concerning other regions, and especially in those in which the bamboo was indigenous. This was probably the first kind of the cane tribe introduced into Europe; since the word cane in all its original forms appears intended to express a hollow tube or channel, for which purpose the bamboo is still extensively and constantly employed. Although the generic name of cane has long since supplanted all others for ordinary walking-sticks, yet at different periods they have been made of a great variety of materials. A slight glance may be taken at some of the substances employed, and some of the peculiarities of the common walking-sticks of other times.

In the Egyptian sculptures persons of importance or official rank are represented walking with tall slender staves, having the lotus-flower on the top. Several ancient specimens of these sticks have been discovered in Egypt, made of cherry-wood and other substances, measuring from three to four feet in length, some being surmounted by a small knob or a flower, and others having a curved projection standing out on one side, like the tusk of a boar, as if it had been intended for the hand to rest upon.

At a very early period of the Sacred history the distinctive character of the staff carried by an individual is indicated from his immediate recognition simply by the production of it with his signet and his bracelets (*Genesis* xxxviii. 18—25). Homer has commemorated the "sceptre-bearing princes" of the Greeks, and especially the sceptre-staff of Achilles, adorned with golden studs: "I will swear a great oath," says the hero, "even by this sceptre, which shall never again bear leaves or shoots, nor will bud again from the time it left its trunk upon the mountains, when the axe stripped it of all its leaves and bark." These sceptres, although they were indisputably the insignia of rank and authority, were also evidently the usual walking-sticks of persons of the highest class. Agamemnon, it is stated, never went forth without bearing with him his paternal staff of royalty.

In the portraits of many of the noble personages of English history, painted in the sixteenth century, may be seen instances of the richness of the superior walking-sticks carried at that period, when they appear to have been tall, stout, and mounted and adorned with gold. In 1531 a cane-staff and a stone-bow were brought as a gift to Henry VIII. by a certain fletcher or arrow-maker, whom the king rewarded with forty shillings. Some far more curious instances of canes belonging to the same sovereign are, however, described in the manuscript inventory of the contents of the royal palace at Greenwich, in the following entries:—"A cane garnished with sylver and gilte, with Astronomie upon it. A cane garnished with golde having a perfume in the toppe; under that a diall, with a pair of twitchers and a pair of compasses of golde; and a foot rule of golde, a knife and a file of golde, with a whetstone tipped with golde."*

From the middle of the seventeenth century walking-sticks appear to have increased in luxury, both in regard of the mountings and also of the material of which they were manufactured, the improvements being derived principally from France. In the early part of the following century, the most fashionable sorts were made of certain fine marbles and agates, exhibiting either a splendid variety of colour or a rich semi-opaque plain tint, which was most expressively described by the English term "Clouded." These wands were made of the most slender proportions, both on account of their specific gravity and the quality of the persons by whom they were to be carried; and they were often richly mounted with silver, gold, amber, or precious stones. Such were the "clouded canes" of the age of Pope and Gay, which were frequently so greatly valued as to be preserved in cases of shagreen or sheaths of leather. Every reader of the "Rape of the Lock" will remember,—

> "Sir Plume, of amber snuff-box justly vain,
> And the nice conduct of a clouded cane,"

as well as Gay's commemoration of the same kind of walking-stick in "The Van:"—

> "Here clouded canes, 'midst heaps of toys are found,
> And inlaid tweezer-cases strew the ground."

The most curious account of the walking-sticks of this period is, however, contained in the "Tatler," No. 103, written by Addison and Steele, and published on Tuesday, 6th December, 1709. In that paper Isaac Bickerstaff represents himself as issuing licenses and regulations for the beaux of the time, as to the carrying of "canes, perspective glasses, orange-flower waters, and the like ornaments of life." The first part of the essay is intended to ridicule and abolish the prevailing absurd though fashionable practices connected with walking-sticks; hence the respective parties were licensed to carry them provided they did not walk with them under the arm, nor brandish them in the air, nor hang them on a button. One of the petitioners desires permission to retain his cane, because it had become as indispensable to him "as any other of his limbs," and because "the knocking of it upon his shoe, leaning one leg upon it, or whistling upon it with his mouth, are such great reliefs to him in conversation, that he does not know how he should be good company without it." The cane of this person being produced, it is described to be "very curiously clouded, with a transparent amber-head, and a blue riband to hang it on his wrist."

In the second half of the last century there was one peculiar form of walking-stick prevailing, which was generally used by females who were advanced in life. The sticks referred to were between five and six feet in height, taper, and slender in substance, turned over at the upper end in the manner of a shepherd's crook, and twisted thoughout the whole extent of the wand. The materials were either wood, ivory, or whalebone, mounted with silver or gold, and sometimes they were formed entirely of a clear, pale, green glass. The length of the most fashionable sticks of this period is noticed in a number of *The London Chronicle* published in 1762, wherein the writer says, "Do not some of us strut about with walking-sticks as long as hickory poles, or else with a yard of varnished cane scraped taper, and bound at one end with waxed thread, and the other tipped with a neat ivory head as big as a silver penny." Towards the close of the eighteenth century two peculiar forms of walking-sticks were commonly carried by the most gay of the young men of the period, one being a very short and strong bamboo-cane, bent over at the top, and the other a stout knotted stick, in which the grotesque natural growth of the wood was frequently regarded as its greatest excellence.

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* *Costume in England*, by F. W. Fairholt, p. 473.

Another kind of walking-sticks comprises those grotesque staves which have been devised or adopted by individual fancy or eccentricity. It is possible that this peculiar humour may be of considerable antiquity, since the knotted walking-staff and wallet were the distinctive attributes of the Greek and Roman philosophers, and especially of the cynics. The chief peculiarity of this class of staves, however, consists in an ingenious adaptation of the excrescences of the wood of which they were made into grotesque human heads and faces, of which the Exhibition contained many curious and remarkable instances. The old English form of these staves may perhaps be referred to the baubles carried by the fools and jesters who were retained by sovereigns and noblemen of the sixteenth and seventeenth centuries. The Jester's Bauble consisted of a short stout staff surmounted by the carved figure of a puppet or a fool's head; and the modern practice of carrying sticks decorated with humorous faces appears to have existed early in the eighteenth century. About 1730 *The Universal Spectator* states, that at the court end of the town, instead of swords, many polite young gentlemen "carry large oak sticks, with great heads and ugly faces carved thereon." Perhaps some of the most remarkable instances of these carved sticks ever exhibited were those executed and carried about by James Robertson of Kincraigie, otherwise called "the daft Highland laird," of whom Kay published an etching in 1784. In the latter part of his life he adopted the amusement of carving, for which he had some talent, and sculptured in wood the effigies of such persons as attracted his wayward imagination, whether friends or enemies; the latter, however, being executed in caricature. These small figures he mounted on the upper end of a walking-stick, sometimes one above another; and as it was reported that he produced a new one every day, he was commonly accosted with the inquiry, "Wha hae ye up the day, laird?" to which he would readily answer, by naming the individual and the reason for selecting him.[*]

It might be supposed that the manufacture of walking-sticks could not form a large branch of commerce, and yet a vast quantity and great variety of materials are annually consumed in it. There is scarcely a grass or a tree of sufficient elasticity or strength, which has not at times furnished the materials for a staff or a walking-stick. The stick-maker, however, gives a decided preference to some few kinds out of the almost infinite variety offered to him by nature. Amongst European woods the blackthorn, the crab, especially the warted-crab, the maple, the ash, the oak, especially the young or sapling oak—the beech, the orange-tree, the cherry-tree, the furze-bush, the cork-tree, and the Spanish reed (a grass called *Arundo donax*), are those principally used; and these woods are most generally cut towards the latter end of Autumn, especially when it is wished to preserve the bark. The West Indies furnish a copious supply of the most approved materials for walking-sticks, in supple-jacks (vine-stems), pimentos (from the *Eugenia pimenta*, or pepper-tree), cabbage-stalks, orange and lemon-tree sticks, and the coffee-shrub and Indian briars. Numerous canes, the produce of climbing palms, and gigantic grasses, are also largely used by the stick-maker. The principal of these are the following:—ratans, dragons, and Penang-lawyers, which are the stems of a species of calamus or climbing-palm, and are obtained from India, Singapore, Java, and China—white and black bamboos, fluted bamboos, wangees, jambees,[*] and dog-head canes, which are the stems of various species of bambusa or grasses attaining a height of from 50 to 60 feet, and are exported from China; ground-ratans, large ground-ratans, malaccas, and dragons from Singapore. There are also the bamboo and jungle-bamboo imported from Calcutta; and, lastly, canes from Manilla.

It must not be supposed that these various materials, in the unwrought state, present an appearance at all resembling the finished sticks. Indeed the copious examples in the North-east Gallery (XXIX., 140, pp. 797, 798), fully confirm this statement; but the truth is much more strongly impressed on the mind after an inspection of the immense warehouses of Mr. B. Meyers, who contributed them. Those repositories appear at first sight to contain stores of little value above that of firewood; yet many thousands of pounds have thus to be locked up for a time, in order that the various woods may become properly seasoned. It is only, indeed, after having passed about twenty times through the hand, that even the commonest walking-stick assumes a saleable appearance: and the better descriptions require many more operations. The principal processes of this manufacture deserve to be described.

1. *Peeling off the Bark.*—From most of the forest-woods the bark has to be removed before the separated boughs can be made into polished sticks; but in some cases it is left on. One of the most difficult articles to manipulate is the warted-crab, the excrescences of which are produced by an abnormal growth of the tree resulting from the puncture of an insect. As a half-penny is the payment for peeling one of the most complicated kind, it will be readily concluded that there must be some simple means of facilitating this operation; and accordingly the sticks are boiled for a couple of hours; the bark then yields to the incision of the finger-nail and may be stripped off without difficulty.

2. *Forming the Crook and straightening the Stick.*—Few limbs of trees or even canes, are sufficiently straight in their natural condition to answer the purpose of a walking-stick, and very few present those conformations which can be readily fashioned into handles; hence the necessity for these two operations, which claim our admiration from their ingenious simplicity. The handle is formed by softening the wood or cane in hot *damp* sand, when it becomes pliable and non-elastic, and readily assumes and retains any curvature or bend that may be given to it. Minute attention, however, is required with regard to the temperature for each description of wood; hence the precise degree which is proper for each can only be learned by long experience; and in cases where a new variety of material is imported, some experimenting becomes necessary. The straightening is performed in a similar manner, excepting that the previous softening is effected in *dry* sand heated on an iron plate, that is in the ordinary sand-bath. When the stick has become sufficiently pliable, it is inserted into a deep notch cut in the edge of a strong plank, and is strained first in one direction and then in another until it has become straight. The stick when softened takes any form much as a piece of red-hot iron would do. The straightening-plank is three inches thick, about six feet long, and one foot wide, and is inclined away from the workman at an angle of

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[*] Biographical Sketches attached to Kay's *Edinburgh Portraits*. Part I.

[*] The relative fashionable value of some of these sorts of cane is satirised in *The Tatler*, No. 142, published on Tuesday, March 7, 1709-10. In that paper, "a plain dragon" is charged at five guineas, and "a true jambee" at ten.

about 30° from the perpendicular, it being firmly secured to the floor at the lower end.

3. *Fashioning the Stick.*—In this operation some sticks are wrought to assume a twisted or spiral form, and others the knotted appearance of a bamboo or whangee; these characteristics are imparted chiefly by rasping and filing. Heads or hoofs of various animals very commonly adorn stick-heads, and grotesque human heads frequently display proofs of considerable skill and surprising humour in the artisans employed. Examples of this latter description were exhibited in Class XXIX., No. 140; and by most of the German and Austrian exhibitors.

4. *Staining.*—After straightening or carving, the sticks are in many instances brought to a very smooth surface by means of emery or glass-paper, and finished off with fish-skin; and they are then, previously to the varnishing, made to assume so many different hues by means of dyes, that the uninitiated would conclude that each was a perfectly distinct variety. The surface is likewise sometimes charred, and the charred portion scraped off partially here and there, so as to produce a very ornamental appearance. Sticks are also embellished with lithographic-transfers, but not in England, as hand-labour is too expensive. Malacca-canes, when not sufficiently long between the joints to form a straight stick, are made to appear continuous by reducing the larger part to correspond to the smaller, and tapering it gradually from the point of juncture. It then becomes necessary to colour that portion which has been reduced in size, and this is done with so much skill, that the stained and natural surfaces are not distinguishable.

Hitherto, mention has been chiefly made of sticks of vegetable origin. Of such as are made of animal substances may be instanced whalebone, tortoise-shell, ram's horn, rhinoceros horn and hide, as commonly employed for sticks; and occasionally the real bone of the whale, the spine of the shark, the horn of the narwhal, and ivory. The horns of animals under particular treatment with heat and by mechanical appliances, are drawn out into long cylinders; and tortoise-shell raspings are easily conglomerated by heat and pressure, and in the soft state formed into elongated rods applicable to the manufacture of sticks. The hide of the rhinoceros forms a very transparent horn-like substance, and is very elastic and tough. The feet of fawns, which are frequently used for stick-handles, are made to retain the required form by merely baking them. Ivory, horn, and bone, are also largely used for stick and umbrella handles, and give, in their preparation for these purposes, employment to a considerable number of workmen.

Metals are not much used in the formation of the entire stick, but are restricted chiefly to the handles and ferules; still, however, iron sticks painted to represent wood and cane are not unusual.

Ratan, or common canes, although used for sticks, are more frequently employed as a substitute for whalebone by milliners, stay-makers, and umbrella-makers. For the first two uses they are merely split by hand to the required size. They are also used for chair-bottoms, and are then previously bleached by the vapours from burning sulphur (sulphurous acid). For umbrella-ribs the canes are first assorted into sizes by lads. They are then cut into various lengths ranging from 10 inches to 30 inches by means of a hand-saw, a gauge-board being used to facilitate the operation. After this, three sides are removed by means of a plane, the cane being held at one end by a vice, and resting throughout its length on a plank. The ribs are subsequently dyed by boiling with logwood and copperas (sulphate of protoxide of iron), and dried thoroughly after this operation in a drying-room heated to a high temperature with a stove. Lastly, the excess of dye, a sort of crust, is removed by rubbing the ribs with a piece of waxed-cloth, by which they become polished, and they are then set straight by straining them in a cold state.

Before proceeding with the review of the contributions of the several nations, attention is claimed to the fact that London, Hamburg, Berlin, and Vienna, are the chief seats of the manufacture under consideration, and that by a curious coincidence the principal makers in three of those cities bears the name of Meyer or Meyers. Two of them, namely, those residing in London and Hamburg, are present by their works in the Great Exhibition; but the third, of Vienna, does not exhibit.

Austria.

The display of walking-sticks in the Austrian Section is very extensive, and has been contributed principally by two stick-makers; and also by a manufacturer of pipe-tubes, who has been rewarded chiefly for the latter article (*see* Pipes). Although the two other exhibitors have not received any Award, their contributions are deserving of favourable mention from their extent, cheapness, and goodness of workmanship. The largest exhibitor is A. Tautz (685, p. 1042), who sends a very extensive collection of sticks, from 9*d*. to several pounds each. They comprise most of the known varieties, and are generally ornamented with ivory handles, which, although not remarkable for any great correctness of form, are very well executed and very elaborate, and many of them are exceedingly humorous. Taking the amount of work into consideration, the goods of this maker are generally low in price. The exhibitor next in importance is T. Ludwig (679, p. 1042), who has contributed walking-sticks from 1*s*. each, but not ranging to prices so high as those sent by the maker already mentioned. His contributions are remarkable for their cheapness wherever much hand-carving is displayed.

Belgium.

The Walking-sticks in the Belgium Department are contributed by one exhibitor from Bruges (4, 6), and consisted entirely of a description ornamented with inlaying, which is well-executed.

British Colonies.

The exhibitors of Walking-sticks from the various dependencies of Great Britain are very numerous, and their contributions highly interesting from the variety of materials employed in their formation; none, however, can be considered in any way as representing the art of stick-making in a commercial sense. From *Western Africa* is a stick, or rather, staff of honour usually carried before the African chiefs. Beside this, which was sent by Dr. McWilliam (5a, pp. 953, 954), are several sticks from the horn of the rhinoceros, contributed by Mr. Hanbury (28, p. 950), and a stained Quina walking-stick from the Groenkloof Missionary-station. From *South Africa* Mr. Bridges (21, p. 950) has sent some sticks of rhinoceros-hide. *British Guiana* is represented by two exhibitors, Mr. Bee (156, p. 987) and Mr. Duggin (148a, p. 986); the first of whom has sent a walking-stick made of the outer part or rind of the Tooroo palm from the River Demerara, and the second one made of a tree called letter-wood. From the *Eastern Archipelago* are ratans and bamboos contributed by P. Hammond and Co. (2, p. 988). The *Indian Courts* contain some very interesting specimens of decorated sticks, as they do of most of the ornamental arts, they are contributed by four exhibitors, beside the Honourable East India Company (p. 924). The specimens at present to be noticed consist of four bamboo-walking-sticks, richly mounted in gold and silver, sent from the Rajah of Ulwar); a stick enriched with a painted ornament, and mounted with silver, contributed by the Rajah of Kisnaghur (p. 924); sandal-wood and carved ivory *Chowrees*, or Whisks, from the Rajah of Bhurtpore (p. 924); an ivory walking-stick, with a gold ring; two Ivory Chowrees, one from Jodhpore, the other from Bhurtpore; and two Chowrees, made of the tail of the Yak (*Bos Grunniens*), with silver handles (p. 934). There is also a selection of walking-sticks of various descriptions, made at Calcutta, and in Cochin China; Betel-nut sticks and a Sandal-wood whisk from Calcutta. Most of these beautiful and interesting articles were purchased by the Company for the purpose of the Exhibition. The small collection from the *Island of St. Vincent* (p. 975) consists principally of specimens of Supple-jacks; and from *Trinidad* is a walking-stick sent by the Governor, Lord **Harris** (pp. 974, 975). From *Van Diemen's Land* are two contributions of walking-sticks, made with the hard portion of the bone of the whale, with heads carved out of the whale's tooth, one being sent by Sir W. T. **Denison** (304, p. 998), and the other by Mr. T. **Screen** (305, p. 998): and there is also a stick made of the Oak of Tasmania (*Casuarina quadrivalvis*), contributed by the Venerable Archdeacon Marriott.

China.

In the Chinese Court is a bamboo walking-stick, curiously carved, which was contributed by Mr. F. S. **Carpenter** (33, p. 1425), in addition to which may be mentioned two Chinese sceptres, one from **Her Majesty's Consul at Shanghae** (28, p. 1420), and a still more interesting and elaborately carved specimen contributed by Mr. P. P. **Thoms** (16, pp. 1422, 1423), of Warwick Square, a full description of which will be found in the *Illustrated Catalogue.* It would appear, from Mr. Thom's account, that it dates from 2169 years B. C. These specimens, however, must be regarded as mere curiosities, and in no way representing the commerce of China in this branch of trade, which as regards the raw material is very important, large quantities being annually exported. From Canton alone 1,200,000 sticks of various kinds were exported in 1846, consisting chiefly of different kinds of canes and bamboos, but comprising also laurel-sticks, stems of the tea-plant, and the root of the fig-tree of the Pagodas (*ficus indica*).

France.

The French Department contains some very elegant examples of walking-sticks, which have been sent principally by an exhibitor noticed in the List of Awards; but specimens were also exhibited by the umbrella-manufacturers, who have been spoken of under the preceding article. Indeed many of the umbrella-manufacturers of France are also makers of walking-sticks and riding-whips. France does not export a very large quantity of walking-sticks, on account of the far less cost of production in London and Hamburg of the ordinary descriptions, and in Vienna of those with elaborately carved handles. The chief specimens sent by the French stick-makers, and also by the umbrella-makers, consist generally of articles made of elongated ram's horn and conglomerated tortoiseshell. In 1847 there were, in Paris, one hundred and sixty-five manufacturers of walking-sticks, and riding and driving-whips, employing nine hundred and sixty-two workpeople, who produced goods valued at 140,320*l.* The journeyman, who in Paris works by the piece, earns from 2*s.* 10*d.* to 4*s.* 10*d.* per day; and a skilful engraver or enchaser about 7*s.* 3*d.* per day. The workwomen earn from 1*s.* 2*d.* to 1*s.* 10*d.* per day. M. Natalis Rondot quotes 12,000*l.* as the annual value of the productions of the largest manufacturer in Paris; but this estimate comprises also riding and driving-whips. About nine-tenths of these articles are exported. The imports of bamboo-canes into France are as follows:—

Years.	Bamboos and Large Canes.	Ratans and other small Canes.
	Cwts.	Cwts.
1830	146	126
1835	254	468
1840	610	1,820
1845	828	4,120
1850	950	3,606

Hamburg.

The most important display of walking-sticks is undoubtedly that in the Hamburg Department, contributed by H. C. **Meyer**, jun. (86, p. 1139), who it appears is the most extensive stick-maker in the world. His collection contains about five hundred varieties, comprising most of the known materials. This exhibitor, who in Hamburg employs between two and three hundred workpeople, has also a branch-establishment in New York. There is also a small collection from another exhibitor of Hamburg, which, being a free port, possesses an almost equal advantage with London in regard to obtaining materials free of duty, and is generally a large purchaser at the Colonial sales in London of all the productions obtained from the British dependencies. Being placed on an equality in this respect, Hamburg has another great advantage in the cheapness of hand-labour over London, and is consequently a most powerful rival in the manufacture of sticks.

Hesse.

From the Grand Duchy of Hesse is contributed a collection of sticks, ornamented with transfers from paper, printed by lithography, and which are produced at so low a price as to defy the competition of Hamburg or London. Large quantities of these very neat productions, imitative generally of sticks covered with plait, are annually exported to England and America.

Prussia.

There is one exhibitor who sends good articles from Essen.

Sardinia.

There is one exhibitor of beautifully finished plain sticks, which, although comprising few varieties, are very meritorious.

Switzerland

Sends a gold stick-head with internal mechanism.

Tuscany.

The contributions from Tuscany consist of five walking-sticks, composed of numerous pieces of horn, with handles of gilt bronze.

United Kingdom.

The manufacture of sticks in England is in an increasing and most flourishing condition; for not only are the goods for home-consumption chiefly made in this country, but Great Britain also possesses a very large export trade in the finished article, and almost exclusively supplies the Continent with the raw material with which her markets are abundantly furnished from all parts of the world. To give some idea of the extent of the trade, it may be stated that the principal London maker prepares annually 80,000 bundles, which are equal to 2,500,000 ratans, principally for parasol and umbrella ribs; and he also sells annually the subjoined quantities of manufactured sticks, viz.:—

Partridge canes - - - - - - -	60,000
Bamboo canes - - - - - - -	80,000
Malacca canes - - - - - - -	110,000
Dragon canes - - - - - - -	100,000
Ground ratans - - - - - - -	15,000
English sticks, such as oak, ash, crab, maple, &c. - - - - - - -	144,000

Polished ash-sticks are chiefly manufactured at Birmingham, where they are sawn out by machinery, and subsequently turned and polished. At present the English maker is unable to compete with the German manufacturer in producing sticks ornamented with transfers from printed papers, but probably the substitution of letter-press for lithographic-printing would turn the scale in favour of England.

The importation of walking-sticks is, however, very small as will be seen from the following table:—

Value of the Imports into the United Kingdom, of Manufactured Walking-sticks in 1850.

	£.
From the Hanseatic Towns - -	792
,, Holland - - - - - -	450
,, France - - - - - -	269
,, Other Parts - - - - -	93
From all Parts - - -	1,604

Whale-bone sticks are made better and cheaper in Germany, and the continental makers are also more proficient in making sticks from the hide of the rhinoceros; but as regards those ornamented with silver wire, England is unrivalled, and holds a high position with regard to the chased silver and gilt handles; indeed the ferrules and metal-work generally are unsurpassed. The same remark which was made with respect to umbrellas, here applies to the carved ivory stick-handles: the fault appears to consist in choosing subjects which cannot be well executed at such prices as can be afforded for the carving.

The following wholesale prices will give some idea of the value of the different kinds of sticks of British manufacture, though not a very accurate one, without at the same time seeing the samples:—

	Per doz.	Per doz.
Polished Ash sticks – –	3s.	to 6s.
Bamboos – – – – –	2s. 6d.	to 6s.
Partridge – – – – –	6s.	to 18s.
Whangee – – – – –	4s.	to 48s.
	Each.	Each.
Malacca – – – – –	4s.	to 40s.
	Per doz.	Per doz.
Beech, with crutch handles –	12s.	to 18s.
Canes with loaded heads –	10s.	
	Each.	Each.
Sword-sticks – – – –	7s. 6d.	to 12s.

Walking-sticks are sent by thirteen exhibitors, whose productions are dispersed in various divisions, as, for example; in Classes VIII., X., XVI., XXII., and XXIX.

These specimens comprise many instances of the employment of walking-sticks for containing various implements, alluded to in the introductory matter. Beside the instances there quoted, are to be found—a walking-stick which serves the purpose of a miniature wine-cellar and larder (Class XVI., 81, p. 522); one which contains a voltaic-battery (Class X., 423, p. 455), which continually subjects the owner to an electric current; one (Class XXIX., 183, p. 800), to contain guide-maps, and two or three others convertible into seats, umbrellas, and other instruments.

UNITED STATES.

The United States are represented by one contributor, who exhibits a gold-headed walking-stick, made from the curled-hickory.

WURTEMBURG.

Beside one manufacturer, who exhibits sticks to some extent, three contributors send stick and umbrella-handles, with other articles in ivory, one of whom has obtained a Prize Medal, to be alluded to under the article Toys.

Beside those who exhibit walking-sticks, with articles discussed in other portions of this Report, there are forty-six exhibitors of walking-sticks only, or principally; of these, there are:—

5 Holders of a Prize Medal.
3 Who obtained Honourable Mention.
38 Unrewarded.

46 Total.

The number of Exhibitors from the various countries is as follows:

Austria – – – – –	2
Belgium – – – – –	1
British Colonies:—	
Guiana – – – – –	2
Eastern Archipelago – –	1
East Indies – – – –	5
South Africa – – –	1
St. Vincent – – – –	1
Trinidad – – – –	1
Van Diemen's Land – –	3
Western Africa – – –	3
China – – – – –	3
France – – – – –	1
Hamburg – – – – –	2
Hesse – – – – – –	1
Prussia – – – – –	1
Sardinia – – – – –	1
Switzerland – – – –	1
Tuscany – – – – –	1
United Kingdom – – –	13
United States – – – –	1
Wurtemburg – – – –	1
Total – –	46

LIST OF AWARDS.

BAGRE, —(France, 1123, p. 1232). Honourable Mention is accorded for a collection of walking-sticks made of ram's-horn and tortoiseshell.

CIAUDO, JOSEPH (Sardinia, 68, p. 1304). Prize Medal for a collection of well-manufactured walking-sticks, comprising several varieties of wood.

FRANK, J. G., Offenbach, (Grand Duchy of Hesse, 61, p. 1129). Honourable Mention is accorded for a large collection of well-made and very cheap walking-canes, which are ornamented with tartan and other patterns, transferred from lithographic impressions on paper, and then highly varnished; and also for papier-maché snuff-boxes.

HEDINGER, C., Stuttgart, (Wurtemburg, 92, p. 1119). Prize Medal for a collection of Malacca walking-sticks, partridge walking-canes, umbrella and parasol sticks, and some few umbrella-frames. The goods exhibited are well made, and at very reasonable prices.

MEYER, H. C., jun. (Hamburg, 86, p. 1139). Prize Medal for a most extensive assortment of excellent walking-sticks, sword-sticks, and dart-sticks, the mounts of which are, in most cases, tastefully designed and well executed. The collection comprises also split whalebone, plain and fluted, which is used for covering sticks, whips, opera-glasses, and telescopes.

MEYERS, BARNETT, 18 Crutched Friars (Class XXIX., 140, pp. 797, 798). Prize Medal for a very large and interesting collection of canes and sticks of various descriptions, in the raw state, which comprises all the principal varieties. Also parasol and umbrella ribs of dyed ratan; cane-ribs for milliners, cap-makers, whip-makers, and chair-makers, together with an excellent collection of highly-finished walking-canes, sword-sticks, and dart-sticks, the mounts of which are good in design, and of the best class of workmanship.

SCHULZ, C., Essen (Prussia 593, p. 1083). Prize Medal for a collection of well-made walking-sticks, and sword-canes, which are well manufactured, and are sold at reasonable prices.

TONTI, L., Florence (Tuscany 111, p. 1298). Honourable Mention for a collection of walking-canes composed of numerous pieces of horn of different tints.

IV. FANS.

Upwards of 3000 years ago the artist of ancient Egypt painted the fan on the walls of the tombs at Thebes. There the Pharaoh sits surrounded by his fan-bearers, each in his due rank; and there is seen an investiture of a fan-bearer, which realises the description in *Genesis* of the honours paid by Pharaoh to Joseph. The office of fan-bearer must have been honourable, and the insignia of office were long slender vividly coloured fans on variegated or twisted handles: in war the same officers acted as generals or marshals, using their fans as standards; and in peace they assisted the Pharaoh in the temple, and waved their variegated fans both to produce a cooling breeze, and to guard the sacred offerings from the contamination of noxious insects.

The fan is mentioned by Euripides, and its origin from "barbarous countries;" its use in Greece was similar to that in Egypt, but its forms were far more beautiful. The wings of a bird joined laterally and attached to a slender handle formed the simple yet graceful fan of the Priest of Isis, when Isis became a Grecian deity; but it had not this form alone, for the Greek vases of Sir W. Hamilton show that feathers of different lengths were taken and spread out somewhat in the form of a semi-circle, but pointed at the top; a thread connected the feathers at their base, and another near their summit, and the fan thus made was fixed in a handle. This fan, the precise type of the state-fan of India and China of the present day, was waved by a female slave.

The fan, according to Virgil and Apuleius, was sacred to Bacchus, and the "*mystica Vannus Iacchi*" was carried in procession in the feast of that deity, as well as in the Eleusinian Mysteries. Its appellations multiplied, though its office remained the same, and it was termed indifferently "*Flabellum*" or "*Muscarium*."

The modern Greek church is careful to place a fan in the hands of its deacons to guard the officiating priest and the elements from desecration.

The Roman ladies certainly enjoyed the luxury of the fan, which, gorgeous with peacock's feathers, or delicate with the tinted plumes of the ostrich, could not yet be folded, and rendered the services of an attendant necessary.

In the works of the middle ages references are made to the two forms of the fan, to that employed for winnowing the grain, and that used in the service of the church, alternately to court the breeze or wave away the flies, till we hear of the fan as brought to France by Catherine de Medicis, when it was no longer stiff and unyielding, but light and pliable. In the early part of the seventeenth century, it was so constructed that it could be folded in the manner of those used in the present day. Formed of paper and perfumed leather, it became the delight of the French Court; and attracting the attention of artists, fans in the luxurious reigns of Louis XIV. and Louis XV. (in the latter under the name of "Pompadours") shone with gilding and gems, and at length glowed with the pictures of Boucher and Watteau; until at length no toilet was esteemed complete without a fan, the cost of which was frequently in those days as high as from 12*l.* to 15*l.* sterling. In Italy, on the contrary, in the early part of the seventeenth century, even painted fans were of a very moderate price, and of universal use. "The first fans," says Coryat, in his *Travels* in 1608, "that I saw in Italy, I did observe in this space between Pizighiton and Cremona; but afterwards I observed them common in most places where I travelled. These fans both men and women of the country do carry to cool themselves with in the time of heat by often fanning of their faces. Most of them are very elegant and pretty things. For whereas the frame consisteth of a painted piece of paper and a little wooden handle, the paper which is fastened into the tops is on both sides most curiously adorned with excellent pictures, either of amorous things, having some witty Italian verses or fine emblems written under them; or of some notable Italian city, with a brief description thereof added thereto. These fans are of a mean price, for a man may buy one of the fairest of them for so much money as countervaileth an English groat."

England must have been a great buyer of fans in the last century, as a lady of that period would have felt as awkward without her fan as a gentleman without his sword. Indeed Addison makes the comparison, and in the Spectator he describes an academy where the use of the fan is taught. "In the flutter of a fan," he observes, "there is the angry flutter, the modest flutter, the timorous flutter, the confused flutter, the merry flutter, and the amorous flutter." He says, "I have seen a fan so very angry that it would have been dangerous for the absent lover who provoked it to have come within the wind of it."

Gay again gives the fan as a present from Venus to a despairing lover, in order to soften his mistress, and describes in verse the hint which the peacock's tail presents for its construction.

China.

In fan-making the Chinese and French are the great rivals, and may be said to monopolise the supply of the whole world. In the lacquered fans the superiority of the natives of China is fully admitted; they are unrivalled especially when price is taken into consideration, in the sculpturing and piercing of the wood, bone, ivory, or mother-of-pearl framework. Even their commonest fans are remarkable for boldness and originality of design, brilliancy of colouring, sharpness of drawing, and solidity and correctness of workmanship. The manufacture of fans is carried on almost exclusively at Canton, Soutchou, Hang-tchou, and Nankin. The fans of ivory and bone and of feathers, are made exclusively for exportation to Europe or America; those used by the Chinese are of bamboo polished or japanned, and covered with paper: they are sold at from 10*d.* to 14*s.* 6*d.* per dozen, according to the quality of the frame and the design of the leaf.[*] The examples which are in the Great Exhibition did not, however, come direct from any Chinese maker, but were contributed by three English exhibitors, viz.: Messrs. C. T. Braine (p. 1424), J. Daniell (p. 1424), and Hewett and Co. (p. 1421). The examples exhibited comprise fans of painted and embroidered feathers; a feather-fan painted with silver outlines, representing groups of Chinese figures, the feathers being alternately blue and white; an ivory-fan elaborately carved and pierced, and considering the amount of work, very cheap, its price being only 20*s.* There are also several very common paper-fans, ornamented either with rude delineations of landscapes, or besprinkled with gold-spangle.

France.

Fan-making has arrived at a high degree of perfection in France, and presents a remarkable instance of the subdivision of labour, as may be gleaned from the statement, that about twenty different operations, performed by as many pairs of hands, are necessary to the production of a fan which sells for less than one halfpenny; and that these various processes are not all carried on in a single manufactory, but on the contrary, form four distinct branches of trade, directed by masters employing the various artisans, who, for the most part, work at their own homes, and who are frequently assisted by their wives and children.

A fan consists of the frame of solid material, called a "*Pied,*" which is composed of the inner ribs or "*Brins,*" and the two outer ribs or "*Panaches,*" and likewise of the flexible leaf or "*Feuille.*" The frame is made of wood, bone, ivory, tortoise-shell, or mother-of-pearl. The first operation is performed by sawing the material into the required form for the inner and outer ribs. These ribs then pass into the hands of another workman, who shapes them with a file, and they are then taken up successively by the polisher, the piercer, the sculptor, the gilder, and the workman who fixes on them the spangles and pins of gold, silver, and steel. The frame is now sent to the manufactory which furnishes the necessary drawings for the series of operations, where it is riveted, the rivet being frequently ornamented with a precious stone.

The leaf or feuille is sometimes single, but more often double; and it is usually made of paper lined with silk or calico, but also of parchment, lamb's-skin, satin, and silk gauze. The richer kinds of feuilles are painted in water-colours on vellum, by artists known as *feuillistes;* and the highest and most expensive class by artists of celebrity, since Boucher and Watteau, Camille Roqueplan, Gavarni, Clément Boulanger, and Dupré, have affixed their signatures to fans which they have decorated. The devices on the more ordinary descriptions of fans are printed from copper plates, and coloured by hand, and the most common sorts are ornamented by the process of chromo-lithography.

The feuille is folded in a mould of strong paper, and is then mounted on the frame and glued to the prolongations or "*Bouts*" of the inner ribs. The feuille of the best fans is after this painted on the edge with gold-size, and gilt with leaf-gold; but the feuille of the common fans is printed in Dutch metal, previous to its being cemented on the frame. The decorator now ornaments the frame with gold or coloured ornaments, and the fan lastly passes into the hands of the overlooker, who attaches the tassels, and selects the proper sized sheath into which she places it.

The frame or "*Pied*" is made in the parishes of Andeville, the Deluge, the Boisière, Corbeil-Cerf, and Sainte Geneviève. In the district situated between Méru and Beauvais, in the Department of the Oise, 2,000 workpeople, men, women, and children, are employed in the fan-trade. The woods used are the beam-tree, the plum-tree, ebony, sandal, and the lime-tree. The dexterity and sureness of hand of the peasant workman are said to be quite wonderful. Considering his want of knowledge of the principles of drawing, his facility in engraving, sculpturing, and gilding, is certainly remarkable. The piercing is performed by means of minute saws, which the workman makes for himself with pieces of watch-spring. A remarkable piece of saw-piercing in the shape of a mother-of-pearl fan is exhibited in the French Section, No. 149; it contains no less than 1,600 holes in the square inch: this tour-de-force is the production of one of these peasant artisans, named Désiré Fleury.

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[*] *Etude pratique du Commerce d'exportation de la Chine,* by Natalis Rondot, pp. 92, 93.

The printing, the colouring, and the mounting of the feuille, and the final embellishment of the fan, are usually performed at Paris, under the direction of the fan-maker, called *par excellence* "*Eventailliste;*" though he has really but little to do with the manufacture of the fan, and must be regarded rather as the collector into one focus, and arranger of the produce of others; yet his labours are not the less essential. The mounting of the feuille, its ornamentation with feathers, and final decoration, are the operations usually performed by a small number of workpeople in his own establishment; besides which he furnishes the drawings to the peasant in the Oise, for the framework to suit the constant changes in fashion, he instructs his feuilliste as to the style of ornament, he groups together the frames and feuilles, and finally he overlooks the whole to see that the workmanship has been well executed. Except the mountings of the feuille and the final adorning of the fan, the other operations are usually performed by workmen at their own homes. The number of fan-makers or *Eventaillistes* in Paris in 1827, was 15, who employed 1,010 workmen (344 men, 500 women, and 166 children), and sold about 40,420*l.* worth of fans. According to the "*Statistique sur l'Industrie à Paris,*" drawn up by our colleagues M. Natalis Rondot and M. Say, it appears that in 1847, there were 122 fan-makers, comprising chamber-masters as mounters, feuillistes, painters, and colourers. The value of the fans made was 110,000*l.* These masters employed 575 workpeople (262 men, 264 women, 29 youths, and 20 girls). The workmen on the average earn 3*s.*, and the women 1*s.* 8*d.* per day. The men were for the most part copper-plate engravers and printers, lithographic draughtsmen and printers, painters, and colourers; the women were mounters, illuminators, painters, colourers, and overlookers. Thus in twenty years, it appears that the produce in fans had increased in value nearly threefold, whilst the number of workpeople had diminished to one half. This change is to be attributed to the employment of machinery; especially of the fly-press in stamping out and embossing the ribs, and the extensive employment of chromo-lithography, an art not practised at the former period. By these means the French have been enabled greatly to increase their exports by the production of cheap fans, to compete with those made by the Chinese. P. DUVELLEROY (France, 495, p. 1201) exhibited some small fans, the price of which was as low as 5*d.* per dozen.

The collection of fans in the French Department is most complete, and contains several specially decorated in honour of the Exhibition, and of Her Majesty and Prince Albert. Beside these and others, painted by first-rate artists, it comprises most of the descriptions manufactured for exportation, and which possess distinctive characters, according to the market for which they are destined. For instance, some display great differences in the length of the ribs and the portion of the circle occupied by the fan when open: other fans, intended for Turkey and Morocco, are composed entirely of feathers, and, in conformity with the Mohamedan doctrine, no living object is painted on them. The principal foreign markets for fans made in France are the South American States. In the decoration of such fans as are intended for Buenos Ayres blue and green are carefully omitted, these colours having political significance, and being prohibited from use on pain of death. All the exhibitors are of the class called "*Eventaillistes,*" as none of the manufacturers of the Department of l'Oise send their productions.

BRITISH COLONIES.

The colonial dependencies of Great Britain contribute many examples of Fans, some of which are interesting on account of their simplicity, whilst, on the other hand, those from India present most striking proofs of the luxurious splendour of the Indian princes. *British Guiana.* Mr. W. H. HOLMES (132, p. 986), exhibits fans made of the Ita-palm. *Canada.* A fan of somewhat similar nature, but made of the bark of a tree, is contributed by Miss HELEN ROCHELEAU (175, p. 967). *Ceylon.* There are several rich "Punkahs" or fans, and a richly-painted ivory fan-handle from this island. *India.* The Indian Department contains fans or *Punkahs* in great variety as regards form and decoration and the material employed, some of them being of a very costly description. There are, for example, two fans contributed by H. H. the RAJAH of KOTA (p. 924), one with an ivory handle, the other with a gold handle: but as the names of the various manufacturers were unfortunately not ascertainable at the time the Jury examined these specimens, no prizes were awarded in their favour. The Indian fan differs from that of Europe and China in not closing, and likewise in its form; and it is usually kept in motion by an attendant. Beside the fans affixed to central handles, all of which are most gorgeously enriched with embroidery and jewels; there are exhibited others resembling a curtain suspended from a silver rod, which is held horizontally by the attendant, and waved backwards and forwards over the head of the wealthy Hindoo: and there is also the circular standard-fan; the handle being a silver staff, crooked at the top, to which the fan is attached on the side opposite to the crook. The attendant stands by the side of his master, and placing the end of the staff against his foot, inclines it away from his body and slowly swings it to and fro. There is also a beautiful peacock-feather fan from Assam, and a fan or *Punkah*, composed of China beads and pearls, and made in the city of Delhi. The most simple, however, are those made of the entire or the divided leaf of the *Borassus flabelliformis*, manufactured at Calcutta, and commonly used both by natives and Europeans. The other examples comprise, a punkah made of khus-khus grass (*Andropogon muricatus*) which, when wetted, emits a fragrant perfume; fans made of sandal-wood, from Calcutta; a fan made of bamboo from Moorshedabad, and several of similar description from other parts of India; and lastly, from Bengal, large and hand-fans, made of the palmyra-leaf. As far as the Reporters could ascertain the names of the contributors, it appears that, besides the fans from the Rajah of Kota, before named, several of the examples were sent by the RAJAH of PATTIALA (p. 924), the RAJAH of JODHPORE (p. 924), the JUBBULPORE SCHOOL of INDUSTRY (p. 924), and Captain DALTON (48, p. 791). The inspection of these beautiful productions of Indian workmen, naturally suggests the idea that their skill and remarkable taste might be turned to profitable account, if directed to the production of fans suitable to the European and American markets. *Nova Scotia* (p. 970) sends an example of a very simple Indian fan. *Trinidad.* Lord HARRIS, the Governor (p. 975), sends examples of fans for ladies. And from *Western Africa*, Mr. R. JAMESON, of Liverpool (22, p. 955), exhibits several fans from the banks of the Niger, one of which is made of a species of grass.

EGYPT.

A few specimens of fans are exhibited in the collection from Egypt, to which much interest attaches, as coming from a country in which, possibly, the fan was first devised.

SPAIN.

There are two exhibitors of fans in the Spanish Court, one of whom contributes painted and also printed "*Feuilles;*" and the other both feuilles and complete fans, some of which are copies from French models. The examples, although they will bear no comparison in point of taste or execution with the splendid fans from France, are good of their kind; and it would appear that the attention of their exhibitors has been directed rather to the manufacture of an article for general sale, than to the production of works of art. But it is remarkable, that no finer specimens should have been sent from a country in which the use of fans is so prevalent that they are commonly offered for sale outside the arena of the bull-fights and other places of amusement.

Tunis.

The fans in the Tunisian Court are ten in number, and are in some cases ornamented with rich embroidery.

Turkey.

The only example is an embroidered fan made at Adrianople.

Wurtemburg.

Several bone and ivory fans are exhibited by M. C. **Stoll** of Ulm, they are reasonable in price, but not nearly so good as the ivory-fans contributed by the French makers.

The number of exhibitors of fans is twenty-three; of these, there are:—

2	Holders of a Prize Medal.
1	Who obtained Honourable Mention.
20	Unrewarded.
23	Total.

The number from the various countries is as follows:—

British Colonies:—	
British Guiana	1
Canada	1
Ceylon	1
India	5
Nova Scotia	1
Trinidad	1
Western Africa	1
China	3
Egypt	1
France	3
Spain	2
Tunis	1
Turkey	1
Wurtemburg	1
Total	23

List of Awards.

Ducrot and **Petit**, Paris (France 149, p. 1178), Honourable Mention for a collection of fans in ordinary demand and at reasonable prices, namely, from 5*d.* to 40*s.* each; also excellent examples of pierced and sculptured ivory and mother-of-pearl fans, one of the specimens of which has been before alluded to in the introductory notice. These are of much higher quality, and range in price from 3*l.* to 12*l.* each.

Duvelleroy, P., Paris (France, 495, p. 1201), Prize Medal for a display of fans ornamented with artistic paintings, and remarkable for the beauty of the inlaying, and the pierced ivory and mother-of pearl frames. The most elegant fan in this collection is one painted by Roqueplan; the ribs are of richly-pierced and sculptured mother-of-pearl inlaid with gold, and it is valued at 40*l.* Beside the above, others intended for foreign markets were exhibited, the prices of which vary from 5*d.* to 40*s.* per dozen.

Félix, Alexandre, Paris (France, 199, p. 1183), Prize Medal for a collection of fans, being for the most part copies of the best examples of ancient fans: these, although not possessing the merit of originality, are such remarkably beautiful specimens of vellum-painting, that they fully entitle this manufacturer to the award, and are moreover the richest of any exhibited.

V. PIPES AND AMBER MANUFACTURES.

Before discussing the merits of the pipes contributed from all quarters of the globe to adorn the Great Exhibition, it will be proper to notice the materials principally employed in their manufacture.

Clays, of different kinds, are more used than any other substance in the formation of pipes: but as their nature and composition will probably be fully discussed in the Special Report on the fictile-arts, of which clay pipe-making is comparatively but a small branch, it is needless here to describe them.

Woods of several descriptions are next in importance. The wild cherry-tree, and the jasmine are the principal sorts, and great care is bestowed on their culture to ensure their growing free from knots and blemishes; the young stems of the jasmine being wound round with cloths to effect that object. Lemon-tree and ebony are also in request, the latter being generally used for carved tubes.

Mother-of-pearl, *Horn*, *Ivory*, and *Bone* are extensively used; nor are the *precious metals* and costly *gems* excluded from a share in the formation of the pipe. But these have not that intimate connection with the subject under notice, which appertains to two materials—*Meerschaum* and *Amber*, whose names are euphonious to the ear of the genuine smoker. The former substance is devoted exclusively to his use; and the latter though not entirely his own, pays to him a very considerable tribute, in the form of mouth-pieces.

So early as the year 1609, the genuine meerschaum must have been held in estimation in England; since Dekker appears to refer to it in his "*Gull's Horn-book*," when he wishes his gallant to be able to discourse "which pipe has the best bore, and *which burns black*, and which breaks in the burning."

Meerschaum (*Ecume de mer*) is a mineral of somewhat rare occurrence. It consists of magnesia, silica, and water, and may be called a hydrated silicate of magnesia ($MgO, SiO_3 + HO$). As the compound is not crystalline, its constituents are variable, and thus silicates of iron and alumina are often found in combination with it. These affect the colour of the meerschaum, which when pure is quite white. Silicate of iron frequently occurs, and gives it a tinge of colour, varying from the palest yellow to a deep brown. Good meerschaum is tolerably soft, it resists the pressure of the hand, but is easily indented by the finger-nail, and, especially after having been wetted, may be easily cut with a knife. The fracture is generally earthy, and rarely conchoidal: still the state of aggregation of even pure meerschaum is very variable, as is proved by the marked differences in its specific gravity. Some kinds sink in water, others float on its surface; these qualities in the estimation of the pipe-maker, are indicative of different values, for he rejects both the very heavy and the very light, and prefers those of medium density. The light varieties are generally very porous, and even contain large cavities, whilst the heavier kinds he suspects to be an artificial product.

Meerschaum is met with in various localities, in Spain, Greece, and Moravia; but by far the largest quantity is derived from Asia Minor, it being dug chiefly in the peninsula of Natolia, near the town of Coniah. Formerly the material was roughly fashioned on the spot into bowls, which were more elegantly carved in Europe. The art was especially cultivated in Pesth and Vienna, where it formed an extensive and important branch of trade. These rough bowls still occur in commerce, but by far the greater part of the meerschaum is exported in the shape of irregular blocks with obtuse angles and edges, requiring careful manipulation with the aid of water, in order to remove irregularities and faulty portions. A beautiful specimen of meerschaum thus cleaned is contributed by **Ludwig Hartmann** (Austria, 675; and there is also a box of meerschaum earth in the Grecian Department, 23). This preliminary treatment still leaves numerous blemishes, and the meerschaum of commerce has defects of various kinds; besides various minerals scattered through its mass, it contains a hard sort of meerschaum, which the manufacturer calls chalk (*Kreidemassen*), and which is the cause of much difficulty in the carving.

Previous to the mechanical treatment of the meerschaum* for making the bowl, it is subjected to a certain preparation. It is soaked in a liquified unguent composed of wax, oil, and fats. The wax and fats which the substance absorbs, cause the colours which meerschaum assumes after smoking. Under the influence of the heat produced by the burning tobacco, the wax and fats pass through all the stages of a true process of dry distillation, the substances thus formed become associated with the products of the distillation of the tobacco, and by their diffusion through the meerschaum, all those gradations of colour which are so highly prized by the connoisseur are produced.

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* This subject is ably discussed under the head "Meerschaum," in Prechtl's "*Encyclopädie der Gewerbe und Künste*," from which some of the foregoing remarks have been abstracted.

Occasionally, though rarely, the bowls are artificially stained by dipping them, before they are soaked in wax, in a solution of copperas (sulphate of iron) either alone, or mixed with one of dragon's blood. This process must manifestly affect, very materially, the shades of colour produced in smoking.

Attempts have not been wanting to imitate meerschaum, the process being rather mechanical than chemical; for although chemists have of late been very successful in the artificial production of minerals, for instance palagonite (Bunsen), spinelle (Ebelmen), crystallized carbonates (Senarmont), no one has attempted the production of meerschaum, chemically.

The large quantity of meerschaum parings that are left in roughing out the bowls would entail considerable loss, unless some process had been devised of rendering them available. A species of meerschaum bowl has long been known in commerce under the name of *Massa-köpfe* (massa bowls), which is made from the parings; these are triturated to a fine powder, boiled in water, and moulded into blocks with or without the addition of clay, each of these blocks suffices for one bowl; but before they can be used they must be allowed to dry for some time, as they contract considerably. Specimens of composition pipe-bowls and cigar-tubes are exhibited in the Austrian Section (687). These bowls are distinguished from real meerschaum by their greater specific gravity, but there is no very certain test by which the real meerschaum can be distinguished from the composition, and many suppose that all the heavier descriptions are spurious, though there is no absolute proof of this being the case. A negative test may however be mentioned; the composition bowls never exhibit those little blemishes which result from the presence of foreign bodies in the natural meerschaum, therefore if a blemish occur in a meerschaum bowl, which is very frequently the case, the genuineness of the bowl is rendered most probable; but as these do not show until after the bowl has been used for some time, the test is not of much value.

Amber.—The most extensive use of this elegant material is for the manufacture of the mouth-piece, an essential constituent of the genuine meerschaum and Turkish pipe. Up to the present day, amber mouth-pieces continue in great request in the East, where they fetch very high prices, instances of which will be quoted. There is a current belief in Turkey that amber is incapable of transmitting infection, and as it is a great mark of politeness to offer the pipe to a stranger, this supposed negative property of the amber accounts in some measure for the estimation in which it is held. In the Christian countries of Europe, ivory, bone, and horn, have, to some extent usurped the place of the more costly material, which is reserved for the higher class of pipes. Amber is also much employed in numerous small fancy articles, especially for beads, necklaces, brooches, and earrings. The Exhibition furnishes also examples of its being worked occasionally into candlesticks, salvers, pipe-tubes, and other larger articles. The coarser descriptions and chips of amber are also employed for the manufacture of varnish, and the preparation of amber-oil and succinic acid, which it yields by distillation at a moderate temperature. Copal, which bears a strong resemblance to, but is much cheaper than amber, is occasionally substituted for it, fraudulently or through ignorance. There is no difficulty in distinguishing the two by a chemical analysis, but this renders the sacrifice of a small piece of the substance necessary; some varieties of amber, especially the dark yellow and transparent descriptions, are scarcely to be distinguished, unless by a well-practised eye, from copal. A few words may be said respecting the chemical characters of amber which, however, do not affect its employment in manufactures. According to an analysis of Berzelius, it contains a volatile oil, succinic acid, two resins soluble in alcohol and ether, and a complex bituminous substance (succinic bitumen) which is not affected by any solvent.

The mode of obtaining amber is peculiarly interesting. The greater part is found on the coast of Prussia Proper, especially between Königsburg and Dantzic; it is distinguished as terrestrial and marine amber; the former is dug in mines, and is generally found in alluvial deposits of sand and clay, associated with fossil wood, iron pyrites, and alum shale. Amber is also found in some other countries, but never to any amount. The marine amber is cast ashore during the autumnal storms on the coast of Pomerania and Prussia Proper. It is then picked up, or fished for with small nets. There are several fine specimens of both descriptions of amber in the Austrian Section (675, p. 1042), and in the Prussian Section (438, 441, 40, and 41, pp. 1075, 1050). In the case bearing the latter number are specimens of land amber, and the fossil wood associated with it which were obtained at a depth of 60 feet by the exhibitor, M. TESSLER (41, p. 1050), who employs about 20 workpeople in his amber-pits. The opinions respecting the origin of amber are very divided, some hold the view expressed by Tacitus in his *Germania*, that it is a resin exuded by certain coniferæ, traces of which are frequently observed among the amber. Others assume it to be a species of wax or fat, having undergone a slow process of putrefaction; and they base their views upon the fact that chemists are able to convert cerous or fatty substances into succinic acid by inducing oxidation artificially. It is quite certain that at one time amber must have been liquid, for numerous small animals are found enclosed within it; these for the most part are insects belonging to an extinct species of *Arachnidæ* (40). There are numerous and excellent specimens of amber enclosing insects in the Prussian Section (441), and others in a case which deserves favourable mention from D. T. TESSLER, who has sent one specimen containing the leg of a toad.* The processes which nature employs for the preservation of the structure of extinct insects, is one which the microscopist successfully imitates by embalming his delicate dissections in Canada balsam between two slips of glass.

There is evidence of the extreme antiquity of amber in the fact that the Phœnicians of old fetched it from Prussia. Since that period it has been obtained there uninterruptedly, and no diminution in the quantity annually collected has been perceived. This would almost induce a belief in the correctness of the putrefaction theory, above alluded to, and we may perhaps assume that a constantly new formation of amber is taking place; this view is somewhat strengthened by the different appearance of the varieties of amber, which seem to exhibit the successive stages of its development and decay: still this conclusion to many will appear strained. The different kinds of amber are distinguished by varieties of colour and degrees of transparency. It is found of all shades of yellow, from the palest primrose to the deepest orange, or even brown. In point of clearness amber varies from vitreous transparency to perfect opacity, specimens being obtained nearly as white as ivory; in this latter case the transformation is assumed to have advanced further than in the ordinary varieties. It is rarely found, and is chiefly used for cameo ornaments, and is mounted on darker amber which forms the back ground. Several examples of its employment are exhibited in the Prussian Section.

An inquiry naturally suggests itself as to which of these varieties of amber is the most valuable. It is self-evident that this must depend, as in the diamond, upon the size and the uniformity of the pieces. Besides, as all the varieties, excepting the white, which has its special uses, are equally applicable for manufacturing purposes, it follows that the value of any particular sort must depend in a great measure upon its rarity. The straw-yellow, slightly cloudy, translucent variety is the most rare, and is that which the Orientals prefer to all others, and which they purchase at extravagant prices. There are few specimens of it in the Exhibition, and it is needless to search for them in the German Department, as every piece that is found in Prussia is exported to Turkey in the raw or manufactured state; and it is in the section occupied by this latter country (1928, 1929) the only specimens in the Exhibition will be found.

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* According to M. Natalis Rondot, specimens of amber containing insects are of frequent occurrence in China.

Some writers are of opinion that the preference which the orientals show for the pale yellow, slightly clouded variety, has been transmitted to them from the ancients, but their arguments will not bear a close examination.

Having alluded to this matter, it will be as well to advert to the opinions held on the subject by the ancient authors. It appears that the word "electron" (amber) had two significations; one referred to the substance which we call amber, hence the derivation of the word electricity, from its long-known property of attracting, when rubbed, light substances, such as straws, which was the first electric phenomenon ever observed; the other meaning applied to an alloy of gold and silver found in nature, or produced artificially. Pliny* expresses himself very clearly on this point; he says that gold always contains silver, and that when the silver amounts to one-fifth of the compound it is termed "electrum;" if the proportion is higher, the electrum ceases to be malleable.

It has been assumed that the latter was the original meaning of the term, and that it was subsequently applied to amber on account of its resemblance to the white gold, the variety most closely resembling the alloy possessing the highest value. This view is supported by the circumstance that we find "electron" spoken of by the epic poets Hesiod and Homer as employed in articles for which amber would scarcely be applicable. The applicaction, for instance, of amber for shields might cause some alarm for the safety of the Homeric heroes. But the ancient poets did not always pay minute attention to the natural qualities of the materials which they mentioned in their narrative; this is evident from Hesiod's employing other fragile substances, such as ivory and alabaster in the manufacture of shields. Moreover, the fine carving of these show-pieces was not adapted to resist heavy blows. The learned Buttmann (*Abhandlungen der Berliner Academie*, 1818, 1819), very correctly observes that these works of art are derived by the poet direct from the workshop of Vulcan, and that this at once does away with any protest against the insecurity of ivory, alabaster, or enamel in the manufacture of his shields. The same learned antiquary has compared critically the most important passages in which the word "electron" occurs, and he has demonstrated, incontrovertibly, that the word originally meant amber, and that the second interpretation has only been introduced at a later period, especially by the tragic poets. Thus it follows that the transmission of the predilection for the straw-coloured cloudy amber from the ancients is far from being proved, and that we must content ourselves with the explanation first attempted of its resulting from the greater rarity of this kind of amber. This predilection appears to be confined to the East, as in other countries, *e. g.*, Russia, the orange-yellow transparent variety is decidedly preferred, possibly on account of its cheapness. The Russian peasant girls adorn themselves with double and treble rows of amber beads; though frequently they are supplied with mere copal-beads instead of the genuine article.

Having made these general observations on the character of amber, we pass to the detailed consideration of what has been presented to us in the Exhibition under the head of Pipes and Amber Manufactures.

GERMANY.

No one will be surprised that this land of smokers bears off the palm in the manufacture of pipes and amber; nor that her exhibitors outnumber those of all other nations collectively. All the States of Germany, however, have not contributed equally, the pipes being chiefly from Austria, and especially from Vienna, and the amber-manufactures from Prussia. The meerschaum works of the Viennese are unrivalled, as regards taste in design and excellence in execution; the carving of many of the pipe-bowls and cigar-tubes being examples of highly-cultivated art. Most of the fancy pipe-tubes, composed of horn and mother-of-pearl, are more curious than graceful; the cherry-tree tubes are in great variety, and are good examples of this component of the long pipe; besides these, there are large numbers of bone and wood mouth-pieces, and others made of amber, the latter being beautifully worked.

The meerschaum pipes from *Prussia* are not numerous, nor are they so elaborate as those of Austria. The Prussian Section presents such a series of amber specimens as are not likely to be again collected; the manufactured amber does not, however, evince much feeling for artistic design on the part of their exhibitors, whose merits rest principally on the excellence and difficulties of the workmanship.

The contributions from the other parts of Germany consist of meerschaum and other pipes from *Bavaria*, which are not remarkable; porcelain pipes from *Hamburg* and clay-pipes from *Nassau*. Those from Hamburg are of fancy forms, and those from Nassau are chiefly plain descriptions, which are sold at exceedingly low prices.

BRITISH COLONIES.

British Guiana.—T. B. DUGGIN (146, p. 986) sends a specimen of a pipe, or rather tube, used by the aborigines for smoking tobacco, called a Winna; it resembles a cheroot in outward appearance, but is hollow so as to contain the tobacco. It is said to be made from the rind of the fruit of the Manicole-palm (*Areca manicot*, Lodd.), from the River Berbice. It may be remarked that such tubes, made of paper covered with a leaf of tobacco, are now manufactured in England. *Canada* contributes a collection of well-made clay-pipes. The *Indian* collection contains examples of the costly and beautifully-ornamented cocoa-nut and lac Hookahs, mounted in silver with their rich tubes or snakes, and the simple pipe composed of two pieces of bamboo, one for the bowl cut close to a knot, and a smaller one for the tube. These primitive pipes are in common use amongst the poorer natives of India, and yet Dr. Royle cites an extemporary pipe sometimes used by the natives, which surpasses even this in simplicity; the amateur makes two holes, one longer than the other, with a piece of stick, in a clay soil, inclining the stick so that they may meet; into the shorter hole he places the tobacco, and applies his mouth to the other, and thus luxuriates in the fumes of the narcotic herb. There is, likewise, a specimen of the Singoo opium-pipe which is of very small dimensions, the tube not being larger than a thimble. The opium is placed in the bowl, and ignited by placing a piece of charcoal on it, which is effected with a small pair of tweezers, which find a place in this interesting and well-arranged collection.

CHINA.

The habit of smoking is very general in China, being common to both sexes in all classes of society, and at all ages. In every part of this vast empire the tobacco plant is cultivated, and consumed both as snuff and for smoking. So prevalent is the habit that little girls and boys are commonly seen smoking, and from this early period it is persevered in by its votaries through life. It is always customary to offer visitors a cup of tea and a pipe. M. Natalis Rondot estimates the number of smokers in China as at least 100 millions, and states that pipes are made in enormous numbers, and in an almost infinite variety of forms; they are of three classes, the water-pipe, the straight-pipe, and the opium-pipe. The Chinese pipes are generally very long, and the bowl very small, it being usually made of nickel-copper (white metal). The only contribution however is from Dr. Berncastle, who sends an opium-pipe and appurtenances.

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* *Historia Naturalis*, xxxiii., c. 4. Omni auro inest argentum vario pondere, alibi dena, alibi nona, alibi octava parte. Ubicunque quinta argenti portio est, electrum vocatur. Fit et cura electrum argento addito; quod si quintam partionem excessit, incudibus non resistit. Et electro auctoritas Homero teste, qui Menelai regiam auro, electro, argento, ebori fulgere tradit.

Id. Page 469, vol. ii., of Holland's Translation.

Egypt.

The specimens in the Egyptian Court comprise two Narguilés or water-pipes, one of zinc and one much richer, mounted in silver; also several pipe-bowls of Assouam and Assiout.

France.

The examples consist of clay-pipes only from two exhibitors; they are very numerous, and are exceedingly well manufactured, but their forms are not such as to sustain that high reputation for graceful design which this country enjoys. This is to be attributed to the class of persons for whom the pipes are intended, and who prefer a pipe-bowl moulded into the form of some grotesque head with staring eyes, to the most elegant figures which could be devised. Very large quantities of these pipes are exported to England, Germany, Italy, the United States, and other countries, and are much esteemed on account of the very excellent quality of the earthenware of which they are formed. Their superior texture, it appears, is due in some measure to the clay of which they are chiefly composed, but principally to the great skill of the manufacturers in compounding it with other materials. To give some idea of the extent of the pipe-manufacture at St. Omer, it may be stated that one of the exhibiting manufactories—that of **Dumeril, Sons, and Co.** (p. 1181)—employs 450 workpeople, and produces annually 100,000 gross, or nearly fifteen million pipes, varying in price from 1*d*. per dozen to 3*d*. each; and that the other—that of **L. Fiolet** (p. 1184)—employs 850 workpeople, and produces 200,000 gross, or nearly thirty million pipes, consuming 7,674 tons of clay in their manufacture.

Persia.

Mr. **J. B. Thomson** (3, p. 1426) contributes a Narghili or Narguilé, and a lady's amber mouth-piece, and Mr. **J. Hudson** (10, p. 1427) several specimens of pipes, which illustrate the luxurious habits of the Persians in smoking.

Sardinia.

The contributions from this country consist of beautiful examples of carved meerschaum pipe-bowls, which equal those of Austria, but are insignificant in point of number, having been contributed by only one exhibitor.

Turkey.

In the Turkish collection are numerous rich examples of the Narguilé, or water-pipe, in some cases composed of silver, and ornamented with precious stones; the flexible tube, or Marpitch, used with the Narguilé, is formed of a spiral wire covered with leather, over which another wire is coiled, so as to fall between the interstices of the inner spiral. The Turks, in smoking the Narguilé, inhale the fumes into the lungs, and never consume the last portions of the tobacco, as the smoke becomes too pungent. There are numerous examples of the long-pipe, or Kablioun, and the short-pipe, or Chiboque, with the cherry-tree, jasmine, wild-plum, and ebony tubes; and likewise the crude gimblets, with which these tubes, five feet or more in length, are bored. In boring the tube, the Turk places it above the gimblet and thus gets quit of the chips; after boring the hole half way he meets it from the other end of the stick. The wild cherry-tree, which is principally used, seldom occurs free from defects in the bark, to repair which, so that the reparation cannot be discovered, is the chief difficulty. There are examples of Lulés or pipe-bowls used with these tubes, they are composed of the red-clay of Nish, mixed with the white-earth of Roustchouck. They are very graceful in form, and are, in some cases, ornamented with gilding, but as the Turk prefers a fresh bowl each time, the plain ones are chiefly employed on the score of economy. It is not unusual in Turkey to compute distances, or rather the duration of a journey, by the number of pipes which might be smoked in the time necessary to accomplish it. The Imames or amber mouth-pieces exhibited in the Turkish section surpass those of any other in splendour. One exhibitor sends four of choice amber, which are worth together, 1,000*l*.; besides these, there are three groups from distinct exhibitors; in the case of one was noticed an amber cigar-tube, which is one of numerous instances of the innovations upon Turkish customs by the introduction of European ideas. If more awards have not been made for Turkey than those cited in the list, it does not arise from want of meritorious examples, but simply because it was quite impossible to obtain a correct catalogue of exhibitors at the time the Jury examined the articles contributed from this country.

Tunis.

Weeds for pipes, and two embroidered pipe-guards, are the only contributions.

Tuscany.

The only example in the Tuscan Section is a beautifully-carved ebony pipe-tube.

United Kingdom.

The pipes in the British side of the Exhibition are unimportant; two consist of steel, one is a contrivance for condensing the fumes of the tobacco, and the other two are of meerschaum. No common clay-pipes are exhibited; their manufacture forms a distinct branch of the fictile-art, and is usually practised by small makers; the processes employed being very simple and performed with wonderful celerity. The stem of the pipe is first formed by rolling a piece of clay with the hand on a slab until it forms a cylinder slightly tapered; a ball of clay is then attached to the thickest end and placed in a mould formed of two halves hinged together, by merely closing the mould the clay assumes the form of the outside of the bowl; a plunger corresponding to the intended cavity is then forced in, and the excess of clay which exudes pared off. The pipe is completed by threading the stem on to a wire, which thus forms the bore, and after drying it is baked in a furnace of peculiar construction.

The number of exhibitors of pipes and amber is forty-nine, of these there are:—

10	Holders of a Prize Medal.
18	Who obtained Honourable Mention.
21	Unrewarded.
49	

The number of exhibitors from the various countries is as follows:—

Germany:—	
Austria	13
Bavaria	1
Hamburg	1
Nassau	2
Prussia	11
British Colonies:—	
British Guiana	1
Canada	1
India	1
China	1
Egypt	1
France	2
Persia	2
Sardinia	1
Turkey	5
Tuscany	1
United Kingdom	5
	49

List of Awards.

Alba, Samuel, Vienna (Austria, 664, p. 1041).—Honourable Mention is accorded to this exhibitor, for a very large collection of meerschaum pipe-bowls, cigar-tubes, and amber mouth-pieces. The plain bowls and cigar-tubes, and those ornamented with foliage are very creditable productions, but where human figures are introduced, they are not so well executed.

Astrath, Carl, Vienna (Austria, 666, p. 1041).—Prize Medal, for an assortment of most exquisite specimens of meerschaum pipe-bowls and cigar-tubes; the sculpturing of the figures displaying remarkable artistic skill, and the execution of leafage being bold and sharp. Considering the excellence of the work, the prices are very moderate (10,243, 30*s.*; 10,208, 45*s.*; cigar-tube with figure of Venus, 45*s.*: another with that of Hercules, 53*s.*) Besides the above, the collection comprises several of the richest amber mouth-pieces, one of which is valued at 33*l.*; some of the mouth-pieces are flat, such as are used in Germany; others round, such as are used in the East.

Beisiegel, Philip, Vienna (Austria, 667, p. 1042).—Honourable Mention. For meerschaum pipes with silver mounts and amber mouth-pieces; meerschaum pipe-bowls and cigar-tubes; cherry-tree and ebony pipe-tubes, and plain amber mouth-pieces, which are all very well manufactured, and of good design.

Dumeril, Sons, and Co., St. Omer, Pas-de-Calais (France, 176, p. 1181).—Honourable Mention. For a great variety of clay-pipes, such as are used by the working classes, and more particularly by the peasantry. These pipes are more remarkable for their cheapness and very excellent manufacture, than for any beauty of design.

Fiolet, Louis, St. Omer, Pas-de-Calais (France, 211, p. 1184).—Honourable Mention. For a large assortment of clay-pipes exceedingly well-made. The bowls are mostly in the form of heads, some intentionally grotesque, and others intended to represent eminent personages, scarcely less so, on account of the eyes being picked with two dabs of black. These pipes are not remarkable for any of that excellent taste usually displayed by the French.

Flöge, Gerhard, Vienna (Austria, 670, p. 1042).—Prize Medal. Carved meerschaum pipe-bowls and cigar-tubes in great variety, and of excellent designs and execution; also a large collection of amber for smoking purposes, including the round mouth-piece used in Turkey.

Friedrich, Johann, Vienna (Austria, 671, p. 1042).—Prize Medal. A very large assortment of meerschaum pipe-bowls and cigar-tubes, with amber mouth-pieces of beautiful designs, frequently containing several figures, which are exquisitely and boldly sculptured. The prices, which vary from 17*s.* 6*d.* to 7*l.* 10*s.* each, are reasonable.

Grünhut, J., jun., Prague (Austria, 673, p. 1042).—Honourable Mention is accorded for a meerschaum pipe-bowl and two cigar-tubes, the carving of which is very sharp and spirited.

Hadji, Mihran Duzoglou (Turkey, 1928, 1929, p. 1398).—Prize Medal. For four most splendid imames or round amber mouth-pieces, richly ornamented with brilliants; the two shortest, which in smoking are pressed against the lips, are each worth 305*l.*, and are of that peculiar colour and degree of transparency which approaches nearest to the Turkish ideal of beauty; the two longer mouth-pieces are of a different form, and although not of so good a colour, nor enriched with as many diamonds, are yet worth 200*l.* each.

Hartmann, Ludwig, Vienna, (Austria, 675, p. 1042).—Prize Medal. For a very large collection of well-made mouth-pieces of amber, mother-of-pearl, bone, and wood; cherry-tree, and other pipe-tubes; hard-wood cigar tubes from 1*d.* to 2½*d.* each; walking-sticks from 9*d.* to 7*s.* 6*d.* each; meerschaum pipe-bowls and cigar-tubes; the foregoing articles are those in general use in Germany, and consequently they are not elaborately ornamented.

Henderson, —, Montreal (Canada, 187, p. 968).—Honourable Mention is accorded for a case of well-made clay-pipes.

Hoffmann, C. W., Dantzic (Prussia, 439, p. 1075).—Prize Medal. A large assortment of amber-manufactures, amongst them a pair of candlesticks of smoky amber, 22*l.* 10*s.*; a letter-weight of a single piece, 9*l.*; a snuff-box set in gold; and other articles which are well manufactured, but are not remarkable for beauty of design.

Hoffmann, G. J., Dantzic (Prussia, 440, p. 1075).—Honourable Mention (*the same Award by the Jury of Class XXIII.*). For a very large collection of amber-beads, some of which are of large size.

Jantzen, G. E., Stolpe (Prussia, 205, p. 1059).—Honourable Mention (*the same Award by the Jury of Class XXIII.*) For an assortment of amber-manufactures, comprising necklaces made of strings of very beautiful pearl-like beads, which are very rare; a ladies'-companion, the handles of the various instruments it contains, and also the needle-case and crochet-needle-holder being of amber; besides these the Collection comprises several miniature ornaments of amber.

Lux Brothers, Rhula, Saxe Gotha (Prussia, 796, p. 1094).—Honourable Mention. For a great variety of plain meerschaum pipe-bowls, imitation meerschaum bowls, painted porcelain bowls, and carved wood pipes.

Mannheimer, Wolff, Königsberg (Prussia, 438, p. 1075).—Honourable Mention (*the same Award by the Jury of Class I.*) For the exhibition of two unusually large pieces of amber; one of which is a specimen of that sort obtained in the amber pits, and has a rough exterior; it weighs 6 lbs.: the other is marine amber, and is water-worn; it weighs 4½ lbs.

Müllenbach and Thewald, Hoehr (Nassau, 10, p. 1132).—Honourable Mention. For remarkably cheap clay-pipes, varying in price from 6*d.* to 2*s.* per hundred.

Naim Effendi, Constantinople (Turkey, 1441, 1447, p. 1396).—Prize Medal for a valuable collection of round amber mouth-pieces, for the chiboque or long pipe, ornamented with rings of artificial aventurine and with jewels; the prices of these vary, according to the size and colour of the mouth-piece, the lowest being 37*s.* 6*d.*, and the highest 35*l.*; and also for a collection of jasmine pipe-tubes.

Partsch, A., jun., Theresienfeld (Austria, 611, p. 1038).—Honourable Mention. For an assortment of cheap clay-pipe-bowls, coloured and glazed.

Romoli, Luigi, York Terrace, Chelsea (Tuscany, 124, 125, p. 1300).—Honourable Mention. For an ebony pipe-tube, wrought in pierced carved work.

Roy, W. von, Dantzic (Prussia, 441, p. 1075).—Honourable Mention. For a most interesting collection of all the known varieties of amber, systematically arranged in four cases, which contain likewise succinic acid, crude and pure, obtained from amber. Also for various manufactured articles, amongst which the most remarkable is an oblong salver, composed of separate pieces of amber arranged to form a mosaic pattern, the Royal Arms of England being engraved in the centre.

Said Aga (Turkey, 3369, 3372, p. 1399).—Honourable Mention. For an assortment of those amber mouth-pieces which are in most general use in Turkey, and which vary in price from 10*s.* to 30*s.*; and also amber cigar-tubes; and a large collection of pipe-tubes, and wood mouth-pieces.

Strauss, J., Turin (Sardinia, 80, p. 1305).—Prize Medal. For several elaborately-carved meerschaum pipe-bowls, the sculpturing of which is very exquisite.

Tessler, C. L., Stolpe (Prussia, 41, p. 1050).—Honourable Mention is accorded for various manufactures in amber, among which are strings of well-formed spherical beads, a cigar-tube, a ring-stand composed of different coloured ambers, the ornament and workmanship of which are very good. This exhibitor has likewise sent a specimen of land amber, together with the fossil wood with which it is generally associated.

Wingender Brothers, Hoehr (Nassau, 9, p. 1132).—Honourable Mention is accorded for an assortment of various descriptions of clay-pipes, intended chiefly for exportation, and which are remarkable for their low price, 5*s.* 6*d.* per thousand.

Winterfeld, J. A., Breslau (Prussia, 204, p. 1059).—Prize Medal. For the largest collection of amber-manufactures, the workmanship of which is exceedingly good: also a collection of most of the varieties of raw amber. The manufactures comprise amber mouth-pieces; large pipe-tubes, composed entirely of amber; amber cigar-tubes; ear-rings; necklaces; cameo-brooches, the white opaque amber forming the figure or head; a set of chess-men; and numerous other articles.

Wöbecke, H. (Hamburg, 89, p. 1139).—Honourable Mention. For a collection of well-made pipes manufactured with Turkish clay.

Zeitler, Joseph, Vienna (Austria, 687, p. 1042).—Prize Medal. Massa pipe-bowls and cigar-tubes, which are manufactured from meerschaum dust. The forms of these articles are elegant, and the execution so good that they are distinguished only with difficulty from the real meerschaum. The price of massa pipe-bowls is much lower than those of the real meerschaum, and they are usually mounted with plated instead of real silver tops.

VI. SNUFF-BOXES.

The boxes, which are known under this very general name, have exhibited equally the extremes of coarseness and of elegance. Under the former condition, they will be remembered in the box of horn, brass, or japanned-iron—the last, however, being known rather as a common receptacle for tobacco; and in the latter state, they will be recognised in the countless portable depositories for snuff, for which all the most costly productions of nature have supplied the materials.

The word snuff is an inflection of the old northern verb *snif;* and it existed as a term expressive of strong inhalation through the nostrils, or of angry impatience, long before the invention of the substance to which it now gives a name. Out of the latter signification originated the colloquial expression of the sixteenth and seventeenth centuries to "snuff pepper," or to "take in snuff." It will be remembered that this last phrase occurs in Shakspeare's Henry IV. (Part I., Act I., scene 3), in immediate connection with a small box containing perfume, as displayed by the courtier who enraged Hotspur:—

> "He was perfumed like a milliner;
> And, 'twixt his finger and his thumb, he held
> A Pouncet-box, which ever and anon
> He gave his nose, and took 't away again;
> Who, therewith angry, when it next came there
> Took it in snuff."

The word pounce, out of which is formed pouncet-box, is supposed to have been remotely derived from *poinsonner*, to prick or pierce, and hence the claws of a hawk were called his pounces; and pouncings, as a term relating to costume, were regarded as ornaments executed by a roll of points, or in open-work. A pouncet-box, therefore, signifies a small box having a perforated cover, containing perfumes, the scent of which escaping through the open flower-work of the top, was regarded, in the sixteenth and seventeenth centuries, as a preservative against contagion or poison. From the pouncet-box the perfumes, whether moist or dry, were inhaled into the nostrils; but it was probably not until a century after the general encouragement of tobacco in England that the finely-granulated leaf became commonly established as a pungent perfume, and at length introduced the costly and elegant snuff-box.

So early, however, as the beginning of the reign of James I., a "taker of tobacco" was to be furnished with an apparatus greatly resembling that of a modern Scotch mull, when supplied with all its accustomed instruments, like the ram's-head boxes mounted in gilt silver, and displayed in several parts of the Great Exhibition; as that, for instance, in Class I., No. 25; Class XXIII., No. 46; or the still finer example, No. 26, which was considered worthy of Honourable Mention by the Jury of that Class. "Before the meat come smoking to the board," says Dekker, in his *Gull's Horn-book*, in 1609, "our gallant must draw out his tobacco-box, *the ladle for the cold snuff into the nostril*, the tongs and priming-iron, all which artillery may be of gold or silver, if he can reach the price of it." Both the practice and apparatus of taking snuff are described by Howell, in 1646, as quite common in other countries; since he says, "The Spaniards and Irish take tobacco most in powder or smutchin, and it mightily refreshes the brain; and I believe there's as much taken this way in Ireland as there is in pipes in England. One shall commonly see the serving-maid upon the washing-block, and the swain upon the ploughshare, when they are tired with labour, take out their boxes of smutchin, and draw it into their nostrils with a quill; and it will beget new spirits in them, with a fresh vigour to fall to their work again."

There is very little information extant concerning the older receptacles for snuff. In the Appendix to Volume XIII. of the *Archæologia*, published by the Society of Antiquaries (p. 395, plate xxiv.), is an engraving of two small carved cruets, found under a staircase in the Tower of London, which were exhibited to that Society in November, 1797. In their general form they very much resembled powder-flasks, and were about 2½ inches in length and 2 inches in width; but they were provided with screw-stoppers, to one of which was attached a small spoon. On the exterior they were ornamented with designs representing shooting of birds, stag-hunting, and bull-baiting, and also French mottoes, evidently stamped from a mould, as if they had been formed of leather softened in hot water; but the materials of which these bottles were made is not stated.

In the extract already given from Howell's *Letters*, it is stated, that so early as 1646 even the peasants in Scotland were accustomed to "take out their boxes of smutchin, and draw it into their nostrils with a quill;" which explains the intention of the spoon attached to the cruets referred to, the manufacture of which probably belongs to the early part of the seventeenth century. The word erroneously printed "smutchin" by Howell, is accurately *sneeshin*, a vulgar name for snuff, which causes sneezing: and hence sneeshin-mill (sometimes corrupted into *mull*) is the Scottish name for snuff-box. Dr. Jameson,* from whom these illustrations are derived, adds, that the word mill "is the vulgar name for a snuff-box, especially one of a cylindrical form, or resembling an inverted cone." No other name, he continues, was formerly in use; and the reason assigned for it is, that when tobacco was first introduced into this country, those who wished to have snuff were accustomed to toast the tobacco-leaves before the fire, and then bruise them with a piece of wood in the box, which was thence called a mill, because the snuff was ground in it. From these notices it is easy to perceive how a ram's horn, from its conical shape, became one of the primitive forms of the Scotch snuff-box; although at the present time it is frequently one of the most costly and luxurious. Down to the middle of the eighteenth century, the "sneeshin-horn," with the spoon and hare's-foot attached to it by chains, appears to have been regarded as so completely a national characteristic, that when Baddeley played Gibby in *The Wonder*, with Garrick and Mrs. Barry, he came on the stage with such an apparatus.†

In the early part of the eighteenth century in England, fashionable snuff-boxes had probably reached the highest degree of variety and luxury. In *The Tatler*, published on Tuesday, March 7, 1710, several gold snuff-boxes are noticed, which came out last term; but that a new edition would be put out on Saturday next, which would be the only one in fashion until after Easter. "The gentleman," continues the notice, "that gave fifty pounds for the box set with diamonds, may show it till Sunday, provided he goes to church, but not after that time, there being one to be published on Monday, which will cost fourscore guineas." These costly articles, so happily satirized by Steele, are represented as the productions of a fashionable toy-man, named Charles Mather, popularly known under the name of "Bubble Boy."

Every species, however, of metal boxes, together with the "amber snuff-box" of which Sir Plume, in *The Rape of the Lock*, was "justly vain" in 1711, and the boxes made of shells mounted in gold or silver, noticed by Dodsley in 1733, are all belonging to the Reports on the other Classes of the Exhibition. To describe the manufacture of the snuff-box in all its ramifications, would require that most of the known arts should be passed in review, as the greater number, not excepting even that of glass-making, have from time to time been subservient to its production. The discussion of these subjects is clearly beyond the province of the Reporters for Class XXIX., the Jurors for which were called upon to judge of such snuff-boxes only as are composed of papier-maché, wood, ivory, tortoise-shell, or horn: those made of glass and the various metals belonging to other Classes. Notwithstanding this limitation, the Reporters have endeavoured to ascertain the number of exhibitors who have contributed snuff-boxes in other Classes; but there may be some examples which have escaped their observation.

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* *An Etymological Dictionary of the Scottish Language.*

† *The Gull's Horn-book*, by T. Dekker; edited by the Rev. J. Nott, 1812, p. 119.

The manufacture of papier-maché snuff-boxes does not call for any special notice in this place; for although it forms a distinct branch of papier-maché work, its various processes scarcely differ in their details from those universally employed in the making of other articles. It may be remarked that the production of snuff-boxes of this material is chiefly carried on in Germany and France, whence they are exported to most parts of the civilised world.

The manufacture of those very beautiful articles, called Scotch boxes, is the only one calling for especial notice in the present Report. These ingenious productions were originally made in the village of Laurencekirk, by Mr. Stiven,* whose son and successor is present by his works in the Great Exhibition. The art, however, appears soon to have spread to other parts of Scotland: for we are informed that in 1832, in the parish of Old Cumnock in Ayrshire, upwards of a hundred persons, comprising men, women, and children, were employed in the practice of it, and in 1845 there was also an extensive manufactory of wooden snuff-boxes in the town of Mauchline.† In this work, about sixty persons were at that period employed. Judging only by the importance of the contributions to the Great Exhibition from Laurencekirk and Mauchline, it might be inferred that the latter town is at present the principal seat of the manufacture of Scotch wares; which now includes the production of numerous other articles beside snuff-boxes.

In Classes XVII. and XXIX. are examples of covers for books and memorandum-books; paper-knives and book-markers; card-cases and card-trays; spectacle-cases; needle-books, thread-reels, crochet-cases, knitting-cases and work-boxes; razor-cases, sheaths for razor-strops, pomatum-boxes, scent-boxes and dressing-cases; egg-cups, tea-caddies; and even candlesticks. To give an idea of the wholesale prices of some of these articles, the following quotations are cited:—Cigar-cases are sold at 42*s.* per dozen; paper-knives from 10*s.* to 17*s.* per dozen, according to size; snuff-boxes from 22*s.* to 168*s.* per dozen; and netting-cases at from 5*s.* per dozen.

The *Scotch Snuff-box*, which has long been renowned for the perfection of its hinge and the close fitting of the cover, is cut out of the solid wood, the description chiefly employed being the sycamore or plane-tree. Mr. W. Chambers states that this is the timber used at Old Cumnock; and that a piece of rough wood which costs 25*s.* will make snuff-boxes to the value of 3,000*l.*‡ The first operation consists in making a number of circular excavations in close contiguity to each other, by means of a centre-bit, or a drill running in a lathe; the interior is then squared out by means of gouges and chisels, and is afterwards smoothed with files and glass-paper. The celebrated hinge is formed partly out of the substance of the box and partly out of that of the lid, the greatest attention being paid in its construction to the accurate fitting of the various parts one into the other. The box is lined in the inside with stout tin-foil, and is painted on the outside with several coats of colour, each of which is rubbed down smooth with glass-paper before the succeeding coat is applied. It is then ready to receive the various styles of ornament, which, in some cases, are produced by the hand of the artist, and, in others, by mechanical means. The most usual decoration consists of the tartan-patterns, the component lines of which are drawn separately by pens fixed in a ruling-machine on to the box itself, if bounded by planes or slightly-curved surfaces: although such lines were also formerly drawn by means of a rose-engine on *circular* boxes, it is now found a more convenient practice to rule the lines on paper, and then to attach the paper to the boxes. Another style of ornamentation, known by the name of "Scoto-Russian," is of more recent introduction, and imitates, in a remote degree, the beautiful enamelled silver snuff-boxes, for which Russia has long been famous. In these, the outside of the box is first covered with stout tin-foil, then completely painted all over the surface, and afterwards placed in the ruling-machine, which traces upon it an intricate pattern of curved and straight lines, by means of a sharp flat tool. This instrument penetrates completely through the paint, but only scrapes the tin-foil, which is left very bright and resembles inlaid silver. Several coats of copal varnish, each of which is successively polished down, are then applied to complete the snuff-box.

In the manufactory of the Messrs. Smith, of Mauchline, which is said to be one of the largest, about eighty artisans are employed, who have been instructed in the works. The workmen earn from 16*s.* to 24*s.* per week, according to their skill and the department in which they are engaged; and the women from 7*s.* to 9*s.* per week. An artist capable of making a copy of an oil-painting earns 30*s.* per week.

AUSTRIA.

There are two exhibitors of snuff-boxes in the Austrian Section, one of whom, P. BIGAGLIA, (600), has contributed some beautiful specimens composed of a sparkling glass, called Artificial Aventurine; which is a silicate of oxide of copper, wherein part of the oxide of copper has been reduced to the metallic state by processes which are kept secret. The reduced copper exists in the form of minute crystals, which, under the microscope, present a most splendid appearance. Although mention is here made of these articles, they really belong to Class XXIV. The other exhibitor has sent examples of papier-maché snuff-boxes, glove-boxes, work-boxes, cigar-boxes, spice-boxes, and buttons, which are creditable productions of their class, and remarkable for their cheapness.

CHINA.

In the Chinese Court there is a beautifully carved snuff-box, sculptured out of English cannel-coal, which was taken to China for that purpose by the exhibitor, Captain SHEA, p. 1420. The carving, which it appears occupied the Chinese artist a fortnight, cost the exhibitor only 2*l.* sterling. This specimen, however, does not strictly belong to Class XXIX., nor does it represent the snuff-box used by the Chinese. The snuff-box, or rather snuff-flask of China, is in form and size like a smelling-bottle, and is made of rock-crystal, coloured glass, porcelain, wood, and other materials. To the stopper is attached a small spatula, for the purpose of taking out the snuff, a contrivance which has already been described as formerly in use in England.

BAVARIA.

The contributions from Bavaria, sent by two exhibitors, consist of papier-maché small-wares, including snuff-boxes, which are produced at remarkably low prices, and are exported in very considerable quantities.

BRITISH COLONIES.

The *Indian* Courts contain several examples of snuff-boxes, the most curious being—the gourd snuff-boxes, mounted in gold and silver, from Scinde; a snuff-box made from a cocoa-nut, highly polished; another from the bilva fruit; and a beautiful specimen made of buffalo-horn inlaid with metal (p. 920). *St. Helena* contributes snuff-boxes made from the willow-tree under which the remains of the great Napoleon reposed until their removal to France, and also from a willow-tree which he planted behind the library at Longwood. From *Van Diemen's Land*, J. MILLIGAN (201–203, p. 996) exhibits several specimens, interesting from the variety of the materials of which they are made; comprising a globular snuff-box turned out of the tooth of the sperm-whale, which is employed in the colony for stick-heads and similar purposes; a turned snuff-box of iron-wood (*Olea upetala*); one of the huron-pine; and one of the musk-wood of Tasmania (*Eurebia argophyllum*).

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* *The New Statistical Account of Scotland*, Vol. XI. p. 144.

† *Ibid.*, Vol. V. p. 164. Chambers' *Gazetteer of Scotland*, p. 175.

‡ *Gazetteer of Scotland*, p. 175.

France.

The beautiful examples of snuff-boxes in the French Department are as peculiar in their style as the Laurencekirk snuff-boxes in their's, and the manufacture of them appears to be confined to France, if not to Paris. These boxes, which are quite remarkable for the accuracy with which the hinge is made, and the close fittings of the lid, are usually lined with a veneer of tortoiseshell very highly polished. The outside or body of the box is composed of various materials, as ivory, tortoiseshell, and rhinoceros-horn, and also of petrified wood and other woods, as the maple, the olive, rosewood, and several sorts of palms cut across the grain. Some examples are very tastefully, *not showily*, ornamented with neat gold and silver mounts, but none, perhaps, are more elegant than those made of the palm-tree cut across the grain. These contributions are from two manufacturers, in the excellence of whose work only a very trifling difference was discernible.

Grand Duchy of Hesse.

The examples from Hesse consist of papier-maché snuff-boxes, very similar in character to, but not so numerous or various as those of Austria and Bavaria. They were sent by one exhibitor (61), who has been rewarded for walking-sticks, and is mentioned in the section relating to them in the present Report.

Prussia.

The snuff-boxes and other articles of small wares sent from Prussia are also entirely of papier-maché, and are principally imitations of the various descriptions of Scotch, of tortoiseshell, and Russian boxes. They deserve commendation for the workmanship, but they are higher in price than similar goods sent from Austria and Bavaria. The following are some of the prices which were quoted as those at which the goods are sold wholesale; but judging from the examples from other parts of Germany, they seem rather to be the retail prices:—Snuff-boxes, plain, 15*s.* per doz.: marbled boxes, 15*s.* per doz.; Scotch boxes, 15*s.* per doz.; damasked, or engine-turned boxes, similar to the "Scoto-Russian," 15*s.* per doz.

Russia.

The contribution from Russia is the produce of one manufacturer, and consists of papier-maché snuff-boxes, creditably made, but exceedingly high in price. The most common snuff-boxes sell at 2*s.* 10*d.*, and the dearest at 38*s.* each; and the cigar-boxes range from 22*s.* 2*d.* to 38*s* each. In 1842 the government of Moscow possessed five manufactories of papier-maché snuff-boxes, which employed eighty workpeople, and produced goods valued at 3,000*l.*

Saxony.

From Saxony there is also a contribution of papier-maché snuff-boxes, ranging in price from 1*s.* 10*d.* each to 2*s.* 6*d.*, the latter being an imitation of the Scotch box. There are likewise some boxes of buffalo-horn, lined with tortoiseshell, all which productions are commendable for their finish.

Turkey.

The snuff-boxes in the Turkish Court consist of three examples:—One of the bituminous-shale, a well-carved mother-of-pearl snuff-box from Bethlehem, and a box made of enamelled silver, the latter of which does not, however, belong to this Class.

United Kingdom.

Independently of the manufacturers who sent the ram's-head mull, before alluded to as not belonging to Class XXIX., the exhibitors of snuff-boxes are only four in number, and those deserving of especial mention are contributors of Scotch snuff-boxes. The most important display is that to be hereafter noticed in the list of awards. The other principal collections are that of Messrs. **Clarke** and **Davidson** (p. 545), of Class XVII., No. 135, and that of Mr. **Stiven** (Class XXIX., 35, p. 79), which are both deserving of favourable notice.

Wurtemburg.

The snuff-boxes from Wurtemburg are of two kinds, and were contributed by two exhibitors. One of them has sent papier-maché snuff-boxes inlaid with mother-of-pearl and imitation gold and silver, which are very commendable as of the better description of papier-maché work; and the second has supplied some carved ivory snuff-boxes inlaid with mother-of-pearl, which are also deserving of praise.

The number of exhibitors of all nations in this division is twenty-one; of these, there are:—

5 Holders of a Prize Medal.
16 Unrewarded.
21 Total.

The classification according to the various countries is as follows:—

Austria (in addition to another Contributor, who exhibits a snuff-box of glass)	1
China	1
Bavaria	2
British Colonies:—	
India	1
St. Helena	1
Van Diemen's Land	1
France	2
Hesse, Grand Duchy of	1
Prussia	2
Russia	1
Saxony	1
Turkey	1
United Kingdom (*beside Three Exhibitors of Rams'-head Mulls in Classes I. and XXIII.*)	4
Wurtemberg	2
Total	21

List of Awards.

Adt Brothers, Ensheim (Bavaria, 66, p. 1101), Prize Medal, for an assortment of very cheap papier-maché small wares, comprising cigar-boxes, glove-boxes, cigar-cases, snuff-boxes, and memorandum-book-covers, which are well manufactured; and although artistic merit is not aimed at, the less elaborate are creditably ornamented.

Coletta-Lefenvre, Paris (France, 458, p. 1200), Prize Medal, for beautifully-finished snuff-boxes, made of wood or ivory, and lined with tortoiseshell, and remarkable for the close fitting of the hinge and joint.

Hofrichter, C., Reichenau (Austria, 644, p. 1040), Prize Medal, for a very large assortment of Papier-maché snuff-boxes and other papier-maché small-wares, comprising 167 varieties, which, taking the price into consideration, are remarkable for their cheapness and goodness of manufacture. As an example of cheapness may be cited the imitation Scotch snuff-boxes, which vary in price from 4*d.* to 7*d.* each.

Mercier, C. V., Paris (France, 1658, p. 1256), Prize Medal, for tortoiseshell, palm-tree lined with tortoiseshell, and other kinds of snuff-boxes, in all of which the workmanship is most excellent; the accuracy of the hinge, and the close fitting of the joint being points particularly commendable.

Smith, William and **Andrew**, Mauchline, Ayrshire, Scotland (Class XXIX., 280, p. 816), Prize Medal, for a great variety of articles ornamented with Tartan patterns, engine-turned patterns ("Scoto-Russian"), and paintings, and comprising snuff-boxes, blotting-cases,, cigar-cases and several other descriptions of Scotch small-wares, which are remarkable for the great accuracy of the workmanship, high degree of finish, and the beauty of the varnish.

E. MANUFACTURES RELATING TO AMUSEMENTS.

I. MANLY GAMES.

Cricket and Archery are the only games of skill and strength which are represented to an extent worthy of notice.

Cricket.

United Kingdom.

The exhibitors of bats and other implements used in cricket are nine in number, and, as might be expected, they are all British; indeed the articles they contribute are scarcely intelligible to any but Englishmen.

The implements and appliances in the nature of gloves, guards, &c., which the present mode of playing the game, and especially the practice of swift overhand bowling, has brought into use are so various, that there is more room for ingenuity in the manufacture of them than might at first sight appear.

The articles contributed by Dark and Sons (197, p. 800) have great merit. The gauntlets which they exhibit as designed to guard the wrist from the blow of the ball, are lined with slips of cane, and are thereby lighter than those which are thickly wadded or lined with Indian rubber, whilst they furnish a stiffer and more effectual defence against the ball.

So also in regard to the gloves which protect the fingers of the hand that holds the bat: by a tube of Indian rubber fixed along the back of each finger, an improvement is apparent in those exhibited by Messrs. Dark and Sons, inasmuch as a second and smaller tube is fixed within the first, thereby materially increasing the resistance to a blow from the ball without sensibly adding to the weight or diminishing the pliancy of the glove. The bats exhibited by R. Dark (198) are of excellent wood and very well balanced.

Duke and Son (191, p. 800), contributed a collection of all the implements used in cricket, remarkable for the excellent workmanship and finish which they display.

The number of exhibitors is nine; of these, there are—

3 Holders of a Prize Medal.
6 Unrewarded.
—
9

List of Awards.

Dark, Matilda, and Sons, Lord's Cricket Ground (Class XXIX., 197, p. 800), Prize Medal for a collection of bats and wickets.

Dark, Robert, Lord's Cricket Ground (Class XXIX., 198, p. 801), Prize Medal for gauntlets, leg-guards, spiked-soles, balls, and other implements, used in the game of cricket.

Duke and Son, Penshurst (Class XXIX., 191, p. 800), Prize Medal for implements used in the game of cricket.

Archery.

United Kingdom.

In archery the British exhibitors are five in number.

P. Muir and Ainge and Aldred exhibit articles of excellent workmanship. The bows are well balanced, and the materials from which they are made well selected, some of the woods being of great value and rarity. A bow of Spanish yew, exhibited by the last-named firm, is valued by them at 35 guineas. The arrows also of both exhibitors are beautiful specimens of inlaid wood.

British Colonies.

There are several contributions of bows and arrows from the dependencies of Great Britain, but as they are really used as weapons, they do not belong to Class XXIX. The reader is, however, referred to the following:—*British Guiana* (144, 145, and 145a); the *Indian* Court, which contains specimens of bows and arrows from Assam; bows and arrows from *South Africa;* and several contributions from *Western Africa.*

Switzerland.

One exhibitor sends a variety of bows; and a case of arrows remarkable chiefly for the number of separate pieces of wood of which they are framed. One arrow is stated to be composed of no less than a thousand pieces.

The number of exhibitors is six; of these there are—

2 Holders of a Prize Medal.
4 Unrewarded.
—
6

The classification according to the various countries is as follows:—

Switzerland - - -	1
United Kingdom - -	5
	6

List of Awards.

Ainge and Aldred, 126 Oxford Street (Class XXIX., 180), Prize Medal for bows, arrows, and archery-accoutrements, and also for fishing-tackle.

Muir, P., Edinburgh (Class PXIX., 150, p. 798), Prize Medal for bows, arrows, and archery-implements.

Rackets.

United Kingdom.

A small selection of Rackets is contributed by one exhibitor to Class XXIX. The manufacture of these, especially of the heavier and stronger, such as are used in the game of tennis, is better understood in France than in England; indeed the rackets used in the few tennis-courts which still exist in England are mostly imported from France.

Award.

Jefferies, Isaac, Woolwich (Class XXIX., 184, p. 800). Honourable Mention for a selection of rackets which deserve to be mentioned as promising to compete successfully with those of French manufacture.

II. FISHING-TACKLE.

United Kingdom.

The articles exhibited under this head are, as might be expected, almost entirely of British manufacture, the sport of angling being but little pursued in other countries, and nowhere with the same study and scientific skill as in the United Kingdom. Probably there is no other country in which the manufacturers of fishing-tackle constitute a trade in themselves, certainly none in which so much money is annually spent upon the implements which they produce. The British exhibitors are twenty-five in number.

The merits of many of their articles, especially of the rods, could not be completely tested within the limits of the Exhibition. The most valuable properties of a rod consisting in the thorough seasoning of the wood, its capability to resist weather and wear, without warping or twisting, and its retention of an even spring and pliability under constant use, can be ascertained only after prolonged trial; a test which it has not been in the power of the Jurors to apply. The same may, to a great extent, be said of lines, artificial flies, and baits, the durability of which, one of their most valuable and rarest merits, must be proved by experience.

The articles exhibited by C. Farlow (176, p. 800), Ainge and Aldred (180, p. 800), J. K. Farlow (181, p. 800), and James Jones (181, p. 800), may all claim much credit for execution and high finish. In this respect the only distinction between their work appears to be in the amount and character of the ornaments attached to it. But it should be observed that a profuse expenditure of silver and gilding in the metal-work of a fishing-rod, the application of precious stones to the reels and joints, the inlaying of the buts with ivory and rare woods, and the use of velvet or silk, embossed and gilt, in the place of leather or other more appropriate materials, of which the books and cases for containing fishing-tackle are more usually and properly made, cannot be considered as improvements of the articles in question.

Little and Co. (174, p. 800), exhibit some improvements which combine practical utility with excellent workmanship. A multiplying reel, in which, by an ingenious arrangement of the cog-wheels (the teeth of the driving-wheel being internal), the handle of the reel retains its place in the centre instead of being fixed, as is usually the case in multiplying reels, at the edge of the side-plate, thereby being more convenient to wind, and less liable to entangle the loose line. Also an application of sliding rings to the outer ferrules of the joints, which are slightly split, and, by the pressure of the rings, made to gripe the inserted joint more closely, whilst the inconvenience of the joints becoming fixed when swollen by wet, is obviated. Also a mode of forming and fixing the ferrule on the joints, whereby the sudden transition from *pliant* wood to *stiff* metal, which renders a rod, when strained, apt to give way in those parts, is in great measure avoided.

Ainge and **Aldred** (180, p. 800) exhibit some spliced rods of excellent construction, each joint being composed of three pieces, bound together longitudinally, and thereby less liable to twist or warp, whilst it retains an even spring and elasticity throughout.

J. **Bernard** (177, p. 800) and J. K. **Farlow** (181, p. 800) exhibit articles of considerable merit. Rods of similar construction to those last mentioned, and an improvement in the construction of ferrules; the lower and larger joints being fitted into the upper, instead of the upper into the lower. This mode has the advantage that water is less likely to find its way between the joints and make them swell.

France.

With the exception of some lines for float-fishing, of very fine and even texture, which are exhibited in the Department of France (141), there is no contribution from foreign manufacturers.

The number of exhibitors is twenty-six; of these, there are—

2	Holders of a Prize Medal.
4	Who obtained Honourable Mention.
20	Unrewarded.
26	

The classification, according to the various countries, is as follows:—

France - - - -	1
United Kingdom - -	25
	26

List of Awards.

Ainge and **Aldred**, 126 Oxford Street (Class XXIX., 180, p. 800). Prize Medal for fishing-tackle and also for archery implements.

Delage-Montignac, F., Paris (France, 141, p. 1178). Honourable Mention for fishing-lines.

Farlow, C., Strand (Class XXIX., 176, p. 800). Honourable Mention for fishing-rods, fishing-tackle, and artificial baits.

Farlow, J. K., Crooked Lane (Class XXIX., 181, p. 800). Honourable Mention for fishing-rods and fishing-tackle.

Jones, J., Jermyn Street (Class XXIX., 182, p. 800). Honourable Mention for fishing-rods and fishing-tackle.

Little, G., and Co., Fetter Lane (Class XXIX., 174, p. 800). Prize Medal for fishing-rods, fishing-tackle, artificial baits, and an improved winch.

III. TOYS.

One of the most eminent of modern physicists* has remarked that "boys' toys are the most philosophical things in the world;" and a renowned statesman,† taking another view of their importance, affirms that they are an index to the character of a nation.

In illustration of the first position, a few examples may be cited. A child's kite, in the hands of a Franklin and a Romas, has served to identify lightning with electricity; and conveys an instructive lesson on the composition of mechanical forces. The pea-shooter not only affords evidence of the elastic force of gases, but also of their economical employment when used expansively. The sucker illustrates the weight of the atmosphere, and its equal pressure in all directions; and the sling, the hoop, and the top show the property of centrifugal-force: when the top is in rapid motion, it converts for the moment, every spot and bruise on its surface into an elegant zone; and thus also imparts a good lesson in physiological optics. To a reflecting mind toys afford ample food for thought; and they might, perhaps, be made to yield much solid instruction to the child, were it not generally far more wise, for a certain period, at least, to limit its inquiries rather to the discovery of the weakest parts of its plaything.

With regard to the assertion that toys indicate the genius of a nation, it is evident that, as the natural tendency of children is to imitate the employments of their elders, they will always take the most interest in such toys as will assist them in this propensity, and lead them in their sports to do that which they see those around them doing in earnest. Hence, in countries which are of a military disposition, flags, drums, trumpets, guns, swords, and the accoutrements of soldiers, are much in demand for the pastime of even the youngest boys. In a maritime nation toy-ships will be esteemed: and thus the very pastimes of childhood might be made available in promoting the welfare of such services as the particular state most requires.

The Exhibition might, therefore, have afforded an interesting opportunity to statesmen and philanthropists for studying the diversity of character exemplified by the contributing nations, had they been all as well represented in their toys as they were in their other manufactures. This, however, was far from being the case, as will be seen from the subsequent detailed Report.

America.

The only contributions from the United States consisted of India-rubber toys, which belong to Class XXVIII.

Austria.

The toy-trade of Austria is exceedingly well and very copiously represented in the Great Exhibition. From Vienna there are two exhibitors, one of whom sends a great variety of automaton-toys; and the other a general collection of ordinary toys, military-accoutrements, guns, and swords, holding a very prominent position among them. From Bohemia are sent excellent and very numerous examples of those very beautiful boxes of toys for which it is famous, and which form a large item in the export-trade of the country. From the mountains of Tyrol, J. B. **Purger** (655, p. 1041), contributes numerous specimens of carved white-wood toys, which are deserving of favourable mention, both on account of their cheapness and the goodness of the workmanship. The specimens supplied by the other three exhibitors will be found noticed in the List of Awards.

Bavaria.

The chief contributions from Bavaria consist of mechanical toys, which will be noticed in the List of Awards; and also of numerous magnetic toys, exhibited by J. M. **Issmayer** (26, p. 1099) which are deserving of commendation for their ingenuity and variety. Both collections are from Nürnberg, in which city large quantities of these descriptions of toys are made for exportation. Besides the exhibitors of the foregoing specimens are two others, one of whom sends dressed dolls, and the other carved toys, which do not call for any particular comment.

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* Dr. Michael Faraday. † Mr. Richard Cobden.

British Colonies.

British Guiana sends only a single example.

India.—The Indian Court contains a very large collection of toys, chiefly from Bengal and Madras. Highly coloured and rude representations of birds[*] form the greater part of the display; but there are also some instances of toys which are familiar in England, as the humming-top, the merry-go-round, balancing-figures, &c. The collection comprises also several ingenious Malay puzzles, two of which are enclosed in narrow-necked bottles. Figures made in pith are likewise numerous, and are very clever productions. These toys are all such as are in common use in India, on which account they form a most valuable contribution to the Great Exhibition; but they are not nearly so well made as those of Europe. Their selection affords one striking proof, amongst numerous others, of the full appreciation, on the part of the East India Company and its numerous officials, of the objects of the Great Exhibition, and of the great energy and industry displayed by the latter, in collecting even the most trivial objects of interest.

France.

One of the French Exhibitors sends two ingenious drawing-room ornaments, containing automaton birds, which are toys rather for adults than children. Another exhibitor contributes some excellent wax-figures for hair-dressers, which are made by processes similar to those employed for producing the best description of dolls; and they are, therefore, enumerated with toys. But although France manufactures enormous quantities of toys of many kinds, only one description of them has been sent, and that by a single exhibitor from Paris, who exhibits dressed dolls only. "In that capital alone," according to the *Statistique de l'Industrie à Paris*, says M. Natalis Rondot, "there were, in 1847, no less than 371 manufacturers of children's toys, employing 2,099 workpeople (641 men, 1,345 women, 80 boys, 33 girls), who, in that year, produced 172,800*l.* worth of goods." The men earn, on the average, 2*s.* 8*d.* per day, and the women 1*s.* 3½*d.* per day; but some of the men earn 2*s.* 9½*d.*, 3*s.* 2½*d.*, 4*s.* 9½*d.*, according to their skill, or the description of work they are employed on. Many of the masters employ only a single assistant, or work alone, and very few employ more than ten assistants. Thus, of the 371 manufacturers only 62 employed more than 10; 142 employed from 2 to 10; 77 employed 1; and 90 employed no assistant, but did all the work with their own hands. Competition has, it appears, brought down prices so low, that dressed-dolls, including a bonnet, are to be bought for *eight pence per dozen;* and undressed composition dolls at *two-pence half-penny per dozen.* It is to be regretted that none of the very excellent automaton toys, boxes of games, of kitchen utensils, &c., find a place in the French Department, as they are exported from France to a considerable extent. Swords, guns, helmets, and other military accoutrements, are also, as might be expected, produced in large quantities in that country; but are disposed of chiefly for the home trade. Most of the toy-guns are beautifully made, and are generally furnished with percussion locks, which will fire off a cap. Conjuring-toys, for adults as well as children, ought most certainly to have been exhibited, as in the manufacture of these articles Paris has no rival. The nature of the toy-trade in Paris is thus given by M. Natalis Rondot:—

Number of Masters.	Number of Work-people employed.	Nature of Goods manufactured.	Value.
			£.
24	126	Military Toys – – –	13,346
90	805	Dolls – – – – –	48,358
25	151	Card-board Toys, games, boxes.	15,782
12	123	Automaton and mechanical Toys.	13,180
24	139	Masks – – – – –	8,496
16	42	Papier-maché animals – –	5,431
16	43	Wooden carriages and horses	4,426
50	94	Balls, kites, and turned Toys	8,661
10	62	Toys of tin-plate and iron-plate, as kitchen utensils, &c.	9,240
104	514	All other kinds – – –	45,880
371	2,099		172,800

Toys Exported from France.

Years.	To England.	All parts.	Valued at
	Cwts.	Cwts.	£.
1830	197	1,583	12,861
1835	174	2,562	20,822
1840	494	3,018	24,525
1845	697	5,199	42,250
1850	2,269	8,581	75,652

Frankfort.

J. V. Albert (p. 1122) exhibits, amongst philosophical apparatus, Dolls and the Moor's-head conjuring-toy, which admits of a knife traversing the neck without severing the head. The mechanism by which this is effected, though simple, could not be made clear without a diagram.

Hamburg.

The only contribution consists of Heads for dolls made of papier-maché and wax, which call for no comment farther than that they are largely exported to England and other countries.

Prussia.

The principal Toys in the Prussian Department are those of Pewter from Berlin, which are noticed in the List of Awards. Besides these there are specimens of dressed and undressed dolls (No. 256); also a toy-goat, and a horse, of large size, both being covered with the natural skin of these animals (No. 253). **A. Fleischmann**, of Sonnenberg (who made the Model of Gulliver, exhibited in Class XXIX., No. 126, p. 797), sends a "Philharmonic-chandelier." This very humorous production represents M. Jullien, in the centre at the top, with the performers of his band seated round the circles of the candelabrum, in a great variety of quaint and expressive attitudes; their features and varied action being portrayed with much skill and humour.

Saxony.

The contribution consists of a few Toys and busts made in pewter. Yet in 1846 there were six hundred and ninety-seven manufactories of wooden toys, which employed fifteen hundred and twenty workpeople.

Switzerland.

There are not any carved white-wood toys exhibited in the Swiss Department, excepting some beautiful small models of cottages, which cannot properly be classed under this category; and which, indeed, were not brought under the notice of the Jury for Class XXIX. And as the two examples about to be mentioned are not really children's toys, Switzerland must be deemed to be quite unrepresented in this branch of manufacture. **L. Audemars** (No. 22, p. 1267) sends a beautiful little Pistol, weighing only half a grain, and, consequently, so small that it requires a microscope to bring out its details.

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[*] It would appear from the admired Indian drama of *Sacontalá*, written by the poet Cálidás in the first century B.C., that this kind of toy was even then known, and popular. "Go, I pray," says an attendant, in Act vii., "to my cottage, where thou wilt find a plaything made for the hermit's child Sancara: it is a peacock of earthen-ware, painted with rich colours."—*Works of Sir William Jones*, vol. vi. p. 302.

When it is magnified about twenty times linear, all the various parts may be distinctly seen, and they then appear beautifully formed and perfect in their polish. Every part is, indeed, as complete and perfect as it is to be found in an ordinary percussion-pistol, so that the lock acts when the trigger is pulled. The second contribution is a Mechanical singing-bird from another Exhibitor, and will be found noticed in the List of Awards.

United Kingdom.

Although the number of Exhibitors of toys in Classes XXIX. and XXX., whose contributions have been examined by this Jury, is Twenty-one; yet, as the greater part of their productions consists of large models and other special objects, the United Kingdom is scarcely represented in Toys properly so called. Even of Wax-dolls, which are made in this country in considerable numbers, there is only one contribution (Class XXIX., No. 122, p. 797) worthy of notice; and this will be found described in the List of Awards. Rocking-horses are exhibited by J. C. **Dear** (Class XXIX., No. 128, p. 797); and H. **Lucas** (No. 127, p. 797) sends an improvement on the Garden-horse, which is made to rock by means of the motion of one of the wheel-axes as the horse is dragged along. A few Compressible-toys are exhibited (No. 216, p. 801); and a variety of Automaton and other toys, chiefly foreign, are displayed by A. **Bouchet** (No. 124, p. 797). With respect to the models already referred to, those exhibited at (No. 126, p. 797), will be noticed in the List of Awards. The others, which are worthy of favourable mention, are:—a landscape, with clockwork giving motion to a railway train, &c., contributed by J. T. **Cribb** (Class XXX., No. 146, p. 829); another mechanical landscape-picture, by J. L. **Barritt** (Class XXX., No. 339, p. 842); and the model of an English villa (Class XXX., No. 213, p. 832), exhibited by M. A. **Smith**. None of the ordinary strong toys of English manufacture are contributed, probably on account of the makers of these sorts being generally very poor. For most of the English wooden-toys are constructed by chamber-masters, who seldom manufacture goods to order; but, on the contrary, when they have produced a small number, hawk them about from shop to shop, or vend them in the streets. Without capital, and compelled to work almost literally from hand to mouth, they continue to exist only, without any material advance, but making much the same kinds having the same general degree of merit one year after another. That this is no exaggeration, must be conceded by every one who will recall to mind the toys of twenty years since, and mentally contrast them with those of the present day. That the progress has been slow, and requires long intervals for comparison to make it apparent, arises from the fact that all the improvements must be made in the few leisure moments of the workmen, who are compelled to labour many hours each day to gain a livelihood, and who, probably, cannot even afford the time to carry out any suggestions which may be made to them. That the poor workman does, nevertheless, endeavour to improve in his productions, is shown by Mr. Dickens, with touching humour, in *The Cricket on the Hearth*, when Caleb is made to say, "You couldn't have the goodness to let me pinch Boxer's tail, mum, for half a moment, could you?" When surprise is expressed at the question, he thus explains his meaning: "Oh, never mind, mum; he mightn't like it, perhaps. There's a small order just come in for barking-dogs; and I should wish to go as close to natur' as I could, for sixpence. That's all. Never mind, mum." Dolls'-houses, shops, brewers'-drays, waggons, common horses, the body formed of a sort of skittle with a slice cut off on the under side, and four round pins for the legs, are made in large quantities in England. Spades, wheelbarrows, garden-rollers, garden-rakes, skipping-ropes, caoutchouc-balls, tops, kites, and similar toys, are also made in great numbers. Wax or composition dolls are made entirely in England, but wooden-dolls are imported, as are also papier-maché dolls'-heads, the bodies only being made in this country.

That very large quantities of boys' Marbles are also annually imported, we learn from the Hull collection (No. 290, pp. 816, 817), in reference to which it is stated, that 1,600 cwt. of these articles were entered at that port during the year 1850.

As toys are among those foreign productions which come under the category of "Goods Non-enumerated," the Reporters are unable to give a detailed account of the various kinds which are brought into England; but the following list will show the extent of this trade, with respect to the various countries which send their toys hither. The Hanseatic Towns, it must be remembered, represent Wurtemburg, Bavaria, and other parts of Germany.

Value of Toys of all sorts Imported into the United Kingdom in the year 1850:—

From	£.
Denmark – – – – –	323
Hanseatic Towns – – –	33,828
Holland – – – – –	6,201
Belgium – – – – –	1,056
France – – – – – –	4,209
Other parts – – – –	513
From all parts – – –	46,130

Wurtemburg.

Immense quantities of Toys are manufactured in Wurtemburg, more particularly on the borders of the Black Forest, and are exported to England, America, and other countries. The contributions in the Exhibition comprise most of the kinds which are manufactured in that country; as, for example, Mechanical-toys (No. 98, p. 1119), which are noticed in the List of Awards; Boxes of miniature-tools, kitchen-utensils, &c., made of copper, most beautifully finished, the latter being exhibited by F. **Buehrer** (No. 59, p. 1117), with other things not belonging to this class. There are also kitchen, stable, and garden-implements (No. 96, p. 1119); pewter and glass toys (Nos. 94 and 95, p. 1119); dolls' houses (No. 97, p. 1119); and lastly, two collections of very beautiful miniature ivory-work. One of these is exhibited by F. **Schmidt** (No. 83, p. 1119), and although less important than a similar display (No. 82, p. 1119), to be noticed in the list of Awards, is deserving of commendation for the excellence of the workmanship.

The number of Exhibitors from all parts is Fifty-one; of these, there are—

12	Holders of a Prize Medal.
2	Who obtained Honourable Mention.
37	Unrewarded.
Total 51	

The classification according to the various countries is as follows:—

Austria – – – – – – – – –		4
Bavaria – – – – – – – – –		4
British Colonies and British Guiana	1	2
„ India – –	1	
France – – – – – – – – –		3
Frankfort – – – – – – – –		1
Hamburg – – – – – – – –		1
Prussia – – – – – – – – –		4
Saxony – – – – – – – – –		1
Switzerland – – – – – – – –		2
United Kingdom (including 8 in Class XXX.)		21
Wurtemberg – – – – – – – –		8
Total – – –		51

List of Awards.

Allix, A. J., Paris (France, No. 6, p. 1169), Prize Medal, for Hair-dressers' Wax-figures. These are modelled with considerable skill, and present a very life-like appearance; the hair, eyelids, and eyelashes being inserted singly in the wax in such a manner as very faithfully to represent nature. Although these models cannot be strictly considered as belonging to toys, yet their manufacture so closely resembles that of doll-making, that they are noticed in this place.

Bautte, T. F. Geneva (Switzerland, No. 236, p. 1281), Prize Medal (*Honourable Mention accorded by the Jury of*

Class XXIII.), for a Paper-weight of gold, the base being ornamented with scenery painted in enamel. From this a stem ascends, and is surmounted with a small casket which opens and closes by means of clock-work. When the cover is turned back a most beautiful and perfect little bird is discovered, which is apparently singing, and at the same time fluttering its minute wings and twirling about in different directions. As soon as the song is finished the box closes. The bird is scarcely three-quarters of an inch long, yet is most life-like in the details of its construction and its movements; and its warble is perfectly suited in compass to its size. The manufacture of such minute pieces of mechanism is most valuable training for the watch-maker, and they are therefore deserving of encouragement.

Bontems, —, Paris (France, No. 430, p. 1199), Prize Medal. The articles exhibited are of the same class as that just noticed, but considerably larger, the objects being of the size of nature. They consist of two groups of Humming-birds, with clock-work movements, by which the birds are made to hop from one twig to another, at the same time opening their wings; after which they twirl suddenly round, and hop back again, exactly in the manner of real birds confined in a cage. There is also a continual chirping, apparently kept up by the birds, their beaks being made to move. The levers which carry them backwards and forwards are ingeniously concealed in slits formed in the artificial branches. Other birds are represented continually pecking at beetles. The price of one of these groups of automata is 12*l.*, and of the other with the clock, 18*l.* Both groups are under glass shades, and form singularly pleasing drawing-room ornaments.

Bouchet, A., Baker Street (Class XXIX., No. 124, p. 797), Honourable Mention. The Toys exhibited consist of children's Armour, French boxes of Games, a representation of the Great Exhibition, with moving figures, Shops, and various Dolls.

Eichner, G., Nuremberg (Bavaria, No. 80, p. 1102), Prize Medal for Twenty Mechanical toys. These articles, which are made of tinned iron-plate and painted, are quite remarkable for the neatness with which they are finished. They consist chiefly of Carriages with horses, the latter being moved by cranks and levers connected with the wheels. The following specimens are deserving of especial notice:—A Carriage with a pair of horses, 24*s.*; a Carriage with four horses, the carriage containing figures representing Her Majesty and Prince Albert, 40*s.*; a State-carriage, 48*s.*; a Sportsman's-carriage, 6*s.* 6*d.*; and another similar specimen, 4*s.*

Haller's, J., Widow, and Son-in-Law, Vienna (Austria, No. 652, p. 1041), Prize Medal for a collection of upwards of Three hundred Children's Toys, comprising Dolls, dressed and undressed, miniature Furniture, Shops, Drums, Flags, Swords, Guns, Lances, Shakos, Helmets, and other military accoutrements for children, the commoner descriptions of Mechanical-toys, many of which display much ingenuity. There are also numerous other sorts of toys in this collection, which are arranged in the manner of a trophy, and form the largest group in the Exhibition.

Jumeau, P., Paris (France), Prize Medal for Dolls'-dresses. The dolls on which these dresses are displayed present no point worthy of commendation, but the dresses themselves are very beautiful productions. Not only are the outer robes accurate representations of the prevailing fashions in ladies' dresses, but the under garments are also in many cases complete fac-similes of those articles of wearing-apparel. They might serve as excellent patterns for children to imitate, and thus to acquire the use of the needle, with a knowledge of the arrangement of colours and material; in the latter respects they might indeed afford valuable instruction to adults.

Kietaibl, F., Vienna (Austria, No. 653, p. 1041), Prize Medal for a collection of Thirty-nine Automaton-toys. These toys, which are all moved by good metallic clock-work, are most ingenious productions, but they appear to be more expensive than similar manufactures produced in France, with which, unfortunately, the Exhibition afforded no opportunity of comparison. The following are among those deserving of especial notice:—Male and female figures waltzing, 12*s.*, the contrivance for effecting the occasional rapid rotation of the German waltz being very ingenious; a Pianiste, (51*s.*) who plays, or rather appears to play, "God save the Queen," and "Rule Britannia;" an Elephant carrying a Howdah; and four walking Indians carrying a Palanquin. This collection is the only one of detached locomotive-figures.

Montanari, Augusta, Upper Charlotte Street, Fitzroy Square (Class XXIX., No. 122, p. 797), Prize Medal. The display of this Exhibitor is the most remarkable and beautiful collection of Toys in the Great Exhibition. It consists of a series of Dolls, representing all ages, from infancy to womanhood, arranged in several family groups, with suitable and elegant model-furniture. These dolls have the hair, eye-lashes, and eye-lids separately inserted in the wax, and are, in other respects, modelled with life-like truthfulness. Much skill is also evinced in the variety of expression which is given to these figures in regard of the ages and stations which they are intended to represent. From the prices of these dolls, however, they are adapted rather for the children of the wealthy than for general sale; since the prices of the undressed-dolls are from 10*s.* to 105*s.* each; the dressed-dolls, which are attired with much taste, are much more expensive, and vary in price according to the richness of the material of which the robes are made. In a small case adjoining that which contains the toys just enumerated, are displayed several Rag-dolls, which are very remarkable productions, considering the materials of which they are made. They consist entirely of textile-fabrics, and the dolls which are intended, and are well adapted for the nursery, are reasonable in price, varying from 6*s.* 6*d.* to 30*s.* per doll, including the dresses.

Müller, C. A., and Co., Oberleutensdorf, Bohemia (Austria, No. 654, p. 1041), Honourable Mention for nearly Two hundred Boxes of Toys. These boxes are filled with excellent figures representing men and animals, which are modelled in a sort of papier-maché, with trees and rocks, the former being made of wood and the latter of paper. The different series represent Hunting-scenes, Zoological-gardens, Herds of cattle, and numerous other groups illustrative of rural domestic life. The truthful delineation of the various animals is a feature deserving of great commendation, as it renders the toys well adapted to afford instruction as well as amusement. The wholesale prices quoted were, 11*d.*, 1*s.* 0½*d.*, 7*s.* 10*d.*, and 10*s.* 6*d.* per box, according to the number and size of the objects contained in it. For instance, the box for 10*s.* 6*d.* contained the following objects representing stag-shooting:—3 rocks, 12 large trees, 25 small trees, 17 stags in various positions, 3 huntsmen, and 3 dogs.

Rock and Graner, Biberach (Wurtemburg, No. 98, p. 1119), Prize Medal, for a large collection of mechanical and other toys, some made of tinned iron-plate, and others in papier-maché. It comprises: Carriages with horses, which are moved by the revolving-parts by means of cranks and links; a Water-mill, to be acted upon by real water; a Cascade and fountain, in which, also, real water is to be used; a working-model of a pump; collections of Kitchen-utensils, a complete set containing many pieces being charged 6*s.* 8*d.*; and numerous other articles.

Söhlke, G., Berlin (Prussia, No. 265, p. 1063), Prize Medal, for a collection of Pewter-toys; the principal example being a representation of the review at Windsor, on the occasion of the visit to England of the Emperor of Russia, who is portrayed among the numerous figures which this well-executed model contains. Besides this specimen, there are several miniature Dinner and Tea services, also cast in pewter.

Spurin, E. C., New Bond Street (Class XXIX., No. 126, p. 797), Prize Medal, for two Models, one representing an English farm-yard, and the other Gulliver in Lilliput. The Farm-yard is an ingenious model, representing with fidelity the various buildings and the every-day business of such a place; as the feeding of poultry, pumping of water for cattle, thrashing of corn by horse-power, winnowing of grain, &c.; the various figures being moved by clock-work.

The second model was executed by **A. Fleischmann**, of Sonnenberg, who also exhibits a comic chandelier in the Prussian Department. It represents one of the incidents in Swift's well-known romance, when Gulliver wakes in the country of Lilliput, and finds himself "unable to stir." "As I happened," he continues, "to lie on my back, I found my arms and legs were strongly fastened on each side to the ground, and my hair, which was long and thick, tied down in the same manner. I likewise felt several slender ligatures across my body, from my arm-pits to my thighs." Such an incident affords ample scope for the imagination of the artist, and he has proved himself quite equal to the undertaking. There is much humour evinced in the physiognomy and expression and action of the Lilliputians, some of whom are bold enough to push their inquiries so far as to pry into Gulliver's waistcoat-pockets, a piece of temerity which is nigh costing one philosopher-looking individual his life. Others of the natives, however, are far more cautious, and mounted, in fancied security, upon the branches of trees which Gulliver might blow down with a breath, they content themselves with a more distant view of him: others again prefer trusting to the ground and their own legs, and some of them are already on the start at the first signs of waking on the part of the man-monster; some slow, dull-headed individuals, not knowing what is taking place, are eagerly climbing up on his body, whilst others are precipitately sliding down; and even the Lilliputian horses seem to have their presentiment of danger, and are becoming unmanageable.

Wittich, Kemmel, and Co., Geisslingen (Wurtemburg, No. 82, p. 1119), Prize Medal, for upwards of two hundred Bone and Ivory small-wares. The chief part of this collection consists of very small and exquisite Models of furniture, in which there is much minute piercing and carving which, in this respect, exhibit great skill on the part of the workman: these miniature works are much used as chimney-ornaments in Germany. There are also numerous children's Toys; as, rattles, 6½*d.* each; spelicans, 2*s.* the set, in which those with figures are fairly carved, considering the nature of the goods and their prices. Umbrella and stick-handles form also an item of these productions, and present several examples of good carving, as, for instance, one representing bears climbing a pole, valued at 22*s.* Lastly, there are several small articles, such as ladies' brooches, and ladies' companions or cases, containing bodkins, crochet-needles, &c., which are sold for 1*s.* each. The whole of the productions are well manufactured, and reasonable in price.

F.—MISCELLANEOUS.

In addition to the various manufactures already noticed in the previous remarks, there are productions from no less than Eighty Exhibitors, of so miscellaneous a character that they do not admit of being classified under any one of the numerous subdivisions already specified. Of these, however, it must be remarked that braid, sewing-cotton, felt, wire-buttons, bone buttons, pins, needles, fish-hooks, printers' type-cases, black-lead pencils, pencil-tips, large fishing-tackle (including large nets), casks and models of vats, shoemaker's-lasts, gig-whips, hot-water and steam-apparatus, sash-line, sheets of woven-wool, cotton and worsted bobbins, and the covering for stacks, do not belong to this Class, and were, therefore, not examined by this Jury. Of these various manufactures there are Twenty-one exhibitors, leaving still Fifty-nine belonging to the present Class XXIX. Of these, there are:—

Prussian - - - - -	2
British - - - - -	57
Total - -	59

The contributions of these Exhibitors were carefully examined, but no Awards were made in their favour. The following, in Class XXIX., are nevertheless worthy of notice.

Burnishing-Stones.

T. **Chamberlain** (231, p. 802) exhibits specimens of Burnishing-stones for the use of silversmiths, of which both the rough and the finished stones are displayed.

Confectioners' Moulds.

Leale and **Albrecht** (108, p. 796) exhibit several well-made jelly and cake moulds.

Letters for Sticking on Glass and Door-Plates.

H. **Fletcher** (240, p. 802) exhibits Letters to be fixed on glass; and, also, Engraved door-plates filled with a composition said not to be liable to crack in the sun, a very valuable improvement which, however, can be only tested by time.

G. **Lucas** (277, p. 816) exhibits brass and zinc door-plates engraved by machinery, and also filled with a composition said to be not liable to crack in the sun, nor to be acted upon by the atmosphere.

Glass and Emery Paper, and Cloth.

Barsham, Son, and Co. (213, p. 801), and R. and H. **Roberts** (215, p. 801), exhibit excellent specimens of Glass and Emery cloth, and glass and emery paper; and also of the powdered glass and emery of different degrees of fineness, which are used in their manufacture.

Ornamental Paper-Work.

There are several examples of Cut-paper ornaments both in Class XXIX. and Class XXX. The only contribution, however, which need be noticed, is a very beautiful Paper Transparency, representing Chepstow Castle, Monmouthshire, by moonlight, which is exhibited by S. **Herbert** (Class XXIX., 301, p. 817). The effect, which resembles very closely that of the porcelain pictures, is produced by many over-laying sheets of tissue-paper, cut out in the proper form with scissors, a work requiring much patience as well as skill.

Wafers.

H. **Thompson** (209, p. 801) exhibits very beautiful specimens of Cameo-wafers, a manufacture, to a great extent, superseded by the very general employment of envelopes having their seal-flaps gummed and embossed.

The remaining contributions are too unimportant to require enumeration in this Report, especially as they are amply described in the *Illustrated Catalogue.*

WARREN DE LA RUE, Ph. D., Reporter.
A. W. HOFMANN, Ph. D., Joint Reporter.

London, March 1852.

CLASS XXX.

REPORT ON SCULPTURE, MODELS, AND PLASTIC ART.

[The Figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

Jury.

G. Von VIEBAHN, *Chairman*, Zollverein; Privy Councillor in the Department of Commerce at Berlin.
Lord COLBORNE, *Deputy Chairman*, 19 Hill Street, Berkeley Square.
ANTONIO PANIZZI, *Reporter* (Tuscany), British Museum; Keeper of the Printed Books at the British Museum.
C. R. COCKERELL, R.A., Bank of England; Architect.
J. GIBSON, R.A., 7 Tilney Street, Park Lane; Sculptor.
Lord HOLLAND (Tuscany); Minister at the Court of Turin.
Count LEON DE LABORDE, France; Member of Institute, &c.
General GEORGE MANLEY, 19 Rutland Gate; formerly Adjutant-General in Rome.
C. T. NEWTON, British Museum; Assistant in the Antiquarian Department of the British Museum.
A. W. PUGIN, St. Augustine, West Cliff, Ramsgate; Architect.
LAMBERT A. J. QUETELET, Belgium; Secretary of the Academy of Fine Arts, and President of the Circle-Artistique, Brussels.
RICHARD REDGRAVE, R.A., 18 Hyde Park Gate South, Kensington Gore; Artist.
Y. D. C. SUERMONDT, Holland; late Master of the Mint at Utrecht.
Dr. G. WAAGEN, Zollverein; Director of the Museum of Fine Arts at Berlin.
W. WYON, R.A., Her Majesty's Mint; Medallist.

THE Jury of Class XXX. assembled for the first time on Monday the 12th of May 1851. In compliance with the instructions received from the Council of Chairmen, the Jury proceeded to elect a Deputy-Chairman, to make arrangements as to the time and place of their future meetings, and to nominate Sub-Committees, who should lay before the Jury detailed reports upon the several points of inquiry specially assigned to them. Lord Colborne was elected Deputy-Chairman; and at a subsequent meeting the undersigned had the honour to be appointed Reporter.

The Sub-Committees having brought their investigations to a close with the utmost dispatch consistent with the due performance of the arduous duties entrusted to them, severally laid their reports before the Jury, who, after the most mature and anxious consideration, have agreed upon their awards now submitted to the Royal Commissioners through the Council of Chairmen. As the Jury of Class XXX. forms a group by itself, and is not part of any other group of Juries, its awards have not been submitted to any other Jury or Juries for confirmation, as would otherwise have been the case, according to the 12th Instruction from the Council of Chairmen. The Jury, however, considered it expedient to hold a special meeting as a group, and at that meeting the awards previously made were reconsidered and finally settled by the Jurors. It is therefore upon the Jury of Class XXX. alone that the whole responsibility of the awards in the Class of Fine Arts rests.

In making these awards the Jury have acted strictly in accordance with the principle laid down by the Council of Chairmen in their 15th Instruction. They have been guided solely by the merit which they have recognized in the individual works exhibited, without reference to countries, and considering the Exhibition as a whole. And in compliance with the 20th Instruction, the Jury of Class XXX. have made the proportion of the Council to the Prize Medal, a very small one. Even had this instruction not been laid down in such precise terms by the Council of Chairmen, the Jury of Class XXX. would have felt it their duty to exercise great reserve in awarding Council Medals, knowing, on the one hand, that superior excellence is but very rarely attained, particularly in such works as fell within their jurisdiction, and being aware, on the other, that it was only "for very pre-eminent merit" that the Great Medal was intended.

It having already been explicitly stated that the Jury in making their awards were guided solely by the merit which they have recognized in the works exhibited, it might be deemed superfluous to add more on this point; there are, however, one or two facts, obvious indeed, but yet of sufficient importance to be recalled to the minds of such persons as might be led by the decisions of the Jury to draw invidious comparisons between one country and another. It is an obvious but most important fact to be borne in mind, that with respect to the principal branch of the subjects falling under Class XXX. (Sculpture), foreigners have laboured under peculiar difficulties in having had to bring over from distant parts, and at considerable expense and risk, statues in marble or bronze for the Exhibition. Again, all foreign artists have not enjoyed the same means of overcoming these difficulties. In many cases their Governments have given facilities and assistance towards this object, but, even then, this assistance and these facilities have varied in extent. The Jury could not moreover but feel and regret the absence from the list of exhibitors of the names of some of the most distinguished artists in Europe. It might be invidious to mention individuals, but it would be unjust to pass over the fact unnoticed. Among the works, however, by natives of the United Kingdom, to which Medals have been awarded, there are two deserving notice on account of their being exhibited among the Roman sculptures — a graceful acknowledgment of the advantages derived by the artists from that school on which their eminent success reflects so much credit.

The scope and nature of the works on which the Jury of Class XXX. were called upon to adjudicate, gave to their position and duties a special character, and must necessarily impose a peculiar line of conduct upon the Reporter.

There is no doubt, for instance, that a history, however rapid, of the rise, progress, and present state of most classes of industry represented in the Exhibition, will, in the majority of cases, form a part of, and add considerably to, the value of the several Reports, but to attempt such an historical sketch with reference to the Fine Arts must, of necessity, prove unsatisfactory and worse than useless. The Jury believe, however, that their awards will give a just idea of the present state of the Fine Arts as shown in this Exhibition; and they here wish to express their gratification in observing the universally growing taste for objects of art, and the increasing estimation in which they are held. They have noticed with equal pleasure, that industry directed by science fosters this popular tendency. By the novel and successful adaptation of cheap materials and of economical processes to the multiplication of works of art, the best models are daily brought more and more within the reach of all classes. New and pure sources of enjoyment, hitherto the privilege of the few, are thus opened to all the members of civilized society. Again, the diffusion of good taste in the Fine Arts cannot but beneficially affect the productions of industry generally, so that what has hitherto been valued merely for its usefulness may, in many cases, be rendered an object of attraction to a cultivated eye and a refined mind.

The Jury of Class XXX. have been most anxious not to pass over any of the numerous objects in the Exhibition, which it might properly be considered to be their duty to examine. They think it unlikely that any article deserving notice should have escaped their repeated, minute, and diligent inquiries. On the other hand, this Jury have occasionally abstained from examining objects, respecting which, owing to the necessarily uncertain limits of the several classes, doubt might be entertained whether they strictly belonged to Fine Arts or not. Should the Jury of Class XXX. have been led, in some few instances, to limit their jurisdiction too much, they have the satisfaction of feeling that ample justice has been rendered to exhibitors by those Juries, to whose judgment such objects as have not been considered to belong to this Class have been finally submitted. Thus the Jury of Class XXX. have purposely abstained from judging of such metal-casts as they conceived to have been exhibited merely for the purpose of showing either the successful result of a new process, or the novel use of a particular metal. In this case they were aware that another Jury were about to take these points into their consideration, and judge of these objects as specimens of mechanical industry. In some few exceptional cases, such, for instance, as those of Messrs. Perez, Weishaupt, &c., certain objects have appeared to possess so strong a claim to be noticed in this Class, that the Jury have not hesitated to distinguish them by an award, although aware that they had been rewarded by other Juries; but whenever such instances of double awards have been made known to this Jury, the fact has been noticed in this Report.

The Jury would willingly have endeavoured to state, as directed by the 20th instruction of the Council of Chairmen, the several grounds upon which four of the Great Medals have been recommended by them; but it has been found impossible to comply with such an instruction with respect to objects of sculpture, although the Jury felt how desirable it was that such an instruction should be observed in those cases in which the elements out of which the Juries were to form their judgment, were of a more definite and more uniformly appreciable nature.

At a meeting held on the 5th of June, long before the question of individual awards came under consideration, the Jury agreed upon the following resolution:—

"That it is not desirable to assign the Council Medal to every object of art pre-eminently beautiful or excellent in its kind, whether it be executed in an inferior section of the Class or not; but that it should be rather limited to the highest works of the highest class." This resolution, consistent with the view of the Fine Arts taken throughout by this Jury, precluded them from awarding the highest honours to any but works of art of the highest class. Their awards must not, therefore, be compared with those of other Juries guided by different principles, but must be tested only by the rules which the Jurors of Class XXX. have laid down for their own guidance. The holders of the several marks of approbation by which this Jury have distinguished merit ought to appreciate them according to the high value set upon these several marks of approbation by those who conferred them.

In forming their judgment upon works in the highest branch of art coming within their jurisdiction, the Jury have principally looked for the embodiment of ideas, thought, feeling, and passion; not for the mere imitation of nature, however true in detail, or admirable in execution. They have looked for originality of invention, less or more happily expressed in that style which has for twenty-three centuries been the wonder of every civilized people, and the standard of excellence to which artists of the highest order have endeavoured to attain. Wherever indications of originality, chastened by a successful adaptation of this style, have been met with, the Jury have acknowledged a corresponding amount of merit; and it is this originality of conception, improved by such style, which the Jury have recognized by the honours placed at their disposal. They have endeavoured to record, in the most emphatic manner, their anxious wish that artists should study to give their ideas that form and life which spiritualizes every-day nature, and elevates the work of art to the place of a type of nature itself. The Jury of Class XXX. would point to the remains of the Parthenon as embodying the result of the great principles which they have been anxious to inculcate, and which they desire to see universally adopted. The limited number of Council Medals awarded must not, therefore, be regarded as a proof of deficiency of talent in the bulk of the works exhibited, but as evidence of the severity with which the principles adopted by the Jury have been applied.

It was agreed to recommend that Council Medals should be awarded to the following works:—

To Professor A. Kiss, of Berlin, for his group cast in zinc, and bronzed by M. Geiss, representing an Amazon on horseback attacked by a Tiger. (Prussia, No. 279, p. 1065.)

To Baron Marochetti, of Turin, now of London, for his colossal equestrian statue in plaster of Richard Cœur de Lion. (Outside West, No. 76, p. 118.)

To M. J. Pradier, of Paris, Member of the Institute, for his marble statue of Phryne. (France, No. 1407, p. 1343.)

To the representatives of the late Mr. Richard J. Wyatt, for his marble statue of Glycera. Exhibited by Captain Leyland. (Main Avenue East, No. 103, p. 1286.)

It was the unanimous impulse of the Jury on the awards being taken into consideration, to recommend that the same high distinction should be conferred on Mr. Gibson (p. 846), for his marble group of a Hunter and Dog, exhibited by the Earl of Yarborough. Their intention was defeated by Mr. Gibson himself, who, well knowing that should he accept the office of a Juror of Class XXX., he could no longer receive a prize from that Jury, preferred serving his brother artists to his own individual gratification, and thus disqualified himself for receiving the honour which he had so well deserved.

Division A.—Sculpture as a Fine Art.*

Section A.—1. In Metals simple, as Gold, Silver, Copper, Iron, Zinc, Lead, &c.

In this section of the works submitted to their judgment, the Jury awarded the Prize Medal to the following work, it being, however, understood that for this class of reward, when more than one article was exhibited by the same artist, the Jury might, if they thought it expedient, cumulate in their judgment the various species of merit which they recognized in the several productions.

To Messrs. C. M. Weishaupt Sons, of Hanau (p. 1073), for a Set of Chess-men and Board, in silver and gold, ornamented with enamel. Although aware that the merit of these articles has been acknowledged by another Jury, the Jury of Class XXX. wished to record their opinion of them as objects of art. (Prussia, No. 412.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

Mr. A. Vechte, of London (No. 97, pp. 686-690), for his designs for silver works executed by him for the exhibitors, Messrs. Hunt and Roskell. Although a

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* The classification of awards is according to that adopted in the "Head Juries."

Council Medal has been awarded to the exhibitors by another Jury, the Jury of Class XXX. considered it just to record their opinion of the merits of this artist. (Class XXIII., No. 97.)

The Jury of Class XXX. have heard with great satisfaction that another Jury have suitably acknowledged the excellent workmanship of the Shield presented by His Majesty the King of Prussia to H. R. H. the Prince of Wales, on whose behalf it has been exhibited by H. R. H. PRINCE ALBERT. They think it, however, their duty to add that the several eminent artists who have contributed to the execution of the design of Director Cornelius (p. 110), deserve the special praise of the Jury of Class XXX., for the taste and skill which they have respectively displayed in this work. (Main Avenue East, No. 98.)

Section A.—2. In Metals compound, as Bronze, Electrum, &c.

The following Prize Medals were awarded in this section:—

To Mr. JOHN BELL, of London, for his Eagle Slayer, cast in bronze by the Coalbrook Dale Company. (Main Avenue West, No. 53, p. 659.)

To M. JEAN DEBAY, of Paris, for his bronze group representing the Death of the Stag. (Main Avenue East.)

To M. FRATIN, of Paris, for a group of Eagles in bronze. (France, No. 1235, p. 1236.)

To M. E. L. LEQUESNE, of Paris (?), for his bronze statue of a Dancing Faun. (Main Avenue East.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

M. — BONNASSIEUX, of Paris, for a bronze figure representing Cupid cutting his wings. (France, No. 64, p. 1174.)

M. C. CORDIER, of Paris, for his Head of a Negro in bronze. (France, No. 460, p. 1200.)

M. T. KALIDE, of Berlin, for his group in bronze of a Boy with a Swan. (Prussia, No. 285, p. 1066. Prize Medal awarded, Class XXII.)

M. P. J. MENE, of Paris, for his several Animals in bronze. (France, No. 630, p. 1208. Prize Medal awarded, Class XXII.)

M. C. MOELLER, of Berlin, for two bronze groups representing a Boy with a Newfoundland Dog, and a Girl with a Bulldog. (Prussia, No. 292, p. 1066.)

Section A.—3. In Minerals simple, as Marble, Stone, Gems, Clay, &c.

The following Prize Medals were awarded in this section:—

To Mr. E. H. BAILY, of London, for his two plaster statues of a Nymph preparing for bathing, and of a Youth resting after the Chase. (South Transept, Nos. 6 and 7, p. 847.)

To Mr. JOHN BELL, of London, for his plaster statue of Viscount Falkland, no Prize Medal was specially awarded, as he had already received one for his "Eagle Slayer," in bronze. (North Transept, Mo. 28, p. 847.)

To M. GIO. MARIO BENZONI, of Rome, for his statue in marble representing Gratitude. (Rome, No. 16, p. 1286.)

To M. AUGUSTE DEBAY, of Paris, for his group in marble representing Eve, with Cain and Abel asleep in her arms, and designated as the "Premier Berceau." (France, No. 45, p. 1173.)

To Professor F. DRAKE, of Berlin, for a reduced cast in plaster of part of the marble pedestal to the monument of Frederic William III. of Prussia. (Prussia, No. 273, p. 1065.)

To M. A. ETEX, of Paris, for his various works of sculpture in plaster and marble. (France, No. 1215, p. 1236.)

To Mr. J. H. FOLEY, of London, for his plaster statue of a Youth at a Stream; also for his plaster group representing Ino and Bacchus. (North Transept, No. 47, Sculpture Court, No. 19, pp. 848 and 844.)

To M. I. FRACCAROLI, of Verona, for his two statues in marble, representing Achilles wounded, and David slinging the stone. (Austria, No. 710, p. 1043.)

To M. C. A. FRAIKIN, of Schaerbeck, near Brussels, for a plaster group of Psyche carrying off Cupid. (Belgium, No. 465, p. 1166.)

To M. A. GALLI, of Milan, for his marble statue of Susannah. (Austria, No. 711, p. 1043.)

To M. G. GEEFS, of Schaerbeck, near Brussels, for a plaster group representing a Lion in love. (Belgium, No. 466, p. 1066.)

To Mr. J. HOGAN, of London, for his reclining figure in plaster representing a Drunken Faun. (Sculpture Court, No. 14, p. 843.)

To Mr. B. JENNINGS, of London, for his marble statue of Cupid. (Sculpture Court, No. 81, p. 846.)

To M. J. A. JERICHAU, of Copenhagen, for a group in plaster representing a Hunter carrying off the Cub of a Panther. (Denmark, No. 39, p. 1359.)

To Mr. J. LAWLOR, of London, for a statue in plaster representing a Bather. (Sculpture Court, No. 22, p. 844.)

To M. A. LECHESNE, of Paris, for his two casts in plaster representing two groups of a Child protected from a Snake by a Dog. (Main Avenue East, No. 573, p. 1205.)

To Mr. LAWRENCE MACDONALD, now at Rome, for an Iconic statue in marble. (Rome, No. 18, p. 1286.)

To Mr. P. MACDOWELL, of London, for his plaster statue of Eve; also for his statues of Cupid, and of a Girl at Prayer, in marble. (South Transept, Nos. 22, 23, 24, p. 850.)

To Mr. WILLIAM C. MARSHALL, of London, for his plaster figure of Sabrina. (Sculpture Court, No. 15, p. 844.)

To M. RAFFAELLE MONTI, of Milan, for his marble statue of Eve after the Fall. (Austria, No. 746, p. 1044.)

To Mr. HIRAM POWERS, from the United States of America, for a statue in marble representing a Greek Slave. (No. 522, p. 1467.)

To M. J. M. RAMUS, of Paris, for his marble group representing Cephalus and Procris. (France, No. 1419, p. 1244.)

To Professor ERNST RIETSCHEL, of Dresden, for his plaster group designated as "La Pietà," representing Mary kneeling at the Dead Body of our Saviour; and for his bas-reliefs in marble. (Saxony, No. 186, p. 1113.)

To Mr. T. SHARP, of London, for his marble figure representing a Boy frightened by a Lizard. (Sculpture Court, No. 20, p. 844.)

To M. E. SIMONIS, of Brussels, for his equestrian statue of Godfrey of Bouillon, in plaster; and for other works. (Belgium, No. 464, p. 1166.)

To M. G. STRAZZA, of Milan, for his reclining figure, in marble, representing Ishmael. (Austria, No. 713, p. 1043.)

To Mr. E. THRUPP, of London, for his marble statue of a Boy catching a Butterfly; also for a marble figure representing Arethusa. (Sculpture Court, Nos. 56 and 58, p. 845.)

To M. J. TUERLINCKX, of Malines, for a statue in marble representing Giotto. (Belgium, No. 456, p. 1165.)

To the REPRESENTATIVES of the late Mr. M. L. WATSON, of London, for his marble statue of the sculptor Flaxman, exhibited by Mr. Franks; and for his two statues, likewise in marble, of the first Earl of Eldon, and of his brother Lord Stowell, exhibited by the present Earl of Eldon. (Sculpture Court, No. 60, and Main Avenue West, No. 81, p. 848.)

To M. ALBERT WOLFF, of Berlin, for his marble group of a Girl with a Lamb, representing "Innocence." (Prussia, No. 307, p. 1067.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

Mr. WILLIAM BEHNES, of London, for his marble statue representing a Startled Nymph. (Sculpture Court, No. 54, p. 845.)

M. H. W. BISSEN, of Copenhagen, for his plaster statue of Orestes, and for other sculptures. (Denmark, No. 38, p. 1358.)

M. T. CLESINGER, of Besançon, for his marble figure of a Bacchante. The Jury, for reasons totally independent of the acknowledged merits of this young artist, abstained, with regret, from awarding a high mark of approbation to this work. (France, No. 419, p. 1198.)

Professor A. COSTOLI, of Florence, for a marble statue of a Dying Gladiator, exhibited by the Rev. John Sandford.* The work by the same artist described under Tuscany, No. 106 of the General Catalogue, was not exhibited.

Mr. J. Engel, from Hungary, for his marble group representing an episode in the history of the war between the Amazons and the Argonauts. (South Transept, No. 15, p. 848.)

Mr. P. Freccia, of Florence, for his marble statue of Psyche. (Tuscany, No. 110, p. 1299.)

Mr. J. Geefs, of Antwerp, for his plaster statue, "The Faithful Messenger." (Belgium, No. 451, p. 1165.)

Mr. Joseph Jaquet, of Schaerbeck, near Brussels, for his plaster statue representing Cupid disarmed. (Belgium, No. 461, p. 1165.)

Mr. J. Leeb, of Munich, for his marble statue of a Girl carrying a Nest of Cupids. (Bavaria, No. 89, p. 1102.)

Mr. L. Marchesi, of Milan, for his statue in marble representing Eurydice. (Austria, No. 716, p. 1043.)

Mr. F. M. Miller, of London, for his marble group, "The Orphans." (No. 98a, Main Avenue East, p. 850.)

Professor L. Nencini, of Florence, for his reclining marble figure of Bacchus. (Tuscany, No. 108, p. 1298.)

M. Michel Pascal, of Paris, for his model in marble of a Friar presenting the Crucifix to two Children. (France, No. 1660, p. 1256.)

Mr. A. Sangiorgio, of Milan, for his marble bust of the poet Vincenzo Monti. (Austria, No. 722, p. 1043.)

Mr. E. B. Stephens, of London, for his plaster group representing a Deer-stalker and Dog. (North Transept, No. 29, p. 853.)

Mr. W. Theed, of London, for his sculptures in marble and plaster. (Sculpture Court, Nos. 13, 59, and 79, pp. 843, 845, 846.)

Mr. and Mrs. T. Thornycroft, of London, for their statues in plaster of the Royal Children, represented as the Seasons. (Sculpture Court, No. 34, p. 844.)

M. T. Wagner, of Stuttgard, for a figure in marble representing Mary Magdalen. (Wurtemburg, No. 118, p. 1130.)

Mr. H. Weekes, of London, for his marble group, representing a Sleeping Child and Dog. (South Transept, No. 21, p. 853.)

Section A.—4. In elaborate Mineral Materials, as Glass, Porcelain, &c.

The Jury made no award in this section.

Section A.—5. In Woods and other Vegetable Substances.

The following Prize Medals were awarded in this section:—

To Mr. C. Geerts, of Louvain, for his high relief in wood, representing the Coronation of the Virgin Mary. (Belgium, No. 450, p. 1165.)

To M. J. Liénard, of Paris, for his carvings in wood. (France, No. 1326, p. 1239.) The Jury were aware that the merits of M. Liénard had been acknowledged by another Jury. (Council Medal, Class XXVI.)

To Mr. W. G. Rogers, of London, for his cradle, carved in Turkey boxwood. (No. 353, p. 842.)

To Mr. T. W. Wallis, of Louth, for his carvings in wood. (No. 89, p. 825.)

Section A.—6. In Animal Substances, as Ivory, Bone, Shells.

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

M. L. Bigotti, of Lucca, for his bas-reliefs in ivory. (Tuscany, No. 95, p. 1298.)

M. M. Hagen, of Münich, for his goblet of carved ivory. (Bavaria, No. 83, p. 1102.)

M. C. W. Heyl, of Darmstadt, for his goblet of carved ivory. (Hesse, No. 75, p. 1129.)

M. C. G. Klingsey, of Copenhagen, for his ivory jewel-casket, ornamented with bas-reliefs. (Denmark, No. 34, p. 1358.)

M. L. Lautz, of Paris, for his ivory carving, representing the victory of Charlemagne over the Saxons. (France, No. 295, p. 1191.)

Mr. R. C. Lucas, of the Firs, near Winchester, for his ivory carvings. (No. 306, p. 840.)

Division B.—Works in Die-sinking, Intaglios.

Section B.—1. Coins, Medals, and Models of a Medallic character in any material.

The following Prize Medals were awarded in this section:—

To M. K. Fischer, of Berlin, for medals. (Prussia, No. 281, p. 1065.)

To Mr. L. C. Wyon, of London, for his medals and medallion portraits of the Royal Children, modelled by command of Her Majesty. (No. 286, p. 838.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

M. Bernard Afinger, of Berlin, for his medallions. (Prussia, No. 309, p. 1067.)

M. L. J. Hart, of Brussels, for his medals. (Belgium, No. 441, p. 1165.)

M. C. Jehotte, of Liège, for his medals. (Belgium, No. 447, p. 1165.)

M. C. Pfeuffer, of Berlin, for his medals. (Prussia, No. 286, p. 1066.)

Count T. Tolstoy, of St. Petersburg, for his medallions. (Russia, No. 328, p. 1381.)

The Jury having the honour to number Mr. W. Wyon, of London, among their members, were prevented from expressing, by their award, the opinion which they entertain of the works exhibited by this distinguished artist.

Section B.—2. Impressions struck from Dies for Ornamental purposes.

The Jury made no award in this section.

Section B.—3. Gems, either in Cameo or in Intaglio, Shell Cameos.

The Jury were of opinion that the following artist was deserving of Honourable Mention:—

M. Thomas Saulini, of Rome, for his shell cameos. (Rome, No. 24, pp. 1286, 1287.)

Section B.—4. Seals, &c.

The Jury made no award in this section.

Division C.—Architectural Decorations.

Section C.—1. Integral, in Relief, Colour, &c.

The Jury were of opinion that the following artist was deserving of Honourable Mention:—

Mr. N. J. Cottingham, of London, for his model of a spandril for Hereford Cathedral. (Main Avenue West, No. 63, p. 852.)

Section C.—2. Adventitious, as Stained Glass, Tapestry, &c.

The following Prize Medals were awarded in this section:—

To M. G. Bertini, of Milan, for a painted glass window, representing Dante and some of his ideas. (Austria, No. 737, p. 1044.)

To M. A. Gérente, of Paris, for his painting on glass of the history of Samson. (France, No. 231, p. 1187.)

To Messrs. J. Hardman and Co., of Birmingham, for their painted glass windows. (Class XXVI., No. 532, p. 761.)

To M. S. Kellner, of Nuremberg, for a copy in painted glass of a window by Volkamer, in St. Lawrence's Church in that city. (Bavaria, No. 86, p. 1102.)

To Messrs. Marechal and Gugnon, of Metz, for their painting on glass, representing St. Charles administering the Communion to the Plague-stricken. (France, No. 329, p. 1193.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

M. P. Bagatti-Valsecchi, of Milan, for his painting on glass. (Austria, No. 616, p. 616.)

Messrs. Chance Brothers and Co., of Birmingham, for their painted window-glass. (Class XXIV., No. 60, p. 706.)

Messrs. Holland and Son, of Warwick, for their life of Christ, painted on glass. (Class XXIV., No. 63, pp. 706, 707.)

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* This object is not in the Catalogue.

Mr. J. G. Howe, of London, for his imitation of ancient painted window-glass. (Class XXIV., No. 67, p. 707.)

M. A. Lusson, of Paris, for his painted glass window. (France, No. 565, p. 1205.)

Mr. George Myers, of London, for the tomb in stone of Bishop Walsh. (Class XXVI., No. 533, p. 761.) (Prize Medal, Class XXVII.)

Messrs. M. and A. O'Connor, of London, for their painted glass. (Class XXIV., No. 65, p. 707.)

The Jury gladly seize the opportunity which now offers itself of rendering justice to the taste displayed by their colleague, Mr. Pugin, in the arrangement of the Mediæval Court in the Exhibition. (p. 761.)

Mr. W. Wailes, of Newcastle-upon-Tyne, for his painted glass for York Cathedral. (Class XXIV., No. 73, p. 707.)

To the Government Manufactory of Gobelin and Beauvais Tapestry (No. 1367, p. 1241) the Jury award a Council Medal jointly with Class XIX.

Division D.—Mosaics and Inlaid Works.

Section D.—1. *In Stone.*

The following Prize Medals were awarded in this section:—

To the Cavaliere Barberi, of Rome, for a mosaic table, designed and executed by him, representing views of celebrated cities in Italy. (Rome, No. 15, p. 1286.) (Council Medal, Class XXVII.)

To Mr. G. Bianchini, of Florence, for his tables in pietra dura, one of them exhibited by R. S. Holford, Esq., and not entered in the Catalogue, the other entered (Tuscany, No. 113, p. 1299). The Jury were much pleased to learn that the merits of this distinguished artist, with respect to the second table, had been suitably acknowledged by another Jury. The table described under No. 111, in the same page of the Catalogue, has not been exhibited.

To M. Raffaelle Castellini, Royal Manufactory of St. Peter's, Rome, for his copies in mosaic of a medallion portrait of Boniface II., by Bompiani, and of the head of St. John the Baptist, by Guercino. (Rome, No. 23, p. 1286.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

M. Benedetto Boschetti, of Rome, for two mosaic tables. (Rome, No. 17, p. 1286. Prize Medal, Class XXVII.)

M. Domenico Moglia, of Rome, for his mosaics. (Rome, No. 21, p. 1286. Honourable Mention, Class XXVII.)

The Cavaliere Luigi Moglia, of Rome, for his mosaic view of the Temples of Pæstum. (Rome, No. 20, p. 1286). Prize Medal, Class XXVII.)

M. Antonio Rocchigiani, of Rome, for his mosaic view of the Temples of Pæstum. (Rome, No. 22, p. 1286.)

Section D.—2. *In Tiles.*

The Jury made no award in this section.

Section D.—3. *In Vitrified Materials.*

The Jury made no award in this section.

Section D.—4. *In Wood.*

The following Prize Medal was awarded in this Section:—

To MM. Perez and Co., of Barcelona, for an octagonal table of inlaid wood. The Jury have heard with pleasure, that the distinguished merits of this work have been suitably acknowledged by another Jury. (Spain, No. 271a, p. 1346.)

Section D.—5. *In Metal.*

The following Prize Medals were awarded in this Section:—

To M. J. Falloise, of Liège, for various inlaid objects. (Belgium, No. 384, p. 1163.) Prize Medal, Class XXIII.)

To M. J. Roucou, of Paris, for his inlaid work. (France, No. 1689, p. 1257.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

Messrs. S. H. and D. Gass, of London, for a niello bracelet, designed by Mr. Maclise. (Class XXIII., No. 83, p. 683.)

The Royal Ordnance Manufactory, of Toledo, for various inlaid arms. (Spain, No. 266, p. 1346.)

M. E. Zuloaga, of Eibar, for his inlaid ornaments on pistols and other arms. (Spain, No. 264a, p. 1346). Prize Medal, Class XXIII.)

Division E.—Enamels.

Section E.—1. *On Metals.*

The following Prize Medals were awarded in this Section:—

To M. — Bonnet (of Paris?), for the head of St. John, in enamel. (France, 1369, p. 1241.)

To Mr. W. Essex, of London, for his enamel paintings. (No. 241, pp. 435, 436, Class XXX.)

To M. — Hamon, of Paris, for an enamelled casket. (No. 1369, p. 1241.)

To Madame Pauline Laurent, of Paris, for her three enamels in copper, two after Raphael, and one representing Venus. (France, No. 1369, p. 1241.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

Mr. W. C. Bell, of London, for his enamel painting of the "Ecce Homo," after Correggio. (No. 249, p. 836, Class XXX.)

Mr. H. P. Bone, of London, for his enamel paintings on gold. (No. 238, p. 835, Class XXX.)

Mr. J. Haslem, of London, for his enamel paintings on gold. (No. 237, p. 835, Class XXX.)

Section E.—2. *On China.*

The following Prize Medals were awarded in this Section:—

To M. Antoine Béranger, of Paris, for his portrait of Prince Albert, life-size, painted on china, after Winterhalter. (Main Avenue East, No. 97, p. 109.) Also for a Head, painted by him on china, after Rubens. (France, No. 1369, p. 1241.)

To M. H. Bucker, of Dresden, for his paintings on china. (Saxony, No. 176, p. 1112.)

To M. J. Dieterle, of Paris, for the general good taste displayed in the painting of china in the Manufactory of Sèvres, of which he is co-director. (France, No. 1369, p. 1241.)

To Mme. A. Ducluzeau (of Paris?), for her portrait of Her Majesty, life-size, painted on china, after Winterhalter. (Main Avenue East, No. 96, p. 109.) Also for her painting of a Holy Family, on china. (France, No. 1369, p. 1241.)

To M. Jacobber, of Paris, for his paintings of flowers on china, after Van Huysum. (France, No. 271, p. 1189.)

To Mme. Jacotot, of Paris, for the Head of Raphael, painted by her on china. (France, No. 1369, p. 1241.)

To M. N. Korniloff, of St. Petersburg, for a landscape after Berghem, on china; executed at the Imperial China Manufactory, St. Petersburg. (Russia, No. 318, p. 1376.)

To M. — Schilt, of Paris, for his painting on a china vase. (France, No. 1369, p. 1241.)

To M. O. Wustlich, of Bamberg, for his portrait of Charles IX. on china. Exhibited by Mr. Schmidt. (Bavaria, No. 92, p. 1102.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

Mr. — Bradley, of Stoke-upon-Trent, for his painting of Ducks on china, exhibited by Mr. Copeland. (Class XXV., No. 2, p. 711.)

Mr. S. Chesters, of London, for his specimen of painting on china, after Murillo. (No. 246, p. 836.)

MM. Eckelmann and Wüstiah, for their portraits of the Queen with the Prince of Wales, and of Prince Albert, painted on china from miniatures after Thorburn. (Main Avenue West, No. 140, p. 109.)

MM. F. E. Henneberg and Co., of Gotha, for their paintings on china. (Prussia, No. 772, p. 1093.)

M. Mariette de Chassagne, for a painting on china after Horace Vernet, exhibited by M. Boyer, of Paris. (France, No. 1554, p. 1251.)

M. — Nigg, for a Flower-piece and Holy Family, on china, from the Imperial China Manufactory at Vienna. (Austria, No. 615, p. 1038.)

Mme. Turgan, of Paris, for her painting on china. (France, No. 1504A., p. 1248.)

Mr. G. Walther, of Dresden, for his paintings on china. (Saxony, No. 177, p. 1112.)

Section E.—3. *On Glass.*

The Jury made no award in this Section.

DIVISION F.

MATERIALS AND PROCESSES APPLICABLE TO THE FINE ARTS GENERALLY, INCLUDING FINE-ART PRINTING, PRINTING IN COLOUR, &c.

Section F.—1. *Encaustic Painting and Fresco.*

The following Prize Medals were awarded in this Section:—

To M. J. Devers, of Paris, for a Holy Family in enamel paste, painted on lava. (France, No. 818, p. 1219.)

To M. J. N. von Fuchs, of Munich, for his specimen of a stereo-chromic method of producing indestructible paintings on walls, exhibited by Mr. Muhr. (Bavaria, No. 91, p. 1102.)

Section F.—2. *Ornamental Printing, Chromo-Typography, Gold-illuminated Typography, Typography combined or uncombined with Embossing.*

The following Prize Medal was awarded in this Section:—

To M. G. Silbermann, of Strasburg, for his chromotypography. (France, No. 374, p. 1194.)

The Jury were of opinion that the following artist was deserving of Honourable Mention:—

Mr. J. Harris, of London, for his imitations of ancient typography. (No. 244, p. 836.)

Section F.—3. *Lithography (Black), Chromo-Lithography, Gold-illuminated Lithography, Lithography combined or uncombined with Embossing.*

The following Prize Medals were awarded in this Section:—

To Messrs. Day and Son, of London, for their specimens of tinted lithography and chromo-lithography. (Fine Arts Court, No. 80, p. 825.)

To Messrs. M. and N. Hanhart, of London, for their chromo-lithography in graduated tints. (Fine Arts Court, No. 64, p. 823.)

To Messrs. Hullmandel and Walton, of London, for their drawings on stone with the stump, and for their lithotints. (Fine Arts Court, No. 71, p. 824.)

To the Imperial Printing Office of Vienna, for the "Paradisus Vindobonensis" in chromo-lithography. (Austria, No. 362, pp. 1025-1028.)

To Mr. Owen Jones, of London, for his chromo-lithography. (Fine Arts Court, No. 54, p. 823.)

To M. R. J. Lemercier, of Paris, for his lithography and chromo-lithography. (France, Nos. 587 and 588, pp. 1205, 1206.)

To MM. Winckelmann and Sons, of Berlin, for their coloured lithography. (Prussia, No. 306, p. 1067.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

The fac-similes of ancient MSS. and illuminations by Comte Auguste de Bastard, of Paris, have been duly appreciated by the Jury. As it appears, however, that the most important parts of the several objects exhibited are finished by the hand, the Jury abstained from a more special inquiry into their merits. (France, No. 1717, p. 1258.)

Mr. G. Baxter, of London, for his printing in colours. (No. 115, p. 828.)

M. F. Dreger, of Moscow, for his chromo-lithography. (Russia, No. 362, p. 1383.)

Mr. T. Underwood, of Birmingham, for a new process of lithography. (Fine Arts Court, No. 77, p. 825.)

Section F.—4. *Zincography, or other modes of Printing.*

The following Prize Medal was awarded in this Section:—

To Mr. R. Appel, of London, for his anastatic printing. (No. 274, p. 838.)

The Jury were of opinion that the following artist was deserving of Honourable Mention:—

Mr. J. Hanfstaengel, of Münich, for his galvanography. (Bavaria, No. 85, p. 1102.)

To the processes applicable to the Fine Arts generally, belong those employed by the next three Exhibitors, whose claims the Jury of Class XXX. have acknowledged in the following manner:—

Prize Medals were awarded—

To Mr. B. Cheverton, of London, for his process of reducing sculpture by machinery, as exemplified in the Theseus. (No. 194, p. 832.)

To M. A. Collas, of Paris, for his process of reducing sculpture by machinery, as exemplified in the Gates of the Battisterio at Florence, and other works. (France, No. 1709, p. 1258.)

The Jury were of opinion that the following artist was deserving of Honourable Mention:—

Mr. B. E. Duppa, of London, for specimens of a new process of executing fine-art designs on detached tiles; the design being burnt in on the separate pieces, and then put together. Exhibited by Messrs. H. Minton and Co. (Class XXVII., No. 51, p. 767.)

DIVISION G.—MODELS.

Section G.—1. *In Architecture.*

The Jury having been directed to include architectural models in the range of their inquiries, were naturally led to reflect upon, and then to feel it a most agreeable duty to acknowledge publicly, the merit of the Building in which they met. The originality of the construction, and the rapidity with which it has been carried to completion would, in comparatively recent times, have induced popular enthusiasm to ascribe to fairy agency the power of overcoming obstacles hitherto considered to be insurmountable by human ingenuity. The noble simplicity of the whole edifice, the striking grandeur of its proportions, the novel and ingenious application of the materials of which it is constructed, and the admirable adaptation of all its parts to their multifarious purposes, gave to the person who conceived it, as well as to those who, with so much zeal and success, carried out the constructor's design, a right to the highest award in the power of the Jury to recommend. The Jury had, therefore, the honour to propose that a Council Medal be awarded to Mr. Joseph Paxton, and a similar Medal to Messrs. Fox and Henderson. And although the Jury had already rendered justice to the claims of Mr. Owen Jones, by awarding him a Prize Medal for his chromo-lithography, they felt it to be their duty to record here their opinion of the advantages resulting to the Building from the simple and tasteful style of decoration which Mr. Owen Jones has so skilfully suggested and so successfully applied.

The following Prize Medals were awarded in this section:—

To Mr. J. C. Boesche, of Magdeburg, for his models of Magdeburg Cathedral and of the Nuremburg Fountain, executed in limewood. To this artist the Jury have also made a money award of 30*l.* sterling. (Prussia, No. 785, p. 1094.)

To Mr. Jabez James, of London, for his model in various materials of the Britannia Suspension Bridge. (Class VII., No. 106, p. 321. Prize Medal, Class VII.)

To Mr. S. Salter, of London, for his model executed in card of St. Nicholas' Church, now being rebuilt at Hamburg. (Class VII., No. 221, p. 331.)

The Jury were of opinion that the following artists were deserving of Honourable Mention:—

Mr. J. H. Cassebohm, of Oldenburg, for his model of

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* Since the Award Book was closed, it has been ascertained that the two entries No. 257 and 258 refer to the same person.

Heidelberg Castle, carved in cork. (Oldenburg, No. 1, p. 1135.)

Mr. S. Cundy, of London, for his restoration of the Monument of Philippa of Hainault, in English alabaster, from drawings by Mr. G. C. Scott. (Main Avenue West, No. 60, p. 848. Prize Medal, Class XXVII.)

Mr. T. Dunhill, of London, for his model in plaster, and other materials, of a Metropolitan Cattle Market, with abattoirs, &c. (Class VII., No. 90, p. 318.)

M. J. Leeman, of Berne, for his model of the Nuremberg Fountain, carved in wood. (Switzerland, No. 258, p. 1283.)*

M. J. Leeman, of Zürich, for his model of the Cathedral of Strasburg, executed in card. (Switzerland, No. 257, p. 1282. Prize Medal, Class VII.)*

Mr. W. Stuart, of Plymouth, for a model of the Plymouth Breakwater, executed in limestone. (Class VII., No. 28, pp. 311, 312.)

Section G. 2.—In Topography.

The following Prize Medal was awarded in this section:—

To Mr. John Grantham, Secretary of the Liverpool Local Committee, for a model of the Docks and commercial portion of the Town of Liverpool, in various materials. (Main Avenue West, No. 95, p. 851.)

Section G. 3.—In Anatomy.

The Jury of Class XXX. abstained from examining models in Anatomy, as such objects were transferred to another Class. (Minute of May 26th, 1851.)

Designs.

The various designs for decoration, tapestry, embroidery, mixed fabrics, &c., not having been submitted to the examination of any other Jury, the Jury of Class XXX. appointed a Committee of their own body, which, together with members of Juries of other Classes, were instructed by the Royal Commissioners to report on the articles thus overlooked. This mixed Committee having reported accordingly, the Jury of Class XXX. proceeded to award the following Prize Medals:—

To MM. Berrus Brothers, of Paris, for their general ability in designs for shawls. The Jury wished, however, to guard themselves from being supposed to approve of the introduction of landscapes in such designs, as exhibited in frames Nos. 1 and 2. (France, No. 55, p. 1174.)

To M. J. Chebeaux, of Paris, for his cotton and calico prints, apart from their taste. (France, No. 1146, p. 1233.)

To M. C. E. Clerget, of Paris, for his designs generally, and his exhibited works in ornament. (France, No. 799, p. 1219.)

To M. A. Couder, of Paris, for his Shawl Designs, and for his skilful execution of his Designs generally, apart from their taste. (France, No. 1566, p. 1251.)

To the Government Head School of Design, established in London. (Fine Arts Court, No. 10, p. 821.)

The mixed Sub-Committee examined the Designs intended for Manufactures, exhibited by this School, directed by Messrs. J. R. Herbert, R. Redgrave, and H. J. Townsend; the female department being superintended by Mrs. M'Ian. The Sub-Committee reported that in these designs they had observed a purity of taste, a propriety and chasteness of invention, and a well-understood adaptation of style for the several objects, which do great credit to the directors and to their scholars. The Sub-Committee, therefore (Mr. Redgrave, one of its members and a Juror of Class XXX. having withdrawn), felt it to be their duty to propose to this Jury that a Prize Medal should be awarded to the Institution. They moreover recommended that Honourable Mention should be made of three of the pupils, and that six other pupils, viz., S. Ashworth (No. 87, Class XVIII., p. 558), Florence Collins (No. 86, Class XVIII., p. 558), J. S. Cuthbert (No. 10, Class XXX., p. 821), A. Town (No. 10, Class XXX., p. 821), J. Kyd (No. 10. Class XXX., p. 821), and J. Rawlings (No. 10, Class XXX., p. 821), should be mentioned with much approbation. The Jury of Class XXX., after due inquiry and mature deliberation, approved unanimously of these suggestions, and adopted the whole of these recommendations. The names of the three pupils to whom an Honourable Mention has been awarded will be severally found in their proper place.

To M. E. Laroche, of Paris, for his Manufacture of Designs. (France, No. 291, p. 1190.)

To Luke Limner (Mr. Leighton), for a variety of Designs. (Class XVII., No. 24, p. 538.)

To Mr. Digby Wyatt, of London, for good taste generally in his Designs. (Fine Arts Court, No. 30, p. 822.)

The Jury were, moreover, of opinion that the following artists were deserving of Honourable Mention:—

Mr. W. Aldridge, a pupil of the Government Head School of Design, for his Designs. (Fine Arts Court, No. 10, p. 821.)

M. C. Braun, of Paris, for his Designs for Calico Prints. (France, No. 72, p. 1175.)

Mr. John Carter, of Crayford in Kent, for his Designs unapplied. (P. 821.)

M. F. Didier, of Paris, for his Designs for Shawls. (France, No. 820, p. 1219.)

M. N. A. Galimard, of Paris, for his Designs for Painted Glass. (France, No. 228, p. 1187.)

M. Gruenthal, of Berlin, for his Patterns for Berlin Wool. (Prussia, No. 166, p. 1057.)

Mr. J. K. Harvey, of London, for his Designs for Carpets. (Class XIX., No. 197, p. 567.)

Mr. B. Heald (Class XIX., No. 269), of the Government School of Design at Nottingham, for his Lace Designs. (Prize Medal, Class XIX., p. 570.)

Mr. Edwin Ireland, a pupil of the Government Head School of Design, for his Designs. (Fine Arts Court, No. 10, p. 821.)

Mr. J. H. Méreaux, of Paris, for his Designs for Lace Manufacturers. (France, No. 631. Prize Medal, Class XIX., p. 1208.)

M. Meynier, of Paris, for his Designs for Shawls. (France, No. 638, p. 1208.)

MM. Naze and Co., of Paris, for their Designs for Cotton Prints. (France, No. 625, p. 1207.)

M. E. Picard, of Rouen, for his Designs for Woollen, Cotton, and other Printing. (France, No. 347, p. 1194.)

Mr. C. P. Slocombe, a pupil of the Government Head School of Design, for his Designs. (Fine Arts Court, No. 10, p. 821.)

Mr. G. Truefitt, of London, for his Design of a wrought-iron canopied Tomb. (Fine Arts Court, No. 75, p. 824.)

The Jury of Class XXX., having brought their labours to a conclusion, cannot refrain from expressing their hope that steps may be taken for rendering the Great Exhibition as useful after it has ceased to be, as it has proved gratifying and instructive in the course of its short existence. It is the wish to see these hopes realized, that impels the Jury, even at the risk of overstepping the strict limits of their functions, to submit, with great deference, their views on this point to the Royal Commissioners.

The foundation of a permanent industrial Museum in the heart of the metropolis of trade and industry, seems to the Jury the logical and practical consequence of this Exhibition. It is in the "Crystal Palace" that the great truth has been impressed upon us, that art and taste are henceforth to be considered as elements of industry and trade, of scarcely less importance than the most powerful machinery. It seems also natural that this Museum should in the first instance consist of the objects to which the several Juries have called public attention as happy types and models for imitation. While such a Museum, on the one hand, would be a lasting depository of industry and of the arts; it would, on the other, serve as the best and easiest standard of comparison by which human ingenuity might mark its progress, on the opening, ten years hence, of a new Great Exhibition;—it would serve alike as a guide and as a beacon.

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* Since the Award Book was closed, it has been ascertained that the two entries, Nos. 257 and 258, refer to the same person.

Thus the Great Exhibition of 1851, which already stands out so prominently in the past, would bear fruitful and lasting consequences for the future, and would acquire an additional claim to a grateful record in the annals of mankind.

The Greeks, our masters in the nobler arts, did not trust to the historian and the poet alone for the record of their achievements, but committed to the greatest artists the task of immortalizing their military triumphs. The Great Exhibition deserves to be celebrated as the triumph of industry and invention over commercial routine and international jealousies. Whether the "Crystal Palace" shall be removed or not, posterity will look for some mark of gratitude to the illustrious Prince to whom the present generation owe the realization of a gigantic thought; a thought which may have floated in the minds of others, but which received consistency and was brought to maturity by his energy and perseverance.

The Jury of Class XXX., therefore, hope that on the site of the Exhibition Building a statue will be erected to Prince Albert. On its base should be recorded the share which statesmen and others have borne in bringing such an undertaking to completion. The Fine Arts would thus be called upon to perpetuate the memory of the Great Exhibition, to the attractions of which they have so variously and so powerfully contributed.

A. PANIZZI, REPORTER.

London, September 1851.

CLASS XXX.

SUPPLEMENTARY REPORT.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.]

THE Exhibition of the Works of all Nations in the Crystal Palace had for its primary and essential object the display of whatever could be characterized as a production of Industry. It comprehended every kind of unwrought material, no less than the most ingenious results of machinery, or the most exquisite examples of handicraft. But this complete and absolute recognition of industry as the purpose of the Exhibition did not, in the view of the Royal Commissioners, preclude from admission the productions of the Fine Arts; Painting alone being excepted, because, being but little affected by material conditions, it seemed to rank as an independent art. It was not without reason that such a course was adopted, when we consider how greatly, on the one hand, Architecture and Sculpture depend in the execution of their details on mechanical dexterity, and, on the other, how intimately the Fine Arts are connected with many branches of manufacture. So closely, indeed, do their provinces border on those of certain other arts, that it is often difficult to decide in what rank or class objects should be distributed, in the production of which industry and taste have been jointly employed.

This is most strikingly apparent in the case of jewellery and other works in the precious metals, works in bronze, iron, zinc, porcelain, glass, terra-cotta, and also in every description of furniture; but it is not less true of carpets, tapestries, and embroidered and coloured stuffs, in all which the taste and beauty of the design depend upon the manner in which the material has been treated and its special conditions observed.

In the great markets of the world the preference will invariably be at once given to those productions which combine, with other indispensable requisites, the recommendation of good taste in their design and treatment.

Among the many good results which we may venture to anticipate from this Exhibition, it may not be too much to hope for a fuller revival of that happy alliance between the Fine Arts and Industry which subsisted in the middle ages, when the artist was more of a craftsman—the craftsman more of an artist—than is the case at present.

Indeed, even in our own day, such a system of co-operation has been established with regard to one object, the technical application of materials; and of the signal results thus obtained many striking examples may be cited from the Exhibition.

Among these may be mentioned the wonderful specimens of casting in bronze, iron, and zinc; an art which, as regards the two latter metals, has only been brought to perfection in a recent period.

To the present age are also due two most valuable and original inventions, by which works of sculpture may be reproduced, in the one case by means of Galvanoplastic deposit, in the other by the mechanical processes of M. Collas, in France, and of Mr. Cheverton, in England. The cheapness with which the noblest works of art can be multiplied by means of these inventions cannot but tend to the more general development of a feeling for the beautiful. Such then are some of the results of the connexion between Industry and the Fine Arts.

But it was not only on account of their intimate association with the interests of Industry that the Fine Arts had a claim to be admitted into the Exhibition; their presence there, as was anticipated by the enlightened views of the Royal Commissioners, conduced essentially to the impressiveness of the general spectacle. It was the variety and beauty of the works of art that lent to the scene its peculiar grace and charm.

In this Report the objects contributed by the several nations will be considered in succession, commencing with Great Britain.

In the survey of each nation, its productions will be noticed in the following order:—

A. SCULPTURE AND WORKS OF PLASTIC ART—
1. Sculpture on a large scale, and in various materials, whether marble, metal, or wood.
2. Sculpture and its varieties on a small scale, in metal, "biscuit," ivory, wood, precious stones, shells.

B. GRAPHIC REPRESENTATIONS ON PLANE SURFACES—
1. New processes of painting.
2. Enamels on porcelain or metal.
3. Painting on glass.
4. Mosaics.
5. Designs for woven and printed stuffs.
6. Various processes of printing, such as lithography, lithochromy, zincography.

C. ARCHITECTURAL DESIGNS—
1. The Exhibition Building.
2. Architectural and other models.

THE UNITED KINGDOM.

From the first introduction of the Fine Arts in this country to the present day they have received little or no notice from the Government as such: their encouragement, like that of many other important objects, has been left to the public. The foundation of the Royal Academy itself is of comparatively recent date, and the institution is self-supported. The collection of sculpture and antiquities in the British Museum, and that of painting at the National Gallery, have been formed only within the last half century, and many of their most valuable treasures are donations or bequests of private individuals. Before the building of the New Houses of Parliament the distinguished artists of this country had rarely been employed by the Government on works of a Monumental character, and such commissions were, from their nature, not the objects of private munificence. This is one principal cause why, in the English school of painting and sculpture, no true Monumental style has been as yet formed.

Again, it was only in the year 1836 that the Schools of Design were formed; institutions by means of which the Fine Arts have exercised a most beneficial influence on the vast productive energy of Great Britain. Much improvement in every branch of industry has been accomplished by means of these schools, but it must be acknowledged that in many kinds of manufacture the English productions, both in regard to their form and colour, show far less taste than those of other nations.

Both the Government and the nation, however, are now becoming conscious of the great importance of Art, not only in its Monumental character, but in its relation to Industry.

The vast range of comparison which the Exhibition has afforded, by the juxta-position of the products of so many nations, has directed the English mind to more enlightened views; and, from the energy of the national character and institutions, these newly-awakened ideas may ultimately prove of the greatest benefit in regard both to the Fine Arts and the Manufactures of the country.

A. SCULPTURE AND WORKS OF PLASTIC ART.

1. *Sculpture on a large Scale.*

No other nation has exhibited so many works of this class as Great Britain. This may be partly accounted for by the fact that the English sculptors have not been embarrassed, like those of other countries, by the cost of transporting their works from a distance; but the far greater wealth of the English, as compared with other nations, is another cause of this numerical superiority.

With regard to the quality of their sculpture, it must be confessed that the productions of the modern English school, till within a comparatively recent date, have not been such as to command the approbation of the most competent judges.

In the earlier periods of English art the name of Flaxman stands alone; and, fertile as this great genius was in invention, the execution of his works hardly equals the beauty of their conception.

His influence seems to have been scarcely felt for a considerable period: the strong tendency to Realism * in the English school of sculpture found its natural expression in portraiture. Chantrey, long pre-eminent among his contemporaries, produced a great number of admirable busts; but in all the works of this period which have a higher pretension, and claim to rank as Ideal sculpture, there is a striking deficiency, not only in scientific knowledge, but in taste and in genuine Plastic style.†

To this general criticism E. H. Baily (p. 847), in his best works, forms a distinguished exception. Among these, however, we can hardly reckon the three statues in the Exhibition, of a Hunter, a Young Girl, and Eve; of the latter a cast in zinc only was exhibited. But the merit of these works was not overlooked by the Jury, who have awarded them a Prize Medal. (P. 8, 6 and 7.)

Since the period referred to a new race of sculptors has arisen in England, who possess in a remarkable degree the qualities in which their predecessors were deficient. Among the chief causes which have combined to produce this school may be reckoned the influence of the genius of Flaxman, the study of the noblest examples of Greek art preserved to us in the Elgin marbles, and the example of the great Thorwaldsen, with whom many of the English sculptors at Rome had constant intercourse.

Among the most distinguished of contemporary sculptors we may specially mention the name of Gibson. In his Hunter and Dog a lively and imaginative conception is combined with an exquisite feeling for harmony of lines, and with thorough knowledge. The treatment is strictly Plastic; the details carefully and conscientiously wrought out. The unanimous award of the Jury would have bestowed the Council Medal on this work had not the artist been disqualified from receiving a prize by filling the office of a Juror in this Class.

Next should be mentioned the name of Mr. **RICHARD J. WYATT** (Main Avenue, East, 120, p. 1286, and Illustration), whose death, in the full maturity of his powers, we have to deplore.

His statue of Glycera represents a girlish figure, slight and full of simple grace; the characteristics of feminine beauty are indicated in the modelling with great delicacy; the drapery is treated with good taste, and with a due regard for style. One feeling pervades the whole design, and imparts to it a peculiar charm. This work, therefore, united all those qualities which entitled it to receive a Council Medal (103, p. 11, second improved edition).

The following sculptors are well worthy to rank next to the distinguished names already noticed:—

J. H. FOLEY, of London (p. 848, and Illustration), A Youth at a Stream: of this a cast in plaster, and another in bronze, were exhibited. The figure is about to plunge into a river; he still clings to the branch of a tree rising over his head, whilst he advances one foot somewhat timidly. The motive is remarkable for originality and grace, and the conception is well sustained by the whole treatment; in the slender proportions and finely modelled well-turned limbs the artist has admirably expressed the attributes of youthful beauty. Another of his works represents a group of Ino and the infant Bacchus, in plaster (Class XXV., 2, p. 711). Ino, reclining at her ease, holds up to the infant god a bunch of grapes, towards which he eagerly stretches his hands. There is a sprightly grace in the attitude of Ino, and much refinement of form; but on the whole this group is not so simple in conception as the Youth at the Stream: the Prize Medal has therefore been awarded to the two works conjointly. In his statue of Hampden, in plaster (p. 848, and see Illustration), executed for the new Houses of Parliament, the same artist has shown that he can unite the peculiarities of individual life, and the details of costume necessary in an historical portrait, with a true Plastic style.

J. BELL, of London (Class XXII. 641, p. 661). The Eagle-slayer, cast in bronze, and also in iron. This figure represents a powerful man in very strong action, at the moment after shooting an arrow into the air. The violence of the exertion has brought the muscles into full play. The artist has admirably succeeded in expressing the momentary and transient character of the action, and the form is modelled with a knowledge and truth of detail which are seldom found in the English school. His work has, therefore, obtained the Prize Medal.

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* A work is called Realistic when the artist restricts himself to the task of rendering an individual model in all its parts, form, character, and the like, just as they appear before him. On the other hand a work of art is called Ideal when the artist modifies the figure in these same respects, according to his own feeling for its inner significance and outward beauty of form—attributes which necessarily vary in each case.

† When we say of a work of sculpture that it possesses "style," the following qualities ought to be implied. The sculptor must have so treated the solid material, such as stone, metal, wood, with which he has to deal, as not to remind the spectator of the nature of the substance employed, but so as rather to suggest to the eye the character of the object imitated, flesh, drapery, or whatever it may be.

Further, as we learn from the antique sculpture, in the treatment of naked surfaces, the muscles should not be represented by prominences so isolated and abrupt as to impair the general breadth, but should be rather indicated by moderate depressions in broad surfaces.

In drapery, again, to attain the same general breadth of effect in the larger surfaces, which are supposed to be defined by the forms and action of the body, the details of the folds should be represented not by big, heavy projections, but by numerous contiguous channellings or markings.

The sculptor must, moreover, take care not to attempt, in every part of his work, as perfect an imitation as the nature of the solid material he employs would admit, but he should adopt a treatment more and more conventional in proportion as the object he has to represent is less and less important, flesh being the most important; for otherwise the degree of illusion sought for in the imitation of flesh cannot be attained, because the imitation of many subordinate objects can be carried much further in the solid material with which the artist has to work. In sculpture "in the round," it is also necessary that the centre of gravity be so observed as to suggest to the spectator the idea of solidity and security. In reliefs, lastly, this rule is to be followed,—that, whether the work be in high, middle, or low relief, no single portion should project beyond the extreme limit of general relief in each case intended, but that the whole profile of the relief should be restricted within a given scale; that, again, there should not be more than two distances in the composition, so that two figures at the most can stand one behind the other; to attempt greater depth is to invade the province of picturesque composition, and by destroying the idea of relief from an actual plane, to cause indistinctness of outline.

In the statue of Falkland (in plaster, p. 847), executed for the new Houses of Parliament, the same sculptor has displayed a mastery rarely attained in portraiture; the conception is very spirited, the treatment throughout strictly Plastic; the figure is remarkable for its noble presence, and its attitude of calm and dignified repose.

The following artists also exhibit, in their styles, the application of just principles of art:—

P. MacDowell, of London. The most remarkable work of this sculptor is his Eve (in plaster, p. 850). This figure is modelled with great knowledge, the attitude is graceful, and the expression of longing curiosity well rendered. We may also mention his Girl at Prayer (in marble, ibid.), a figure treated with simplicity and depth of feeling, and very carefully executed. His marble figure of Cupid (ibid.) has also considerable merit. Prize Medal.

W. Calder Marshall (5, p. 844, Sculpture Court). The Sabrina of this artist is remarkable for the feminine grace of the motive, the head has a fine character of individuality, and there is great beauty in the form and in the general expression: in marble. Prize Medal.

T. Sharp, of London (20, p. 844). A Boy stretched on the ground, looking round in alarm, as if startled at a lizard. This is a remarkable work—quite unlike, in choice and treatment of subject, any which has been as yet noticed in this Report. The artist has not hesitated to express that dryness and meagreness of form which characterizes the particular stage of boyhood here selected for representation; but these details are rendered with the utmost accuracy, and with an admirable feeling for nature. The eye of the ordinary observer, habitually accustomed to the specious effect of mere smoothness of surface, may, in some degree, be repelled by this truthfulness of representation; but, like all other truth, it will not the less be ultimately appreciated, and we may regard this figure as in itself a proof how great an effort the English school of sculpture is making in the right direction. Prize Medal.

J. Hogan, of Ireland (14, p. 843). A drunken Satyr, gorged with new wine, which has distended all his veins and muscles, makes a last effort to save himself from falling. This work contains evidence of careful study, but the attitude has something violent and ungraceful: in plaster. Prize Medal.

B. Jennings, of London (81, p. 846). In his marble figure of Cupid this artist has been very happy in the representation of youthful form.

The same may be said of the Arethusa of E. Thrupp, of London (58, p. 845), a recumbent figure leaning on one elbow, though there is rather a want of life and individuality in the features. A Boy catching a Butterfly (56, p. 845), by the same artist, is a carefully executed and attractive work: in marble.

A Nymph bathing, by J. Lawlor, of London (22, p. 844), also deserves notice here: in marble. All the three last-mentioned works have obtained Prize Medals.

The portrait statue of Flaxman, by the late M. L. Watson, of London (60, p. 845), shows how greatly this artist excelled in Iconic sculpture. The figure, which is executed out of a very beautiful block of marble, is seated; the general attitude is remarkably true to nature, the head full of intelligence, and the whole design is worked out with great spirit, and with conscientious labour. The colossal seated figures of Lord Eldon and Lord Stowell (p. 848), by the same artist, are also remarkable specimens of the same class of sculpture, though not equal in merit to the statue of Flaxman. The hands appear too large: in marble. Prize Medal.

L. Macdonald, of Rome (Rome, 18, p. 1286). The Iconic figure by this sculptor, executed in the manner and costume of classical antiquity, shows that the artist has a just perception of style and sound knowledge: in marble. Prize Medal.

In conclusion may be noticed the following artists, as deserving the Honourable Mention bestowed on them by the Jury:—

W. Behnes, of London, for his Nymph startled by a Lizard: in marble (54, p. 945).

W. Theed, of London, for his marble group of the Prodigal Son (59, p. 845) embraced by his Father, and for his Narcissus (79, p. 846), also in marble.

H. Weekes, of London, for his Sleeping Child with a Dog: in marble (p. 853).

E. B. Stephens, of London (p. 853), for his Deer Stalker and Dog.

F. M. Miller, of London, for Two Orphan Children at Prayer: marble (p. 850).

Mr. and Mrs. T. Thornycroft, of London, for the Royal Children, in the characters of the Four Seasons: in plaster (34, p. 844).

G. Myers, of London, for the Tomb of Bishop Walsh, in stone; a monument in which the ecclesiastical style of the middle ages is well sustained, not only in the principal figure, but also in the accessories. Prize Medal. (Class XXVI. p. 761.)

To this list the name of Hancock (p. 849) deserves, in my opinion, to be added, for his statue in plaster of the Beatrice of Dante, in her beatified state. The figure is distinguished by a pure and noble expression of the head, although many defects may be remarked in the drapery.

In concluding this notice of English sculpture, it is right to mention that several highly distinguished artists have not contributed any works to the Exhibition.

2. *Sculpture on a small Scale.*

To this branch of English art the remarks already made on sculpture on a large scale are generally applicable. Even at the present day many of the most distinguished artists who have executed and exhibited works of this class are foreigners.

1. *Works in Metal.*

(*a*.) Embossed (Repoussé) Work.

A. Vechte, of France (p. 686-87), at present settled in England. The works of this artist in strictness belong to Class XXIII. (Jewellery and Goldsmiths' Work), but they are so essentially and exclusively productions of Fine Art, that it is impossible to pass them over without mention in this Report. They consist of a shield as yet unfinished, and a vase representing the contest between Jupiter and the Giants, executed in silver for the great establishment of Messrs. Hunt and Roskell at Birmingham. These works show that no living artist has so fully entered into the spirit of the Italian style of the sixteenth century, commonly called the *Cinque Cento*, as Vechte. He has also exhibited a shield, which, having been executed in France, is therefore in the French Department. In its design the artist has harmonized with great skill two celebrated compositions of the Murder of the Innocents, that by Raphael—preserved to us in the engraving by Marc Antonio, and in the tapestry of the Vatican—and that known to us in the picture by Nicolas Poussin. Honourable Mention. (Class XXIII. 97.)

J. V. Morel and Co., of Paris, now settled in London (p. 693). This firm exhibit a set of cups, made of different kinds of precious stones, decorated with small figures, animals, masks, and other ornaments, exquisitely wrought in gold and silver, and in enamel, the whole executed in the feeling of Benvenuto Cellini, and with the same refined taste. In the expression of the heads only there appears a somewhat too modern sentiment. The talent displayed in these works is so remarkable, that though they belong strictly to Class XXIII., where they have been rewarded with a Council Medal, they cannot be passed in silence here. (Class XXIII. No. 117.)

(*b*.) Medals and Coins.

W. Wyon, of London, Chief Engraver of the Mint[*] (p. 838). This artist is certainly one of the most distinguished of his class in the present day. He is endowed with a just perception of nature, and a refined sense of beauty in form and movement. His works are executed in mezzo-relievo, in that style which alone is admissible in Numismatic Art, and which he has brought to great perfection. Both the Medals, and the enlarged models of Medals, which he has exhibited, fully bear out these remarks. But I would particularly call attention to his models of the heads of Her Majesty and His Royal Highness the Prince Albert, for the obverse of the Prize Medal of the Exhibition. His office of Juror alone disqualified him from receiving a prize. (Class XXX. No. 284.)

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[*] This notice was written a few days before the death of the distinguished artist to whom it relates.

L. C. WYON, of London (p. 838). This young artist is a worthy inheritor of his father's talent. His portraits of the children of Her Majesty and that of His Royal Highness Prince Albert, as well as his model for the reverse of the Prize Medal, are executed in a very good style, and the whole is wrought out with the earnestness of a labour of love, as well as with great simplicity and feeling for nature. Prize Medal. (Class XXX. 286.)

2. *Works in Ivory.*

R. C. LUCAS, of the Firs, Winchester (306, ibid. p. 840). This artist has executed with great fidelity copies of several of the most celebrated antique works in the British Museum, such as the bronzes of Siris, the supposed head of Proserpine on the medallions of Syracuse, and the admirable carving in hone-stone by Albert Durer, representing the Birth of Saint John the Baptist, also in the British Museum. Honourable Mention.

3. *Works in "Biscuit."*

MINTON and Co. (Class XXV. 1, p. 709-11). The productions of this great porcelain manufactory properly belong to Class XXV., and have there been rewarded with a Council Medal; but so many of them deserve to rank as examples of Fine Art, that I think it right to mention them here. I would particularly notice the copies of the celebrated silver cups in the Museo Borbonico at Naples, with groups of centaurs in relief, the copy of the Farnese Flora, and also two friezes. The establishment deserves the greatest praise for these productions, by means of which the finest models of Art are circulated, and a correct taste more widely diffused.

The same laudable endeavour to spread the knowledge of Art is apparent in the manufactures of COPELAND (p. 711-14), CHARLES MEIGH and SON (p. 720-22), and JOSIAH WEDGWOOD and SONS (p. 717-19). The manufactory of BELL and Co., at Glasgow (p. 724-25), deserves especial notice, on account of the judgment generally displayed in their choice of forms from the antique. The more sparing use of gold as an ornament distinguishes these works from those of most other English manufactories.

4. *Carvings in Wood.*

Wood carving was from a very early period much esteemed by the English, and has been diligently cultivated among them. An extraordinary number of specimens, not only in the Gothic and Renaissance styles, but in the "Rococo taste" of the last century, have been contributed to the Exhibition, and many of them are of the greatest merit. Though the greatest part of these specimens are articles of furniture, and therefore belong to Class XXVI., yet among them are two of such high artistic merit, that I cannot omit a passing notice of them here. These are—(1.) A large sideboard, exhibited by COOKE and SONS, of Warwick (p. 827). (2.) A bookcase in the style of the Renaissance, by HOLLAND and SONS, of London (161, p. 745, and see Illustration).

Among the wood carvings which may be considered purely as works of Fine Art, are—(1.) Those of T. W. WALLIS, of Louth, in Lincolnshire (89, p. 925, and see Illustration). This artist has represented various kinds of dead game with a true feeling for nature, and with an extraordinary mastery in every kind of detail. He is also entitled to the greatest praise for his carving of a mass of vine-leaves, which is executed with the most minute and scrupulous imitation of nature, without losing the characteristics of a true Plastic style. Prize Medal. (Class XXX. 89, p. 825.)

W. G. ROGERS, of London (353, p. 842). A cradle executed in box-wood for Her Majesty the Queen Victoria, and richly ornamented with carved reliefs; also, a group of musical instruments, among which may be especially noticed a violin. These works show an extraordinary dexterity in the treatment of the material, and the ornaments of the cradle are in excellent taste. Prize Medal.

In concluding this notice of works of sculpture of the United Kingdom, I must mention the machine invented by Mr. B. CHEVERTON, of London (194, p. 832), for the reproduction, either on the same or on a smaller scale, of works of sculpture. The figure commonly known as the Theseus, in the Elgin collection of the British Museum, has been reduced by this process in alabaster, for the purpose of casting in plaster, with an accuracy which leaves the most fastidious critic nothing to desire.

The benefit which all lovers of Art, and more particularly artists themselves, will derive from this discovery, are so obvious, that I need not further insist on them here. Prize Medal.

B. GRAPHIC REPRESENTATIONS ON PLANE SURFACES.

1. *New processes of Painting.*

B. E. DUPPA, of London (Class XXVII. 51, p. 767), the inventor of a new mode of monochrome painting on tiles. The painting has all the appearance of a chalk drawing, and is so united with the tile by the action of fire, as to bear any amount of exposure to the weather. Among the specimens exhibited of this process is a head which appears exactly like a drawing in red chalk. Honourable Mention.

2. *Enamels on Porcelain or Metal.*

W. ESSEX, of London (241, p. 835-36), exhibits a number of copies of celebrated pictures, such as the so-called "Gevartius" of Vandyke; Joseph and Mary with our Saviour, by Murillo—both in the National Gallery; and a Young Girl, after Sir Joshua Reynolds. In all these copies the drawing, colouring, and general character of the originals are rendered with the utmost fidelity. Other specimens, however, such as the Portrait of Shakespere, and that of Her Majesty Queen Victoria, are somewhat hard, patchy, and deficient in modelling. These enamels are on metal. Prize Medal.

S. CHESTERS, of London (246, p. 836). The picture by Murillo in the National Gallery, mentioned in the preceding notice, has been admirably copied by this artist on porcelain. Every trait in the original is rendered with the utmost delicacy; this work reflects the highest credit on its author. Honourable Mention.

Lastly, the following artists may be noticed as fully deserving the Honourable Mention they have obtained: ECKELMANN and WÜSTIAH (Class XXIII., 140, p. 695), for the portraits of the Queen, the Prince of Wales, and of H.R.H. Prince Albert, on a jewel-case belonging to Her Majesty Queen Victoria; HASLEM (Class XXX., 257, p. 835), for his St. John, after Murillo, and also for his Ecce Homo, after Corregio, both which pictures are in the National Gallery; BELL (249, ibid., p. 836), W. C. BONE (233, p. 835), and lastly, BRADLEY, of Stoke-upon-Trent (Class XXV., 2, p. 711), for a duck enamelled on china, and exhibited by Copeland.

3. *Painting on Glass.*

In this branch of painting there are two very distinct styles. The one has been principally employed for the decoration of church windows, and being thus intimately associated with architecture, must rigidly conform to its laws. Thus, in this style the general character of the ornament should be Architectonic, the patterns should be very distinct, combining beauty of form with harmony of colouring; there should be great repose in the attitudes of the figures, and the draperies should be in simple masses. The other style of glass-painting attempts to give all the effect of an actual picture, strictly so called, and to heighten this effect by the gorgeousness and transparency of the colours. The former of these kinds of glass-painting is to be regarded as of higher importance, and has more claims to rank as an original art than the latter, which, however, is capable of being made very attractive. But it is of the greatest importance not to mix the two styles. This has been done in many windows executed in the 15th and 16th centuries, in which the artist, abandoning the Architectonic laws, which ought to be his guide, has attempted those higher artistic effects, which are only to be achieved in other materials, such as oil or fresco, and has consequently fallen very far short of his aim.

Very good works in both kinds of glass-painting were to be seen in the Exhibition, but these must by no means be taken as the best specimens which the art of our age is capable of producing. It is much to be regretted that the Exhibition did not contain any examples either of the ecclesiastical glass-paintings of the Royal Manufactory at Munich, or of the imitation of pictures by Messrs. Boisserée, of Bonn; in both of which establishments works have been executed which have hardly been surpassed in the present age. It is right to add, that the latter manufactory has judiciously availed itself of artists trained in the establishment at Munich.

It is of the greatest importance in the imitation of ancient glass, which is now so generally attempted, that the characteristics of different periods should be faithfully rendered. The number of churches now built in the Gothic style makes this discrimination of styles all the more necessary. But the study of ancient examples may lead to the perversion of taste, if the artist persist in adhering to the conventional forms of the mediæval styles, and choose to ignore the superior knowledge of drawing of his own day. If, however, the laws above stated be observed, they will be found perfectly compatible with natural forms.

(a.) Ecclesiastical Style.*

J. HARDMAN and Co., of Birmingham (Class XXVI., 532, p. 761). In the window-glass exhibited by this establishment in the Mediæval Court, the true principles of the style have been faithfully observed; and the execution of the work is very careful. It may be noticed, however, as a defect in these windows, that the glass of the backgrounds between the figures is too transparent; they are consequently inferior in repose and harmony of colouring to the mediæval windows of the best time. Prize Medal.

CHANCE BROTHERS and Co., of Birmingham (Class XXIV., 60, p. 706). Two Gothic windows also executed according to correct principles. Honourable Mention.

The three following artists also deserve the Honourable Mention which they have received: HOLLAND and SON, of Warwick, for their "Life of Christ" (ibid., 63, p. 706). I. G. HOWE, of London (ibid., 67, p. 707), for his imitation of an ancient painted window. W. WAILES (ibid., 73, p. 707), for the decorative part in his design. The figures are not equal in merit to the rest of the work.

(b) Pictorial Style.

M. and A. O'CONNOR, of London (ibid., 67, p. 707). In his Raising of Lazarus, this artist has been very successful in giving the characteristics of an oil painting; everything is in perfect keeping, and is drawn with great truth and care. In the richness of the colouring, he has turned his material to very good account. Honourable Mention.

4. *Works in Niello.*

In this kind of art, which received the name of "Niello" work in the middle ages, figures or ornaments are first engraved on a silver plate, and the incised lines are then filled up with a paste compounded of silver, copper, lead, sulphur, and borax. The dark colours so inlaid contrasting with the bright surface of the silver, produce an effect not unlike that of a print from a copper plate.

This art, which had been for a long time neglected, was revived in the present day with great success by Wagner, a silversmith from Berlin, established at Paris. In the exhibition was a gauntlet, on which a design by Maclise was engraved in niello, by S. H. and D. Gass, of London (Class XXIII., 63, p. 683). The work is very skilfully executed. Honourable Mention.

5. *Designs for Printed and Woven Fabrics, for Embroidery, and for Book-covers.*

The primary law of all such designs is, that they must not disturb the flatness of the surface on which they are drawn, but only diversify it with lines agreeable to the eye, and with harmonious masses of colour. Hence no foreshortenings should be attempted in such designs, and all perspective views are to be absolutely rejected, as at variance with the principles of a true style of ornament. It is obvious that the character of the pattern will be essentially affected by the quality of the materials and the purpose for which it is intended. Thus, for instance, shawls, though of a yielding texture, rather follow the movements of the body in a general sense; hence the patterns of shawls should be of considerable size, with soft, flowing outlines. Cottons, on the contrary, and other similar clothing fabrics, which cling more to the body, require smaller and more symmetrical patterns.

M. DIGBY WYATT, of London (Class XXX., 30, p. 822), exhibits a considerable number of designs for various purposes. They are in very good taste, and in perfect accordance with the principles here laid down. Prize Medal.

JOHN LEIGHTON, jun., of London (Class XVII., 24, p. 538). The designs for book-covers exhibited under this name have very remarkable merit, from the variety of forms in the patterns, and the happy choice of the colours. Prize Medal.

C. J. RICHARDSON (Class XXVI., p. 208, p. 751). Out of the multitude of designs exhibited by this artist, some show a good taste. Prize Medal.

The following names have also been Honourably Mentioned: JOHN CARTER, of Crayford in Kent (10, p. 821); J. K. HARVEY (Class XIX., 197, p. 567), for the design of a carpet with a rich pattern; and BENJ. HEALD, for his design for lace (269, p. 570). Prize Medal.

THE GOVERNMENT HEAD SCHOOL OF DESIGN IN LONDON (10, p. 821). The designs for textile fabrics contributed by the pupils, both male and female, of this establishment, were executed in such good taste, and with such correct knowledge of principles, that a Prize Medal was awarded to the Institution, and the names of several of the pupils were mentioned with approbation. These names will be found in the Report of Mr. Panizzi.

This seems to be the most fitting place to notice the patterns of the Oriental stuffs which India, Turkey, and Tunis contributed to the Exhibition in such rich variety.

In the fabrics of India the correct principle already laid down, namely, that patterns and colours should diversify plain surfaces without destroying or disturbing the impression of flatness, is as carefully observed as it was in the middle ages, when the decoration of walls, pavements, and carpets was brought to such perfection by the Arabs. But it is not only the observance of this principle which distinguishes the Indian stuffs in the Exhibition; they are remarkable for the rich invention shown in the patterns, in which the beauty, distinctness, and variety of the forms, and the harmonious blending of severe colours, called forth the admiration of all true judges of art.

What a lesson such designs afford to manufacturers, even in those nations of Europe which have made the greatest progress in industry!

In these remarks I have specially referred to the productions of India. Some of the fabrics exhibited by Turkey and Tunis display analogous qualities, but in the greater part of these we trace in the patterns an European influence, which has overlaid or partly superseded the true characteristics of the national style of ornament.

6. *Architectural Designs.*

G. TRUEFITT, of London (75, p. 834). A design for a Gothic tomb and canopy, to be executed in iron; the proportions in this design are very good, the style very correct, and the treatment suitable to the material. Honourable Mention.

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* This style of glass-painting might be termed Architectonic, as it is applicable not only to churches, but to many other edifices, civil as well as religious.

7. *Various processes of Printing, such as Lithography, Lithochromy, Zincography.*

The art of printing in colours has been brought to such perfection by the employment of several successive plates for the same impression, as in many cases to produce an effect quite equal to that of a painting.

(*a.*) Lithochromy.

Day and Son, of London. The specimens exhibited by this establishment are admirable for keeping, force, and finish. Prize Medal. (80, p. 825.)

M. and N. Hanhart, of London. In the plates executed by these artists there is a clearness, force, and harmony of colouring, combined in a degree which is very rarely attained. Prize Medal. (64, p. 823.)

Hullmandel and Walton, of London. In the works of these artists we find similar excellences in a very high degree. The specimens are executed partly with the stump, partly with lithographic chalk and the stump combined, and finally by printing in colours. Prize Medal. (71, p. 824.)

Owen Jones, of London. In the establishment of this artist flower and fruit-pieces are executed with great force and truth, and in his patterns he shows excellent taste. In his imitations of miniatures he has been less happy, though these works display considerable merit. Prize Medal. (54, p. 823.)

T. Underwood, of Birmingham. In the novel attempt to represent water-colour drawing by printing in colours, this artist has been most fortunate: the specimens exhibited by him are well worthy of Honourable Mention. (77, p. 825.)

(*b.*) Printing in Oil-colours.

G. Baxter, of London. The view of the exterior of the Exhibition Building, and a female portrait by this artist, show very great skill in a process which so seldom yields a successful result. Honourable Mention. (115, p. 828.)

(*c.*) Zincography.

R. Appel (274, p. 838). This artist is the inventor of a process, by which he transfers to a zinc plate ancient or modern engravings, and woodcut impressions, as well as drawings executed either with the pen or the pencil. A peculiar kind of ink is employed for the transfer; and not only is a perfect facsimile of the original thus obtained, but copies, to any extent, of this facsimile are again produced, at an exceedingly moderate price, and all of equal excellence. A woodcut by Albert Durer, taken from his "Life of the Virgin," the zinc matrix to which this was transferred, and the impression from this plate, which were all exhibited, afford sufficient evidence of the value of the invention. Many years ago Messrs. Dupont and Co. (France, 181, p. 1182), of Paris, obtained similar results by their process of transferring designs to stone: for this they have received a Prize Medal in Class XVII. (Printing). The advantages of such mechanical means of multiplying rare and costly prints are too obvious to need remark. Every kind of drawing can be executed in Mr. Appel's prepared ink; his invention has therefore this great advantage, that it enables artists at once to fix and reproduce their sketches, instead of having recourse to lithography, woodcutting, or engraving on metal. The most rapid and evanescent expression of an artist's thought may thus be arrested, without impairing the spirit of the original sketch in the process of transfer. Prize Medal.

(*d.*) Facsimiles of Printing executed by the Hand.

J. Harris, of London. The masterly imitation of old printing, by this artist, has received Honourable Mention. (Class XXX., 244, p. 836.)

C. Architectural Designs.

1. *The Exhibition Building.*

In this most admirable edifice every kind of excellence appears to be combined, whether we consider the wonderful adaptation of the whole building to its purpose, the surprising skill shown in the employment of glass and iron, which have never before been used as building materials on so vast a scale, the happy adjustment of the proportions, the calculation of which, from the complexity and extent of the whole plan, must have been exceedingly difficult, the simplicity of the mode of construction, or lastly, the judgment shown in the choice and disposition of the colours with which the building is ornamented. The whole work reflects the greatest honour on all who had a share in it. The utmost praise is due to Mr. Paxton for the design of the Building; to Messrs. Fox, Henderson, and Co., the Contractors, for the masterly manner in which it has been executed; and to Mr. Owen Jones for the painting.* (Council Medals awarded to the two former by Class VII.: see Awards, Class VII.)

2. *Models.*

The practical utility of architectural models, and the instruction and pleasure that may be derived from them, have never been more sensibly felt than at the present day. This branch of art was therefore very properly represented in the Exhibition.

John Grantham (Secretary to the Liverpool Local Committee). A Model of the Town of Liverpool. This work is executed with great accuracy, the proportions are said to be very well preserved, and the details finished with great care. Prize Medal. (Main Avenue West, 95, p. 851.)

Jabez James, of London. A Model of the Britannia Tubular Bridge. Very valuable, as showing the construction of this celebrated work. Prize Medal. (Class VII., 106, p. 321. Prize Medal awarded also by Class VII.)

S. Salter, of London. A Model of the Church of St. Nicholas, of Hamburg, executed after the designs of Mr. Scott. Also a Model of a Church at Wilton. These two models are entitled to the greatest praise, on account of the accuracy of the proportions, and the masterly manner in which all the details are expressed. Prize Medal for first. (Class VII., Main Avenue West, 221, p. 331.)

N. J. Cottingham, of London. A Model of a spandril of an arch, Hereford Cathedral. The manner in which the character of Gothic architecture is preserved in this model shows great knowledge on the part of its designer. Honourable Mention. (Main Avenue West, 63, p. 852.)

S. Cundy, of London. A restoration of the tomb of Queen Philippa, Queen of Edward III., executed in alabaster, with very rich Gothic ornaments. Honourable Mention. (Main Avenue West, 60, p. 848. Prize Medal awarded by Class XXVII.)

T. Dunhill, of London. Model of a Metropolitan Cattle-market, with abattoirs, and other appurtenances, executed in plaster and other materials, and very skilfully planned. Honourable Mention. (Class VII., 90, p. 318.)

W. Stuart, of Plymouth. Model of the Plymouth Breakwater in limestone. Honourable Mention. (Class VII., 28, p. 311-12.)

In concluding this notice, I must also mention the Mediæval Court, fitted up by Professor A. W. Pugin (p. 761), one of the most distinguished among English architects, as a designer of Gothic buildings and ornament. In this Court he has endeavoured, with great success, to present to the spectator a general idea of the ecclesiastical art of the middle ages, by exhibiting an assemblage of altars, shrines, tapestries, painted windows, chalices, and patens, vestments, and other ecclesiastical furniture and objects. Most of these articles are executed from his own drawings. The merit of the collection has been duly acknowledged by the Jury.

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* It has been remarked by several distinguished authorities that, when iron is painted, the nature of the material should be indicated by the colours employed. This is, no doubt, true, as a general principle, yet, in this instance, a deviation from it seems allowable. The combination of white, blue, and red harmonizes most happily with the slender tent-like structure, and light, cheerful appearance of the whole building, and contributes to produce that wondrous and fairy-like effect which has so impressed the minds of all who visited the Exhibition. A darker tone would have been inadmissible, as it would have given a gloomy appearance to the whole.

THE ZOLLVEREIN.

I. PRUSSIA.

Since the year 1815 great efforts have been made in Prussia, by the successive monarchs and administrations of Prussia, to encourage the Fine Arts in that country. Museums, and other buildings of a similar character, have been erected; sculptors, and more recently painters, have been employed in the execution of monumental works, and the cultivation of all those manufactures on which art can exercise any influence, has been greatly promoted by the foundation of the "Institution for Trades" (*Gewerbe-Institut*), under the energetic and judicious management of Privy Councillor Beuth. That these efforts have led to the happiest results has been proved by the Exhibition, which has furnished to Prussia a long-desired opportunity of showing what progress has been made.

A. SCULPTURE AND WORKS OF PLASTIC ART.

1. *Sculpture on a large Scale.*

Until the commencement of the present century, the Berlin sculptors continued to imitate the false and mannered style of the contemporary French school. The first who returned to the principles of nature, and to a careful expression of details, was the sculptor Schadow.

But the Berlin school owes its present excellence to the auspicious co-operation of three great men, who devoted themselves to its improvement. These were, the late architect Schinkel, the late sculptor Frederick Tiek, and Christian Rauch, a sculptor whose active energies still remain unimpaired notwithstanding his great age. These three artists had profoundly studied the masterpieces of ancient art; the contemplation of these had imbued their minds with an intense feeling for beauty, and revealed to them the great laws of style. Inspired by these models, they did not attempt to reproduce them by a servile and spiritless imitation, but rather to apply the principles therein developed to works fitted for the wants of modern times, combining this reverence for antiquity with an earnest study of nature, and a most diligent and scientific carefulness of execution. It is to be regretted that Rauch himself contributed none of his works, if we except one or two copies from his Victories; and that many of his distinguished scholars, such as A. Fischer, Gustav Blaeser, Wredow, and Schievelbein were also absent.

But though the school of Berlin was thus only partially represented in the Exhibition, yet many of the works it contributed gave ample proof how great have been the results of the combined influences which have aided in the development of German art.

A. KISS, of Berlin (279, p. 1065). An Amazon on Horseback attacked by a Tiger. With a ferocious bound the animal has leaped upon her horse, and fastened on him with teeth and claws. The Amazon is about to transfix her assailant with her spear. This work, which is on a colossal scale, has been cast in zinc by Geiss from the original model, and bronzed by electro-deposit. In this group the artist has, by an original and powerful effort of invention, placed before our eyes the most critical moment of the action. The whole expression and character of the Amazon are very nobly conceived; the anatomy displays consummate knowledge; great style is shown in the general treatment of the surface, and the details are wrought out with wonderful force and truth. The whole work is full of soul; it seems the full earnest utterance of a true artistic nature.

The great qualities of this work called forth, at the time of its completion, the most unbounded admiration on the part both of artists and friends of art. It was executed in bronze by a public subscription, and now ornaments one side of the staircase of the Royal Museum at Berlin.

The approbation which it has received proves that, where a work of art possesses striking merits, even considerable faults cannot counteract the favourable impression which is produced. It is one of the fundamental laws of sculpture "in the round," that from many, but at all events from the principal, points of view the outlines of the figures shall be distinct, and at the same time beautiful; and this rule is signally transgressed in the work of Kiss. The forms of the tiger and the horse are blended together in one confused mass, so that the front view is very unsightly, and even in the side views we lose on one side the head of the horse, on the other that of the tiger. Council Medal.

F. DRAKE, of Berlin (273, Prussia, p. 1065). The pedestal of a statue of King Frederick William III. of Prussia, erected by the inhabitants of Berlin as a token of their gratitude for the embellishments which this monarch has bestowed on their Thiergarten (Zoological Gardens). The work exhibited is in plaster, half the size of the original pedestal. In the reliefs with which it is ornamented the sculptor selected subjects which contain allusions to the local destination of his work. Thus he has represented a number of figures, of every age and sex, enjoying themselves in the open air. We see groups of children looking into a bird's nest or feeding the swans, young maidens weaving garlands, old people leading children to the scene of the sports, or contemplating their youthful gambols with an air of calm enjoyment. There is much beautiful feeling in the treatment of this subject: the heads are full of expression, the movements of the figures very spirited, and the different groups are skilfully connected. The composition is executed in a very good style of alto-relievo, the details finished with the greatest care.

On the whole, this work is deserving of the very great and general admiration that has been bestowed upon it. It may however be noted as a defect, that the artist has not throughout preserved the relative proportions of the figures. Prize Medal.

ALBERT WOLFF, of Berlin. A statue in marble of a young maiden holding a lamb in her arms. This figure is entitled by the sculptor "Innocence," and its purity and simplicity of character fully express such an idea. The drapery is throughout treated in a plastic style, and the execution is very careful. Prize Medal. (No. 307, p. 1067.)

T. KALIDE, of Berlin. A Group. A Boy, lightly grasping a swan and looking upwards, holds up his left arm as if to guard himself. The group is designed for a fountain, the water being meant to issue from the beak of the swan.

The figure of the boy is very prettily conceived, and the action very spirited. The whole work is executed with care, and in a good style. Duplicates of this group were exhibited; one in bronze, the property of His Majesty the King of Prussia, the other cast in zinc by Geiss. Honourable Mention. (No. 285, p. 1066. Prize Medal awarded, Class XXII.)

C. MÖLLER, of Berlin. Several bronze casts of animals from models by this artist were exhibited: a Newfoundland Dog, cast by Friebel, of Berlin; a smaller Dog, of the same kind, with a Boy, and a Bulldog with a Girl, by H. Fischer. These works are distinguished by great life and truth. They are very carefully executed, and in a good style. Honourable Mention. (No. 292, p. 1066).

LUDWIG WICHMANN, a pupil of Gottfried Schadow. A Young Maiden in the act of filling her pitcher with water. Cast in bronze, and tooled, from the model of the original, in the foundry of Count Einsiedel, at Lauchammer, in Saxony. This figure is distinguished by beauty of proportions, good anatomy, and careful execution. The Jury were, however, precluded from noticing it, because it was not exhibited in the artist's name, but in that of the foundry where it was cast.

2. *Sculpture on a small Scale.*

(a.) In Metal.

The Shield of Faith. This work was a present from His Majesty the King of Prussia to His Royal Highness the Prince of Wales. Though it belongs properly to Class XXIII., and has received a Council Medal from the Jury of that class, it is so exquisitely wrought, and the design is of so high an order of art, that I feel myself compelled to offer a few remarks on it here. In the execution of this work the talents of several most distinguished artists have been most felicitously combined. The architectural portion of the design is due to the Privy Councillor and Director of Architecture, Stüler. All the groups of figures are modelled from drawings by Cornelius, whose rich and fertile genius has here expressed in truly artistic language the cardinal idea of the Christian Faith, and happily combined with this principal motive an allusion to the immediate purpose for which the shield was executed.

The designs were modelled in low relief by the sculptor, A. Fischer, in a most masterly manner, and with a true perception of the principles of Plastic Art. The reliefs were then moulded, and the casts from them finally chased and tooled with consummate skill, by the engraver, A. Mertens.

The figures of the twelve Apostles, which are from the designs of Cornelius, were beautifully cut in onyx by the distinguished gem-engraver, Calandrelli, who has long resided in Berlin; the fine enamels and ornamental work are executed by Klossauer, jeweller to the Prussian Court. The Council Medal awarded to this shield is presented to His Royal Highness the Prince of Wales, as its Exhibitor (p. 110).

J. Wagner and Sons (840, p. 1006), jewellers to the Court of Berlin. An ornamental piece of plate to serve as a fruit-dish in silver embossed work. This, like the preceding work, belongs in strictness to Class XXIII., in which it has received the Council Medal. I cannot, however, pass over in silence a work which shows to what perfection this class of art has been brought by the silversmiths of Berlin. In the whole design there is great beauty of form, and much invention is displayed in the subjects with which it is decorated. These represent the successive stages in the development of civilization.

The first scene represents the simple characteristics of that primeval age which is still engrossed in supplying the mere physical necessaries of life, when hunting, fishing, and the tending of flocks and herds, are the only occupations of man. This forms the pedestal of the vase; round the columns a more advanced civilization is represented by figures, with the symbols of tillage, horticulture, and the vintage. In the reliefs upon the body of the vase, which are still unfinished, we have the characteristics of a still higher stage of social refinement; mining, commerce, navigation, and the arts and sciences generally, are here represented figuratively.

As the apex of the whole composition, we have the genius of light overcoming a snake, designed to symbolize the highest form of civilization, when man has arrived at the government of those worst enemies, his own passions. Both the detached figures and the groups in relief which develope this train of ideas are disposed with admirable judgment about the vase; they are also executed with great knowledge, and a masterly finish of detail.

In the fruit, flowers, and foliage, which form the subordinate ornaments, the combination of a close imitation of nature with a very good style, deserves the greatest praise. It may, however, be noticed as a defect, that the mass of the figure of the genius is somewhat too large, and that his wings appear ill set on, as if not originally united to his body. It is to be regretted that another Berlin artist, equally distinguished for his embossed work, M. Netto, contributed nothing to the Exhibition.

Julius Franz. (1, Zollverein, 293, p. 1066). Two Victories modelled by this artist, from the figures by Rauch, on a reduced scale, of about two feet in height, cast in bronze, and tooled by Fischer. These works are remarkable for the scrupulous accuracy of their execution.

J. Bernhard Afinger. Four medallion portraits cast in bronze by this artist deserve praise for the truth of the general conception; but the execution, though always careful, is occasionally somewhat feeble, and the treatment too picturesque. Honourable Mention. (No. 309, p. 1067.)

(*b.*) Medals.

K. Fischer, Medallist of Berlin, exhibits nine medals. In the design of these, both obverse and reverse, good taste and feeling for nature are combined with correctness of style in the treatment of low relief, and a very careful and conscientious method of execution.

The medal struck in honour of Alexander von Humboldt, as the author of Cosmos, is specially worthy of mention. Prize Medal. (No. 281, p. 1064.)

C. Pfeuffer, Chief Medallist to the Court of Berlin, exhibits 22 medals. These show a very careful execution, but the overcharged character of the forms, which are sometimes too full and heavy, is at variance with the true laws of this branch of art. Honourable Mention. (No. 286, p. 1066.)

The works exhibited by the Royal Iron Foundry of Berlin fall under Class XXII., and have there been rewarded with a Council Medal; they belong, however, so completely to the Province of Art that they deserve some notice here. The admirable taste shown in the ornaments of these works, and the good style of the sculptures, prove the extensive and abiding influence of the immortal Schinkel in this establishment. Among the works which specially deserve notice are, a large vase inlaid with silver and ornamented with a design by Hesse, chief architect of the Palace, after Thorwaldsen's Triumph of Alexander, and two stands ornamented in a similar style with small groups. (No. 271, p. 1064.)

B. Graphic Representations on Plane Surfaces.

Designs for Tapestry.

This kind of work has been more extensively practised and brought to a greater perfection in Berlin than in any other place. Among the different designs of this class, those of M. Grünthal deserve special notice for their general good taste. Honourable Mention. (No. 166, p. 1057.)

Lithochromy.

Winckelmann and Sons, Berlin. The specimens of Lithochromy exhibited by these artists are among the most perfect that have been produced. By the employment of a number of stones for the same impression, a great variety of tints has been obtained, so that the most complicated objects, and particularly architectural ornaments, can be represented with all that refinement of gradation which they present in a perspective view. The most remarkable specimens are the views of the Castle of Orianda, designed by Schinkel for the Emperor of Russia, and several of the Plates in a magnificent work on Architectural decoration, by M. Lewis Gruner, of London. Considering the excellence of these lithochromes, their price is proportionately moderate, which is an additional merit. Prize Medal. (No. 306, p. 1067.)

C. Architecture.

Models.

J. C. Boesche, of Magdeburg. A model of the Cathedral at Magdeburg, of considerable dimensions; also a model of the beautiful fountain at Nuremburg. These works are accurate in their general proportions, and the details are faithfully and carefully worked out. A model for another fountain is very neatly executed, and the design is pretty and original. Prize Medal. (No. 785, p. 1094.)

To this artist the Jury have also made a money award of 30*l.* sterling.

II. BAVARIA.

A. Sculpture and Works of Plastic Art.

1. *Sculpture on a large Scale.*

The Munich school of sculpture owes its importance to Schwanthaler, whose untimely death in the flower of his years we have to deplore. The number of highly imaginative designs which the fertile invention of this artist has drawn from ancient mythology, from the middle ages, and modern times, has justly earned for him a lasting fame. At the Exhibition he was represented only by a small number of his works. Though in the statues of Queen Libussa and of King George Podiebrad of Bohemia, cast by Miller, of Munich, from Schwanthaler's models, the imaginative conception and noble proportions of the figures are well worthy of this great artist, they afford but a very imperfect idea of the whole range and compass of his genius. As they were not exhibited in the name of the artist, they could not enter into competition for a prize.

It is to be regretted that the distinguished sculptor **WIELMANN** contributed nothing to the Exhibition.

JOHN HALBIG, of Munich. (2 Zollv., 90, p. 1102.) A Colossal Lion, cast in one piece by Miller; part of a group representing Victory in a Chariot drawn by Four Lions, and designed to be placed on the triumphal arch at Munich. The motive of this work is good, but the form is too heavy and clumsy. This overcharged appearance may perhaps be partly explained by supposing it to be calculated for the height at which the figure is to be placed.

J. LEEB, of Munich. A Young Girl looking at a Nest full of young Cupids, which she holds in her hands. This figure shows *naïveté* in its conception, and is carefully executed in marble. Honourable Mention. (Ibid. 89, p. 1102.)

2. *Sculpture on a small Scale.*

M. HAGEN, of Munich. A large Ivory Cup, on which are sculptured figures of children playing, in the style of Fiamingo; in a very good style, and executed with great care. Honourable Mention. (83, p. 1102.)

B. GRAPHIC REPRESENTATIONS ON PLANE SURFACES.

1. *New Processes of Painting.*

J. N. VON FUCHS, Professor in Munich, has invented a new mode of wall-painting, called *stereochromy*, which has many advantages over the fresco method which has been so generally adopted for walls. By the new process, the surface can be retouched to any extent, as in the case of an oil-painting, while it possesses far greater durability, being protected by a varnish from the effect of exposure to the weather. A figure painted by M. Muhr, a pupil of Kaulbach, exhibited as a sample of this process, affords good proof of its merit. Prize Medal. (Ibid. 91, p. 1102.)

2. *Enamels on Porcelain and on Metal.*

OTTO WUSTLICH, of the Fine Arts Establishment of Schmidt, of Bamberg. A miniature of Charles IX. firing upon the Huguenots, on the night of the Massacre of St. Bartholomew, after a picture by Baron Wappers, of Brussels. This miniature is remarkable for its truth, its force and transparency of colouring, the goodness of its general tone, and its careful execution. Prize Medal. (Ibid. 92, p. 1102.)

3. *Painting on Glass.*

STEPHEN KELLNER, of Nuremberg. A reduced copy of the celebrated painting by Volkamer, in the Church of St. Laurence at Nuremberg. In this work, which is executed with the greatest care, the colours and every detail of the original picture are faithfully rendered. Prize Medal. (Ibid. 86, p. 1102.)

4. *Various Processes of Printing.*

FRANZ VON KOBELL, Professor at Munich, exhibits a new mode of multiplying Indian ink and other drawings, by means of copper-plates deposited by galvanic action: the invention is hence called galvanography. The process is as follows:—The drawing having been first executed either with encaustic colours or with lithographic chalk, a plate of copper is precipitated upon it by galvanic action. By the contact of the particles of metal with the colours or chalk drawing, the plate receives, during its formation, an actual impression of the delineated surfaces, the lines being indented on the copper as if by the ordinary process of the burin. The plate, thus engraved by galvanic agency, becomes a matrix capable of yielding other impressions.

F. HANFSTÄNGEL, of the Lithographic Establishment of Munich (Ibid. 85, p. 1102), has exhibited two plates as samples of this process; the matrix or plate impressed by Galvanography, and the patrix, or impression taken again from this plate. An impression in paper, showing the result, is added. These specimens are remarkable for the force, clearness, and evenness of the print. Honourable Mention.

III. KINGDOM OF SAXONY.

A. SCULPTURE AND WORKS OF PLASTIC ART.

Sculpture on a large Scale.

ERNST RIETSCHEL, of Dresden. This distinguished artist, one of the ablest pupils of Rauch, exhibits three works, the varied character of which shows the versatility of his talents. 1. A group of the Virgin weeping over the body of our Saviour, cast in plaster, from a model executed for His Majesty the King of Prussia. In the figure of our Saviour, anatomical truth is combined with nobleness of form; the countenance has a fine dignified character; its mild transfigured expression proclaims the triumph over the agonies of death. In the Mary, the countenance and the clasped hands reveal the deepest but most resigned sorrow of soul. The drapery of this figure is admirably composed. The execution is fully worthy of the invention shown in this group. 2. The Angel of Christ, a very noble relief in marble. The angel is represented in the form of a graceful youth, floating in the air, with the infant Saviour in his arms; two infant angels attend his course. This group has a peculiar charm from the beauty of the heads and figures, the grace of the action, the suddenness of the movement impressed on the flying drapery, and the masterly yet tender handling of the marble. 3. Love riding on a Panther, whose course he tries to arrest, eagerly grasping his neck with both his hands. This beautiful conception is quite in the spirit of ancient art, and is expressed with great vigour of hand. Prize Medal. (185, p. 1113.)

B. GRAPHIC REPRESENTATIONS ON PLANE SURFACES.

Enamels on Porcelain.

HEINRICH BUCHER, of Dresden. This artist exhibits a rich collection of miniatures on enamel, of which I will only notice here the copy of the celebrated "Christ with the Tribute-money" of Titian, in the Dresden Gallery, in which the character and deep transparent colouring of the original are admirably rendered. The works of this artist are also remarkable for their very moderate price. Prize Medal. (176, p. 1112.)

GUSTAV WALTHER. The six enamels, after well-known pictures in the Dresden Gallery, exhibited by this artist, are creditable works in this class of art. Honourable Mention. (177, p. 1112.)

IV. DUCHY OF SAXE-GOTHA.

F. E. HENNEBERG and Co. A view of the Wetterhorn, in Switzerland, painted on china. This work has considerable merit. Honourable Mention. (772, p. 1093.)

V. WURTEMBERG.

A. SCULPTURE AND WORKS OF PLASTIC ART.

Sculpture on a large Scale.

L. VON HOFER, sculptor, of Stuttgardt. Casts in plaster from two Arabian thorough-bred horses, in the stud of the King of Wurtemberg. They are represented rearing; each is held down by a naked attendant. The original groups are executed in marble, and are placed in the garden of the palace at Wurtemberg. Good judges of horses are of opinion that in these works of Hofer the characteristics of a particular breed of horses are very accurately given. (105, p. 1119.)

T. WAGNER, of Stuttgardt. The Penitent Magdalen, a figure in marble. This work is characterised by truth of expression and careful execution, but the drapery is drawn over the ridge of the leg so as to intercept its outline, in a manner not consistent with the laws of Plastic Art. Honourable Mention. (108, p. 1120.)

VI. ELECTORATE OF HESSE CASSEL.

C. M. **Weishaupt Sons**, jewellers, of Hanau. A chess-board in gold and silver. The sides of the board are richly ornamented with festoons of flowers, small animals, birds, &c., in admirable taste, and executed in enamel with the utmost delicacy and minuteness. The pieces are finished with the same extraordinary richness and refinement of ornament. The kings are portraits of the two great antagonist monarchs of the early part of the sixteenth century, the Emperor Charles V. and Francis I. of France; the queens represent Margaret of Parma, the daughter of the Emperor, and Margaret of Valois, the sister of Francis. The work properly belongs to Class XXIII., and has been rewarded there with a Council Medal; but from its great merit as a work of art, I have felt it my duty to notice it here. (412, p. 1073.)

VII. GRAND DUCHY OF HESSE DARMSTADT.

C. W. **Heyl**, ivory-carver in Darmstadt. A large goblet, on which is carved in relief the battle of Arminius, after a design by Lindenschmidt. This work is entitled to great credit, from the extraordinary finish of the execution. The introduction, however, of several planes in the relief, and the violent foreshortenings, give to the whole composition a picturesque character at variance with the principles of Plastic Art, whilst in some of the foreshortenings, particularly that of a horse, there is a positive want of drawing. Honourable Mention. (75, p. 1129.)

VIII. OLDENBURG.

Architectural Models.

J. H. **Cassebohm**, of Oldenburg (1, p. 1135). A model of the castle of Oldenburg, correct in its general proportions, and carefully finished, though in the details of the architecture the character of the several members is not accurately rendered. Honourable Mention.

FRANCE.

The French have been distinguished for many generations by the great encouragement they have bestowed, as a nation, on the Fine Arts. The French Government, under every change in its outward form, has not failed to regard Art as one of the most important instruments of civilization; and recognising its great and beneficial influence on the manufactures of the country, has, by the most liberal grants, placed it in a peculiar manner under the protection of the State. Millions of the national revenue have, in consequence, been devoted to the erection of great public edifices, and to the purchase of the best works of native artists. Establishments like that of the Gobelin Tapestry, and the Sèvres China Manufactory, or the École des Arts et des Métiers, have been not only founded but maintained by the State at an immense cost. In consequence of this encouragement on the part of the Government, the French school of Art has been most fertile in its productions; many branches of art have been brought to a rare degree of perfection, and the diffusion of an improved taste has exercised a most beneficial influence on a variety of trades and handicrafts. By these means Paris has become an universal market, not only for the Fine Arts themselves, but for most of the branches of industry to which they are in any way allied.

A. Sculpture and Works of Plastic Art.

1. *Sculpture on a large Scale.*

During the first years of the French Revolution, commencing with 1789 onwards, a reaction against the style of art, previously esteemed, was brought about by the painter David. This movement was followed up by the sculptors Chaudet and Bosio, who devoted themselves to a diligent but cold imitation of the master-pieces of ancient Roman sculpture.

At a later period the style of many sculptors was affected by the passing but dangerous influence of Canova. After this a very strong Realistic tendency prevailed, and at a later period still the influence of the best Greek Art has been felt in the French as in other modern schools. This tendency on the one hand to revert to the pure Greek models, and the Realistic tendency on the other hand, are the two chief movements which characterise the modern French school. Both styles, and the Realistic especially, were represented in the Exhibition by a number of remarkable works; but it is to be regretted that many distinguished sculptors, such as Rude, Duret, Jaley, Simard, Dumon, Ramay, the Comte Nieuwekerke, the Baron de Triqueti, and David of Angers, did not contribute any work.

J. **Pradier**, Member of the Institute; Phryne (1467, p. 1243). In this youthful female figure the beauty of feature, the subtle refinement of form, and the sprightly grace of the attitude, alike correspond with the name of the celebrated *Hetaira* which M. Pradier has given to his work. The careful chiselling of the surface, and the general breadth of the treatment, show that the sculptor has not studied the master-pieces of Greek Art in vain. On the other hand, for so young and beautiful a form, there is rather too large a development of the body; the drapery in front falls too perpendicularly, so as to cut the figure in two, and its monotonous parallel lines want movement; whilst behind, the mass of folds assumes the unsightly form of a triangle. The idea of ornamenting the hem of the garment with a red "Mæander" border is not happy, for, in contrast with the colourless uniformity of the rest of the marble, such an ornament appears crude and misplaced.

This artist also exhibits a group (Ibid.), cast in bronze, of a crouching Venus conversing with a Cupid, who leans against her. There is great originality in the conception of this group, and the artist has been for the most part very happy in the selection and treatment of the forms. The execution, however, is not equally careful throughout. Council Medal for the Phryne.

Auguste Debay, of Paris. "Le Premier Berceau." This name is given by the sculptor to a figure of Eve, seated, with her hands clasped over one knee, and supporting in her lap her sleeping infants, Cain and Abel. In the form and attitude of Eve there is great beauty, truth, and refinement of feeling, and the countenance admirably expresses the tenderness of a mother. The treatment of the figure, however, is rather too picturesque in character; the general motive is somewhat strained and violent; the forms of the children are not happily composed; and there is great want of style in the hair of Eve, which is gathered together behind in a somewhat clumsy mass. Prize Medal. (45, France, p. 1173; and see Illustration.)

E. L. **Lequesne**, of Paris (Main Avenue East). A Satyr, cast in bronze, represented after the manner of the ancients, dancing on a wine-skin, in a state of joyous drunkenness. In this figure the character of the head, and of the strong, hard muscles, quite correspond with the general Satyr type created by the imagination of the ancient artist. The motion is easy and natural, and the carefulness of the execution is maintained throughout. Prize Medal.

A. **Etex** (1215, Main Avenue, East, p. 1236). Of the three groups exhibited by this artist the most agreeable is that in marble of Hero and Leander, standing mournfully beside each other.

Cain and his Family. The characteristics of a base, abandoned nature are admirably expressed in the countenance and coarse clumsy limbs of Cain, which are very carefully studied from the life; in plaster.

The allegorical group (in plaster) of the City of Paris imploring heaven to take away the plague of Cholera, is a less agreeable work, on account of the manner in which the subject is treated. The City is represented as a seated female figure, with an old man and a youth expiring of the pestilence, one on each side. In these figures the moment of death is expressed with wonderful truth.

This work is a specimen of that class of art which, seeking to act on the feelings through the representation of mere physical suffering, may be called the Revolting, a style which appears to be little cultivated or admired, except in France.

These works all show great knowledge on the part of the sculptor. Prize Medal.

J. Clesinger, of Besançon (1709, p. 1258). A Bacchante, who is rolling on the ground in a state of drunken excitement. This figure is remarkable for the masterly chiselling of the marble, the great knowledge of anatomy, and the beauty of the countenance; but these excellences do not sufficiently excuse the sculptor for having in this work allowed his imagination to be perverted and degraded to the service of a low sensuality. Moreover, the treatment of the hair is at variance with the principles of a good style, and there is a great want of taste in the arrangement of the folds of the drapery. The Jury considered this subject to be of an objectionable character, but have made Honourable Mention of the excellences pointed out above.

J. M. Ramus (1419, p. 1244). Cephalus, tenderly supporting in his arms the dying Procris. This group is, in its leading lines, very happily composed, and shows in the forms much knowledge of nature; but the modelling is not in a sufficiently large style, and is not sustained throughout. Prize Medal.

M. Pascal, of Paris (1660, p. 1266). A group, in marble, of a monk holding out a crucifix, which a little boy is eagerly kissing; a little girl stands by, steadfastly gazing at him. There is a charming feeling for nature in the expression of the heads; but the general composition, and particularly the drapery, may be termed rather Picturesque than Plastic in style, and, with the exception of the nude forms, the whole is only sketched out in the marble. Honourable Mention.

C. Cordier, of Paris (460, p. 1200). The head of a negro, cast in bronze, by this artist, is a true example of characteristic portraiture; the conception is full of life, the execution most masterly, and well sustained throughout. Honourable Mention.

Jean Debay, of Paris (573). A group of a young hunter, rushing forward to despatch a stag, pulled down by a hound. The hunter is naked, and the whole type is conceived in the spirit of ancient art. This group, from the natural manner of the action, forms a very pleasing composition. The hunter and the animals are modelled with great knowledge, and a good style is shown in the execution. Prize Medal. (Main Avenue East.)

Fratin, of Paris (1235, p. 1236). This artist, the most celebrated sculptor of animals in France at the present day, contributes to the Exhibition two eagles with a wild goat, which they have slain, a greyhound, another hound, life size, and several animals on a smaller scale, all in bronze. These works are fully worthy of the artist's reputation. The general conception is most spirited, the details of nature are most faithfully rendered, and the treatment throughout, particularly of the plumage and the skins, is most careful, and in a very good style. Prize Medal.

A. Lechesne, of Paris (573, p. 1205). Two groups, in plaster, of dogs and children. In one is represented a dog rescuing a child from the attack of a snake; in the other, which forms the sequel to the preceding, the snake lying dead, the dog exhausted, and the child full of joy and gratitude for its rescue. These works are very remarkable, from the extraordinary truth and spirit in the modelling and expression of the dog's head. The form of the child, on the contrary, is too swollen and coarse; and in the representation of the shaggy coat of the dog, the execution is too minute, and not in a legitimate style.

In another group, a woman is lying on the ground asleep, or dead. Above her hovers an eagle, about to carry off her child. Here, again, the treatment of the bird is very masterly, and by far the best part of the work. Prize Medal.

Bonnassieux, of Paris (64, p. 1174). A group, in bronze, representing Cupid, as a youthful figure, clipping the tips of his own wings; standing beside him is a dog. The form of the Cupid is very graceful, but the head is too directly copied from the antique type. The execution is very unequal; the dog, in particular, is very carelessly modelled. Honourable Mention.

A. G. Fourdinois (1231, p. 1236). A large sideboard, ornamented with figures and dogs, on a large scale, carved in wood. In these the artist has shown such a happy invention, and such power of execution, that this work must be considered to rank as sculpture, and cannot be passed without a notice here, although it belongs to Class XXVI., and has been rewarded in that Class with a Council Medal.

It may not here be out of place, after this notice of the works of English, French, and German artists, to compare briefly the intellectual tendencies which these three great nations severally manifest in their schools of sculpture.

In each of these schools, though in the case of England only within the present generation, Greek sculpture has been acknowledged as the standard by which all creations of ideal art must be judged.

The English school has, on the one hand, sought to attain the qualities of grace and loveliness of form; more recently this school has also aimed at strength and manliness of character, chiefly in strong action. The French have principally turned their attention to the representation of sensual beauty, to the tender feelings called forth by the relations between the sexes, to other forms of the Sentimental, or to the style which may be designated as the Revolting.

Finally, German art has been especially devoted to the representation of deep religious feeling, or of calm, idyllic scenes; it has also endeavoured to treat the most stirring moments of real life in a grand and impressive manner.

Of the works contributed to the Exhibition by these three nations, those most distinguished in the foregoing notices may be fairly cited in proof of the success with which each school has followed out its peculiar bent.

2. *Sculpture on a small Scale.*

(a.) In Metal.

Among the French works in silver analogous in style to the productions of Vechte mentioned before, is a service of plate in the taste of the sixteenth century, executed by **Feucher**, and exhibited by **Froment Meurice** (1720, p. 1258). This work is the property of the Duke de Luynes. A Prize Medal has been awarded to it in Class XXIII.

The French department of the Exhibition displayed an extraordinary abundance of small groups of human figures and animals, and other small bronzes.

Many of these are from the designs of distinguished artists, among whom may be noticed, **Pascal** (1660, p. 1266), who contributes a charming group of three children with bunches of grapes, designed for a dinner service, **Fratin** (1235, p. 1236), and also **Méné** (630, p. 1208), who works in the same style as Fratin.

In other bronzes we find copies from the works of celebrated sculptors, such as Rude, Duvet, and Pradier; these are often very well executed. A Daphnis and Chloe, after Gaylard, deserves special notice. But a great number of these specimens do not rise above the level of very pretty ornaments, executed without much style, and a notice of them here would occupy too much space. As the French medallists sent no specimen of their works to the Exhibition, no mention has been made of them in this Report, though the skill of many of these artists is very generally acknowledged.

(b.) Sculpture in Ivory.

L. Lautz, of Paris (295, p. 1199). A great cup, ornamented with reliefs, representing a battle scene. The composition of these is too picturesque, and not treated in accordance with the principles of Plastic Art; but it must be admitted, that this is a work of extraordinary merit in the drawing and execution. Honourable Mention.

(c.) Sculpture in Wood.

M. J. Liénard, of Paris (1326, p. 1239). A Boar-hunt, carved on a clock-case. Although this work is treated in a manner utterly at variance with the principles of Plastic Art, it is nevertheless a perfect masterpiece for truth of imitation, drawing, and execution. This artist has received from the Jury of Class XXVI. the Council Medal, especially for a richly ornamented clock-case, but his merits have been also acknowledged in Class XXX. by the award of a Prize Medal.

The process invented by Mr. A. Collas (1709, p. 1258), for reducing sculpture by machinery, which has been already referred to in the opening of this Report, must be noticed here. Prize Medal.

B. Graphic Representations on Plane Surfaces.

1. *New Processes of Painting.*

It is now some years since a process of painting on lava has been perfected at Paris, chiefly by the exertions of the celebrated architect Hittorf. This kind of painting is as durable as that on porcelain, and is burnt in the same manner. A copy of Raphael's picture in the Louvre, called La Belle Jardinière, executed by J. Devers (818, p. 1219), was contributed to the Exhibition as a specimen of this process. It is very carefully and faithfully copied, but the flesh is rather heavy and deficient in transparency. Prize Medal.

2. *Enamels on Porcelain and on Metal.*

Nowhere in Europe has the art of painting in enamel been carried to such perfection as in the celebrated manufactory of Sèvres. The works of this establishment are distinguished not only by the extent of the enamelled surfaces, but also by the perfection with which facsimiles of celebrated pictures are executed, the drawing and colouring of the original being preserved with marvellous truth. The Jury has therefore awarded a Prize Medal to M. Dieterle (1369, p. 1241), as the Director of an establishment where such great results have been attained. Although it is to be regretted that the celebrated Constantine contributed no specimens of his works, the Exhibition contained a great number of paintings of the greatest merit.

Madame A. Ducluzeau, of Paris (1369, p. 1241). This most distinguished artist, whose recent decease I regret here to announce, contributed masterly copies of the following pictures in the Louvre:—*a.* La Vierge au Linge, by Raphael; *b.* The portrait of Vandyke, by his own hand; *c.* A portrait of a male personage, recently ascertained to be a masterpiece of Johann von Calcar; *d.* The portrait of Her Majesty Queen Victoria, after Winterhalter (96, p. 109).

Jacobber, of Paris (271, p. 1189). A Flower-piece, after Jan Van Huysum, by this artist, is a perfect masterpiece. Another flower-piece, after Von Spandonck, has also great merit. Prize Medal.

A. Béranger, of Paris (1369, p. 1241). The copy of a Portrait by Rubens, in the Louvre, and one of His Royal Highness Prince Albert, after a portrait by Winterhalter (97, p. 109). Prize Medal.

Madame P. Laurent, of Paris (1369, p. 1241). Three remarkable enamels on copper, two of which were after Raphael, the other a Venus, were exhibited by this skilful artist. Prize Medal.

Madame Jacotot, of Paris (1369, p. 1241). This celebrated artist, now far advanced in years, contributed a copy of the portrait of Raphael, after the picture in the Portrait Gallery at Florence. The original is rendered with great truth. Prize Medal.

Bonnet, of Paris (1369, p. 1241). St. John enamelled on iron, of great merit. Prize Medal.

Schilt, of Paris (1369, p. 1241). Paintings on two porcelain vases, and on a table, very masterly in execution. Prize Medal.

Mme. Turgan (1504a, p. 1248). A Holy Family, after Raphael, of remarkable merit. Honourable mention.

Mariette de Chassagne (1554, p. 1251). A copy of the celebrated picture, by Horace Vernet, the meeting of Michael Angelo and Raphael, exhibited by Boyer, of Paris. In this work every detail of the original is faithfully rendered. Honourable Mention.

Hamon (1369, p. 1241). A casket of metal with figures, *en grisaille*. In this work there is a successful revival of the process for which the Limoges school of enamel was so distinguished in the sixteenth century. Prize Medal.

3. *Painting on Glass.*

(*a.*) Ecclesiastical Style.

Alfred Gerenté, of Paris (231, p. 1187). A window in the style of the twelfth century. In the figures, which represent the history of Sampson, and particularly in the ornaments, the style of the period is rendered with extraordinary mastery and truth. Prize Medal.

A. Lusson, of Paris (565, p. 1205). In some windows in the taste of the thirteenth, fifteenth, and sixteenth centuries, the artist has given the style of each period with great knowledge and care. Honourable Mention.

(*b.*) Pictorial Style.

Marechal and Guynon, of Metz (329, p. 1193). The sick of the plague receiving the Eucharist. The characteristics of a picture, keeping, truth of drawing, and expression, are very successfully rendered, and the advantages of a material admitting of such force and transparency of colours as glass, are turned to the best account. These excellences are also exhibited in a very high degree in a male portrait. Prize Medal.

4. *Inlaid Works in Metal.*

J. Roucou (1689, p. 1257). Different kinds of arms, such as pistols, inlaid with gold and silver ornaments, in very refined taste, and executed with rare mastery of hand. Prize Medal.

5. *Designs.*

(*a.*) For Woven and Printed Fabrics.

E. Laroche (291, p. 1190). A volume containing many designs for shawls, barèges, and muslins. The patterns show great taste and adaptation to the materials, and are admirably executed. Prize Medal.

Berrus, Brothers (55, p. 1174). This establishment is one of the largest manufactories in France, and the designs for shawls which it exhibits have most remarkable merit both in regard to the patterns and the colours. The introduction of small landscapes, however, in some of these designs, is an infringement on the principle which has been already stated in this Report, that the pattern must not disturb the idea of flatness in the surface. Prize Medal.

A. Couder (1566, p. 1251). Designs for shawls and other stuffs. The execution of all these is very masterly, and those for shawls are in a very good taste. The others are very deficient in this quality. Prize Medal.

J. Chebeaux (1146, p. 1233). Some of the designs for cotton and calico by this artist show a very happy invention, and are executed with very great skill. In his designs for other materials the execution is equally skilful, though there is a want of taste. Prize Medal.

The following artists deserve notice both for the taste and execution of their designs:—

F. Didier (820, p. 1219) and Meynier (638, p. 1208), both of Paris, in their designs for shawls; Naze and Co. (625, p. 1207), and Braun (72, p. 1175), in their designs for cottons; E. Picard (347, p. 1194), in his designs for calicos; J. H. Méraux (631, p. 1208), in his designs for lace. All these have obtained Honourable Mention, and the last a Prize Medal. (Class XIX.)

(*b.*) For Painted Windows.

N. A. Galimard, of Paris (228, p. 1187). In these designs the artist has been very successful in representing figures according to nature, and under the conditions of Architectonic style. Honourable Mention.

6. *The Government Manufactory of Gobelin and Beauvais Tapestry* (1367-68, p. 1241).

This celebrated establishment, which has produced such a number of copies of celebrated pictures, contributed two specimens of tapestry to the Exhibition. One of these is a copy of Raphael's fresco in the Farnesina, in which Psyche is represented carried through the air by Genii, and carrying the vessel which, at the behest of Venus, she has brought from the nether world. The other piece of tapestry is a copy of the celebrated picture by Horace Vernet, representing Ali Pasha looking on at the massacre of the Mamelukes, who, at his command, were shot by his soldiers. In both these copies not only is the general effect of the original picture faithfully rendered, but the intention and feeling of the artist are preserved in a degree which could hardly be expected, when we remember that the process by which these copies are executed is a purely mechanical one. (Council Medal, jointly with Class XIX.)

7. *Different kinds of Printing, such as Lithography and Lithochromy.*

R. J. **Lemercier**, of Paris (558, p. 1205). This artist exhibits a number of lithographs, which from their force, depth of shadow, and fine gradation of tints and general tone, must rank among the most remarkable specimens of this art which have yet been produced. Prize Medal.

Lithochromy.

Engelmann (192, p. 1183). This celebrated establishment has well sustained its reputation by the series of admirably executed specimens of lithochromy, which it exhibits.

Printing in Colours from Wood Blocks.

G. **Silbermann**, of Strasburg (374, p. 1194), is the inventor of this mode of printing, and the coloured impressions from wood blocks exhibited by this artist are in every way remarkable. Prize Medal.

Although the facsimiles of the illuminations and initial letters of ancient MSS., exhibited by the Count **Auguste de Bastard** (1717, p. 1258), are worthy of the greatest admiration on account of the extraordinary truth and skill with which they are executed, yet these works ought hardly to have been admitted into the Exhibition, as most of them were finished by hand.

Here ought not to be omitted the name of Mr. C. E. **Clerget**, of Paris (799, p. 1219), for his designs generally, and his exhibited works in ornament. Prize Medal.

AUSTRIA.

A. Sculpture and Works of Plastic Art.

1. *Sculpture on a large Scale.*

The only parts of the Austrian dominions from which large works of sculpture have been contributed are the Italian provinces, and especially Milan. In these works may be remarked a strong tendency to Realism.

G. **Strazza**, of Milan (713, p. 1043). Ishmael. This name is given by the artist to the figure of a boy lying on the earth, expiring of thirst. The dry and meagre forms, characteristic of this period of boyhood, are rendered with a truth which borders on the repulsive. The execution is masterly. The head, which is evidently studied from some type quite foreign to the subject of this work, conveys an expression of exhaustion which is almost painful. In the representation of this subject by painters, an angel bringing help to Ishmael is always introduced, and from the absence of this figure the general impression produced by the work of M. Strazza is most painful, and unrelieved by any mitigating circumstance. Prize Medal.

R. **Monti**, of Milan (746, p. 1044). Eve after the Fall, arrived at the full consciousness of her crime. This figure, which is in marble, is appropriately conceived; the motive is pleasing, and the execution is very careful. It has consequently obtained from the Jury a Prize Medal.

This figure was not so generally admired by the public as another work by the same artist, representing a girl kneeling, with a thin veil thrown over her face, but the preference was not rightly given. Though extraordinary skill is shown in the execution of this veiled figure, true judges of art must always esteem it a mere specimen of dexterous workmanship, and they cannot but think, that in thus deviating from the undisguised representation of the human features, the artist has renounced the only means by which beauty, character, and expression can be distinctly rendered in the countenance.

A. **Galli**, of Milan (711, p. 1043). A youthful female figure, to which the sculptor has given the name of Susanna. The forms are pleasing and the movement pretty, and the work is very carefully executed in marble. But without the addition of the two Elders it would be impossible to recognize the subject. Prize Medal.

A. **Sangiorgio**, of Milan (722, p. 1043). A colossal bust, in marble, of the poet Vincenzio Monti; the conception of this work is very spirited, and the execution most masterly and careful. Honourable Mention.

I. **Fraccaroli**, of Verona (710, p. 1043). David in the act of slinging the stone at Goliath. The motive of this figure is very spirited, but a little strained; the features have a noble expression. The youthful character of the head does not accord with the rest of the body, in which the muscles are too strongly marked. This artist also exhibits a statue of Achilles wounded in the heel. Prize Medal.

L. **Marchesi**, of Milan (716, p. 1043). Eurydice. In this figure, which is of marble, there is something very pleasing in the general expression, but the execution of the details leaves much to be desired. Honourable Mention.

B. Graphic Delineations on Plane Surfaces.

Enamel Painting.

Nigg (615, p. 1038), Painter in the Imperial Porcelain Manufactory of Vienna. The Holy Family, after a picture in the Imperial Gallery at Vienna, attributed to Raphael. In this copy the forms are rendered with tolerable fidelity, but the pale tone of the flesh very inadequately represents the warm powerful colouring of the original picture. The artist has succeeded better in a flower piece, in which the colours of the flowers are most carefully rendered in all their original truth and force. Honourable Mention.

Painting on Glass.

G. **Bertini**, of Milan (737, p. 1044). A design, in the centre of which the poet Dante is represented seated: on his right hand is Matilda, on his left Beatrice. This picture is set in an architectural frame, in the Gothic style. It is very seldom that we find in glass painting so much artistic expression as has been attained in the figures, more especially the female figures, in this work; and their effect is heightened by the remarkable harmony of the deep soft colouring. But, on the other hand, the architectural frame is utterly at variance with the taste and principles of construction in Gothic architecture, and two great black spaces, in the upper part of the picture, have a very disagreeable effect, from their contrast to the rest of the design, which is meant to produce the impression of a picture. From the arbitrary mixture of the Architectonic and Pictorial systems of glass-painting in this work, its effect as a whole cannot be agreeable to the best judges. Prize Medal.

P. **Bagatti-Valsecchi**, of Milan (616, p. 1038). A painting on glass, representing Lucia Mondella, the heroine of Manzoni's celebrated romance, the "Promessi Sposi." As a specimen of *genre* painting on glass, this work is very remarkable in drawing, colour, general effect, and manner of execution. Honourable Mention.

Lithochromy.

The **Imperial Printing Office of Vienna** (362, pp. 1025–28). The work, "Paradisus Vindobonensis," exhibited by this establishment, contains a great number of lithographs of flowers and plants, which are represented in form, colour, and every other respect, with remarkable truth to nature. Prize Medal.

ITALY.

The Italian sculpture of the present day cannot be described as possessing any one general character; some of the modern school still imitate the style of Canova, as for instance, Bienaimé; others again, like Tenerani, follow rather in the steps of Thorwaldsen; others, like Marochetti, have devoted themselves, in conception and representation, to the romantic school.

SARDINIA.

D. W. Baron Marochetti (76, Outside West, p. 118). This artist, though educated in France, and at present settled in England, is by birth a subject of the King of Sardinia, so that it is most proper to place him under the latter country. He exhibited a colossal equestrian figure of Richard Cœur de Lion, modelled in plaster, and bronzed, and placed in the open air at the west end of the building. Richard is represented in mail, mounted on a fine charger. The frank and noble conception of the chivalrous king, holding up his sword in his right hand, and the spirited action of the horse, make this a very remarkable work In some parts, however, of the modelling of the horse there is a want of knowledge. The hind quarter and hind legs, especially, have rather a lame appearance, and the execution of this part of the horse is very imperfect; the disposition of the veins particularly is altogether arbitrary. The artist has, however, exhibited within the building a horse's head finished in detail, and from this sample we may see that certain further modelling may much improve the general effect. Council Medal.

Nicolas Lendy, engraver at the Royal Mint of Turin, (60, p. 1304). This artist exhibited nine microscopic dies of coins as examples of a process invented by himself, by which dies may be reduced with extraordinary accuracy to a scale, the minuteness of which is hardly credible.

Though the inscription and design on these dies can only be discerned by the aid of a very powerful microscope, the details are rendered with extreme fineness.

TUSCANY.

Among the works exhibited by this country are a Bacchus by Nencini (115, p. 1298), a Psyche by Freccia (117, p. 1299), and a Dying Gladiator by Costoli, all in marble. These three works, though not without merit, must be reckoned of very subordinate rank, when we remember the great celebrity of Tuscany in art; they have, however, received Honourable Mention.

Sculpture on a small Scale.

A wardrobe and jewel-casket, by Barbetti, of Siena (91, p. 1298), are, both in taste and execution, most remarkable examples of the rich style of decorative carving of the sixteenth century, commonly known as the cinque cento style; though these works, therefore, have already obtained a Prize Medal, in Class XXVI., they cannot pass unnoticed here.

L. Bigotti (95, p. 1298). The ornaments carved in ivory by this artist show a good taste, and are carefully executed. Honourable Mention.

Graphic Delineations on Plane Surfaces.

Inlaid Works in Pietra Dura.

This kind of art has been carried to great perfection in Tuscany, and its cultivation there for so long a period has supplied most of the palaces in Europe with works in Pietra Dura, which rank among the finest examples of decorative furniture.

No first-rate specimen was contributed to the Exhibition; there are, however, several table-tops by G. Bianchini (119, p. 1299), which must be considered very remarkable works, on account of the taste displayed in the composition of the flowers and leaves, and the care bestowed on the execution. They therefore received a Prize Medal from the Jury of Class XXX., as well as from that of Class XXVII.

ROME.

Sculpture on a large Scale.

It is to be regretted that the most distinguished artists of Rome, and especially Tenerani, the greatest living sculptor of Italy, sent no specimens of their works to the Exhibition.

Two groups, of a little girl with a dog, by G. M. Benzoni (16, p. 1286), may be noticed here. In one of these the child is represented drawing a thorn out of the dog's foot; in the other the dog, after having killed a snake which was threatening an attack, seeks to awaken the child thus rescued. The motive of these works is attractive, and they are carefully executed in marble, but they are by no means of sufficient importance to be considered adequate representations of the modern school of sculpture of such a city as Rome. Prize Medal.

I. Engel, of Hungary (p. 848). A group in marble, representing an incident in the myth of the Argonauts and Amazons. This composition is not happy in its lines, and the figures are somewhat deficient in character, but the execution is careful. Though this artist is not an Italian by birth, yet, as he received his artistic education in Italy, this seems to be the most proper place for the notice of his work. Honourable Mention.

Cameos.

Fair specimens of this kind of art, which has been so much esteemed at Rome, and cultivated with such great results, have been contributed to the Exhibition in a series of cameos, cut on shells, by the well-known gem-engraver Saulini. The greater part of these are copied from the most attractive works of the celebrated English sculptor Gibson. Honourable Mention. (24, p. 1286-87.)

Mosaics.

This class of art, in which the artists of Rome have so long maintained the first rank, and produced such wonderful results, was far more abundantly and adequately represented in the Exhibition than the other branches of Roman art which we have already noticed.

Barberi (15, p. 1286). A table-top, on which are represented views of celebrated cities in Italy, such as Rome, Florence, Venice, Pisa, &c. These views are arranged in a border round the table; in the central area thus encircled is a representation of the sky. Both in the choice of the subjects of the views, and in the force and refinement of execution, this work is among the most remarkable specimens of mosaic that have been produced. There is, however, rather a want of taste in the form and colour of the ornaments which compose the outermost border of the design. Although this work has been distinguished by a Council Medal in Class XXVII., I have thought it necessary to notice it here, on account of its remarkable character as a work of art.

The Mosaic Manufactory at St. Peter's exhibits two excellent specimens by Castellini (23, p. 1286). One of these, representing a colossal three-quarter portrait of Pope Boniface II., is an example of the ancient style of mosaic, intended for the decoration of churches, and for distant effect. The other specimen is a half-length portrait of St. John, by Guercino. This work shows with what wonderful precision a picture, executed in a period when technical knowledge had been fully attained, may be reproduced in mosaic, with a perfect rendering of the forms, colouring, and general effect.

B. Boschetti (17, p. 1286), of Rome, exhibits two mosaics for table-tops, remarkable for their taste and execution; these have obtained Honourable Mention. Awarded Prize Medal.

Three Roman artists in mosaic, Dominico Moglia (21, awarded Honourable Mention, Class XXVII.), the Cavaliere Luigi Moglia (20, awarded Prize Medal, Class XXVII.), and Rocchigiani (22,—all these at p. 1286), have severally contributed to the Exhibition views of the temples of Pæstum, this subject being a favourite one among the Roman mosaicists. These views are executed on a considerable scale. All these artists deserve praise for the truth and careful execution displayed in their works, but the mosaic of Rocchigiani is distinguished from the rest by the force of the effect, and depth and warmth of the colouring. An Honourable Mention has been bestowed on these three artists.

BELGIUM.

In this country, notwithstanding its moderate size, there is so general a diffusion of talent and feeling for the Fine Arts that they have been more freely developed here than has been the case in other countries far greater in extent of territory. Hence, within the last twenty-five years, side by side with the flourishing school of painting in Belgium, has grown up a school of sculptors, among whom are many distinguished names. In this school of sculpture a tendency to the picturesque, which is in conformity with the whole bent of the nation in art, manifests itself in the general character of the composition, and in a peculiar treatment of the surfaces, in which there is always a certain roundness and fulness, and sometimes an exaggerated development. In many ideal subjects this treatment has a very attractive effect, but in some of the works of Belgian sculptors the want of a proper feeling for bony structure in the representation of the figure, and the affectation of the motive, show that the style of Canova has exercised an unfavourable influence on this school. In portraiture the sculptors of Belgium have shown great ability; in this branch of art the whole Realistic tendency of the national mind has found free scope.

Nearly all the distinguished sculptors of this school sent works to the Exhibition, though in some cases it can hardly be thought that the merits of the sculptor were adequately represented by the specimens he contributed.

A. Sculpture and Works of Plastic Art.

Sculpture on a large Scale.

E. Simonis (464, p. 1166). A colossal figure of Godfrey of Bouillon on horseback, raising the banner with which he led the Crusaders to the Holy Land. Cast in plaster from the original in bronze, which is placed in the Place Royale at Brussels.

In this work the expression of the head is full of life and animation, the action very emphatic, the execution very careful. To compensate for the optical diminution which causes statues placed in the open air to appear meagre and deficient in mass, the artist has in this group exaggerated the forms both of the warrior and the horse. This departure from nature has perhaps been carried too far, and the principles of Plastic Art have been thus lost sight of in the treatment of the surfaces. It may also be remarked that in the side view the form of the horse presents two lines which are too parallel, and by no means happy.

In his group representing Truth trampling on Falsehood, the same artist has shown power in the representation of delicate feminine forms, and the work is carefully executed. The subject, however, is not indicated with sufficient clearness. Two figures of boys, one of whom is crying over his broken drum, prove that M. Simonis has also been successful in that class of subjects called "genre," and which are altogether treated in a Realistic manner. Prize Medal.

C. A. Fraikin, of Schaerbeck, near Brussels (465, p. 1166). A figure of Psyche moving lightly forward, and bearing a Cupid on her shoulders. The motive of this figure is spirited, the forms are expressed with great tenderness, and the group presents attractions from several points of view. There is, however, in the movement of the head of Psyche something affected, and in the style of Canova. Prize Medal. (465, p. 213.)

G. Geefs, of Schaerbeck, near Brussels (466, p. 1166). A group, in which the power of beauty over savage nature is allegorically represented by a lion, who is allowing his claws to be cut by a pretty undraped female figure. This work, of which a cast is exhibited in plaster, is very carefully executed as a whole; the forms of the female figure are very pleasing, though the treatment is rather too soft.

The bust of His Majesty the King of the Belgians, exhibited by the same artist, is very spirited, and is carefully executed. Prize Medal. (466, p. 213.)

J. Tuerlinckx, of Malines (456, p. 1165). A figure, in marble, representing the celebrated Giotto when a boy, looking at his first drawing with an expression of joy. The conception of this work is very spirited, and it is carefully executed. Prize Medal.

C. Geerts, of Louvain (450, p. 1165). This artist, the most distinguished for wood-carving in Belgium, executed the carvings for the new stalls in Antwerp Cathedral. His chief contribution to the Exhibition is a "Coronation of the Virgin," executed in wood. In this work the artist shows a great knowledge of the Gothic style in the motive of the figures, the expression of the heads, and the manner in which the folds of the drapery are disposed. There is, however, somewhat too much of systematic uniformity in the character of the heads and drapery. Prize Medal.

Joseph Geefs, of Antwerp (451, p. 1165). "The Faithful Messenger." In the work so entitled the sculptor has represented a dove perching on the shoulder of a young girl, to whom it has returned. This statue is very pleasing, but is hardly a work of sufficient consequence to give an idea of the distinguished merits of this artist. Honourable Mention.

J. Jaquet, of Schaerbeck, near Brussels (461, p. 1165). A group, in plaster, of Cupid asking Venus to restore his bow, which she has taken from him. This work is pleasing, though somewhat affected in motive. The execution is careful, though the development of the muscles, particularly on the back and shoulders, is too strong. Honourable Mention.

Sculpture on a small Scale.—Medals.

L. J. Hart, of Brussels (441, p. 1165). Thirty-nine Medals, among which a portrait of Rubens may be particularly noticed. These works show very considerable skill in the class of art in which they are executed. Honourable Mention.

C. Jehotte, of Liège (447, p. 1165). A series of Medals by this artist are also skilfully executed. Honourable Mention.

B. Graphic Representations on Plane Surfaces.

Inlaid Works in Metal.

J. Falloise, of Liège (384, p. 1163). A shield, some drinking cups, a vase, an armlet, all in steel, inlaid with silver. The masterly execution, refined taste, and correct style shown in these works, place M. Falloise in the first rank in the class of Workers in Metal. Prize Medal. (Awarded Prize Medal, Class XXIII.)

SWITZERLAND.

J. Leemann, of Zürich, a bookbinder (257, p. 1282). The model of the Cathedral of Strasburg, executed in cardboard with a penknife. This model deserves special notice, on account of the correctness of the proportions, and the labour and dexterity shown in the execution. Honourable Mention. (Awarded Prize Medal, Class VII.)

J. Leemann, of Berne* (258, p. 1283). The model of the beautiful Fountain at Nuremberg, executed in wood with the utmost truth of detail. Honourable Mention.

SPAIN.

Inlaid Works.

(*a.*) In Wood.

Perez and Co. (271a, p. 1346.) A manufactory for inlaying wood at Barcelona. A table-top, inlaid with a variety of ornaments, in the centre of which are the Royal Arms of Great Britain. The patterns, with a few exceptions, are in admirable taste, the colouring exquisite throughout, the execution of extraordinary fineness, the most minute particles of wood being employed to express the faintest gradations of colour. Altogether this is a work of the highest rank in its class. Prize Medal.

(*b.*) In Metal.

E. Zuloaga (264 and 264a, p. 1346). The proprietor of an establishment at Madrid for works in metal, from which were exhibited various specimens executed in iron, inlaid with gold and silver, and ornamented with reliefs.

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* It has been already pointed out, in the Report of Mr. Panizzi, that the model of the Fountain of Nuremberg is executed by the same artist as the model of Strasburg Cathedral, which precedes it.

These works are of rare excellence in every respect, both as regards the taste of the patterns and the artistic style of the execution. Among the most remarkable are a chest, worthy to receive the muniments of the proud nobility of Castile, two pairs of pistols, a couteau de chasse, and a sabre. Honourable Mention. (Awarded Prize Medal, Class XXIII.)

The Royal Ordnance Manufactory of Toledo (266, p. 1346) exhibits a number of works inlaid in the same manner, among which may be particularly noticed a dagger. Honourable Mention.

DENMARK.

Sculpture on a large Scale.

It was for this country that the great Thorwaldsen embodied his spiritual conceptions in such a number of masterpieces of sculpture, and there are not wanting in Denmark at the present day distinguished sculptors who follow in his footsteps with greater or less success.

J. A. Jerichau, of Copenhagen (39, p. 1359, and see Illustration). Group of a Panther and Hunter. The animal has fastened on the hunter as he is carrying off one of her cubs; he is about to pierce her with his spear. This group is full of life, and finely conceived; the execution shows great knowledge, and careful minute labour in the details. It should, however, be noticed that the artist has missed the true proportions in the legs of the hunter, which are too short.

Another group by the same artist, "Eve after the Fall," leaning on the seated figure of Adam, has great merit. Equal praise is due to him for a bas-relief intended to form part of a frieze; a drawing of the whole design gives a very favourable impression of it. Prize Medal.

H. W. Bissen, of Copenhagen (38, p. 1358). A figure of Orestes in rapid movement, and brandishing a sword. In this work the conception is full of life, and the momentary character of the action well rendered; the expression of the countenance is noble, the execution careful. Honourable Mention.

Sculpture on a small Scale.

C. G. Klingsey, of Copenhagen (34, p. 1358). A jewel casket in ivory, ornamented with reliefs, after celebrated works by Thorwaldsen. The artist has shown a highly cultivated taste and correct feeling for style, not only in the general form of this casket, but in the adaptation of the reliefs to so small a scale, and in the architectural ornaments. This work is also to be especially commended on account of the great care shown in its execution. Honourable Mention.

RUSSIA.

It is to be regretted that Russia has contributed to the Exhibition no specimen of sculpture on a large scale, although we could here mention two distinguished Russian names, that of R. M. Von Launitz, now residing at Frankfort, a sculptor full of talent; and the well-known Baron Kloth, of St. Petersburg, who, in the representation of horses studied from the life, is one of the most distinguished artists of modern times. His groups of horses, with their trainers, at St. Petersburg and Berlin, may be cited in proof of his merits.

Count **Tolstoy**, President of the Royal Academy of Arts at St. Petersburg (328, p. 1381), exhibits plaster casts of a series of medallions, on which are represented in relief the incidents of the successful war carried on by Russia against France, from 1813 to 1814. These works are well known to all connoisseurs, and deserve notice on account of the invention shown in the designs, some of which are very happy; the execution is also careful. Honourable Mention.

N. Korniloff (318, p. 1376), a painter in the Imperial Porcelain Manufactory of St. Petersburg, exhibits a copy of a landscape with cows, by Berghem, in which the characteristics of this master, both in form and colour, are rendered with remarkable truth and admirable execution of the details. Prize Medal.

Lithochromy.

F. Dreger, of Moscow (362, p. 1383), for an illustrated work, in which furniture and other examples of mediæval decoration are represented in a very masterly manner. Honourable Mention.

It is to be regretted that so distinguished an artist as Fogelberg, now living at Rome, did not contribute any work to the Exhibition on behalf of the school of his native country, Sweden; and that, in like manner, the Netherlands were not represented by Roger, the Director of the Academy of Art at Amsterdam, an admirable sculptor in the Realistic style. The works of both these artists would have shown the great excellence of the respective schools of sculpture to which they belong.

THE UNITED STATES OF AMERICA.

The American States, which in the course of a few generations have established so vast a scheme of municipal and political institutions, have attained to great perfection in many branches of industry, and are now beginning to turn their attention to the sciences, and also to those arts which minister to the spiritual rather than the animal wants of man, and which have for their high purpose the investigation of truth, and the expression of beauty through form.

All who have truly at heart the advancement of civilization, and regard it as the common good of mankind, must sincerely rejoice at the success which has attended this new movement of the American mind.

Sculpture on a large Scale.

Several natives of the United States may be mentioned who have attained proficiency in this difficult branch of art, which cannot be acquired without a certain course of training. I am acquainted with the works of two American sculptors, Greenough and Hiram Powers, of whom the latter alone contributed to the Exhibition, and was only represented there by two specimens of his works:—1. The Greek Slave (522, p. 1467). In this work a youthful creature of very delicate form is represented in marble. The figure is studied from the life, and exhibits an extraordinary refinement of imitation. The treatment of the back, especially, is one of the happiest efforts in modern sculpture. It should be noted, however, that the manner in which the right hand of this figure is made to lean on the trunk of a tree, while at the same time the real support of the body is on the left leg, gives an appearance of uncertainty to the motion of the whole figure, and deprives it of that charm of contrast which the sculptors of antiquity imparted to their statues by throwing the weight of the figure decidedly on one side, so as to leave the other side free. It may be added, that the expression of gentle endurance and resignation which characterizes the head, by no means serves to indicate the subject represented by this figure; the sculptor has therefore been obliged to have recourse to the symbol of the marble chain, to justify more fully the title which he has given to this work. 2. A Fisher Boy, listening attentively to the murmur of a shell (548, p. 1468). A youthful refined figure, sculptured in marble; the execution is careful, but not equal to that of the Greek Slave. Prize Medal.

FINE ART CASTING.

The art of casting sculpture in different metals is obviously of the greatest importance for the diffusion of the finest works. I should not be therefore justified were I to pass over the specimens of Fine Art casting in the Exhibition, though these have been already examined and rewarded by the Jury of Class XXII.

The following artists and directors of foundries may be particularly noticed:—

(a.) *Castings in Bronze.*

England. The **Coalbrookdale Company**, in Shropshire (pp. 659-661). The cast of Bell's figure of the Eagle-slayer shows great perfection, both in the casting and subsequent tooling.

J. A. Hatfield, of London (135, p. 829). "Foley's Youth at the Stream." This work is deserving of notice, as a remarkable specimen of casting.

Zollverein. The foundry of Count G. **Einsiedel**, of Lauchhammer in Prussian Saxony (1 Zollverein, 762, p. 1092), exhibits a great number of large and important specimens of casting. Among them may be especially noticed the figure of a Girl at the Fountain, by Wichmann, a very good example of casting and tooling.

Friebel (1 Zollverein, 289, p. 1066). This artist has executed, at Berlin, the whole of the casts of Rauch's monument of Frederick the Great. A Newfoundland Dog, after a model by Moller, and remarkably well cast and tooled, and a number of smaller figures were exhibited by this artist.

C. U. **Fischer**, of Berlin (1 Zollverein, 296, p. 1066). This artist also exhibited a great number of casts, among which may be especially noticed an Eagle, and a Danaid, after Rauch.

Kesler, of Greiswald (1 Zollverein, 299, p. 1066). The figure of the Muse Polyhymnia, in the Royal Museum at Berlin; a very successful specimen of raw casting.

Miller, director of the celebrated Royal Bronze Foundry at Munich (2 Zollverein, 90, p. 1102), an establishment which has accomplished much under his management, and which, under its late director, Stiglmayer, had already produced such an abundance of castings, and on so colossal a scale.

Those executed by Miller are the Lion, which has been already noticed in this Report, and the two noble figures by Schwanthaler, the first of these being a specimen of raw casting, and the two figures being tooled.

These works are most admirable for the sharpness and clearness of the casting, and also for the beautiful subdued colour of the bronze.

France. **Eck** and **Durant**, of Paris (1211, p. 1235). The Dancing Satyr, by Lequesne; an excellent cast, well tooled.

Quesnel, of Paris. The Venus and Cupid, by Pradier, and the group of a Hunter killing a Stag, by Jean Debay, are also well worthy of notice.

Simons and **Sons**, of Paris (460, p. 1200). The bust of a Negro, by Cordier; a masterly specimen both of casting and tooling.

(*b.*) *Castings in Zinc.*

Zollverein. M. **Geiss**, of Berlin (1 Zollv., 267, 279, pp. 1063-65). In the establishment of this artist the casting of zinc has been brought to remarkable perfection, and works of sculpture, of a colossal and of the smallest scale, as well as architectural ornaments of the most refined taste, have been reproduced in this material.

By a process recently introduced, copper is deposited on the zinc by galvanic action; a bronze surface is thus produced, which is as beautiful as it is durable. The Exhibition contained the following admirable examples of the casting of this establishment:—The Amazon, by Kiss; the Hebe, by Canova; the Boy with the Swan, by Kalide; Baily's Eve; the celebrated figure in the Glyptothek at Munich, known as the "Ilioneus," or the "Niobid;" two Stags, by Rauch; also a Corinthian and an Ionic Capital.

I am of opinion that the Council Medal was quite as fully deserved by this establishment as by that of the "Vieille Montagne."

Sp. Devaranne and **Son** (p. 1085). This firm has also brought the art of casting in zinc to great perfection, and exhibited a number of works of the same kind as those contributed by Geiss.

Out of this great collection the following may be mentioned as most worthy of notice: the Venus, by Canova; a Lion and a Panther, life-size; and the Danaid, by Rauch.

Belgium. The establishment called "La Vieille Montagne," in Belgium (pp. 161 and 1152), which has produced a number of zinc castings of remarkable excellence, has exhibited one most masterly specimen, Her Majesty Queen Victoria, seated on her throne.

(*c.*) *Castings in Iron.*

England. The **Coalbrookdale Company** (641, Class XXII., p. 659). A very successful cast of Bell's Eagle-slayer.

Zollverein. The **Royal Iron Foundry of Berlin** (1 Zollv., 271, p. 1061). The great importance of this establishment has been already pointed out in the notice of the several specimens exhibited by it. The process of Galvanoplastic deposit may be here also noticed, as another mode by which sculpture may be reproduced with accuracy, and at a reasonable cost.

Julius Winckelmann (1 Zollv., 282, p. 1065), proprietor of a Galvanoplastic establishment in Berlin. The statue of Frederick William II., Elector of Brandenburg. This work is very remarkable on account of the great sharpness of the forms.

C. WAAGEN, Reporter.

November 1851.

CLASS XXX.

SUPPLEMENTARY REPORT ON DESIGN.

By RICHARD REDGRAVE, R.A.

[The figures after the Names (between parentheses) refer to the Exhibitors' Numbers and to the Pages in the Official Descriptive and Illustrated Catalogue.]

It was the original intention of Her Majesty's Commissioners that all exhibited "Designs" should be referred to the consideration of the Juries of the respective classes, to whose award the *fabrics* to which such designs were applied, or intended to be applied, were submitted. It was subsequently determined that it would be more advisable that this duty should be undertaken by the Jurors of Class XXX., assisted by associated Jurors from the various classes of manufactures designed for. The awards on Design will therefore be found among those of the Jury of Class XXX.

With a view to the permanent record of the opinions formed on the careful examination entailed by their duty, Her Majesty's Commissioners directed a Report to be drawn up by one of the members of the Jury, which should not be limited to the merits of the "Designs" exhibited, but should have regard to the general state of design as applied to the various fabrics and manufactures in the Great Exhibition.

Such then are the objects to be embraced in this Report, and they form an extensive and onerous duty to be fulfilled by any one individual. When the varied applications of design and ornamental decoration called for by the different uses, materials, and modes of manufacture are considered, and the vast multitude of objects to which they are applied (all more or less requiring examination), the task of the Reporter will be seen to be one of great difficulty and labour, in the execution of which he trusts peculiar indulgence may be claimed.

The desire evinced by the rudest as well as the most civilized nations for the decoration of their buildings, utensils, and clothing, almost raises ornament into a natural want, and must render its proper application of the utmost consequence to the manufacturer, since upon it the value of his manufactures in the various markets of the world greatly depends. It can hardly be possible, therefore, that any one should doubt, on the present occasion, the importance of a careful review of the union of design and ornament to manufacturing skill, since all that the inventive powers, the fancy, and the handicraft of man can do, has this year been gathered into one place, and the world been invited to consider and examine it. But without some critical guidance, some judicial canons, or some careful separation of the meretricious from the beautiful, it is to be feared that the public taste will rather be vitiated than improved by an examination of the Exhibition, as it will readily be allowed that the mass of ornament applied to the works therein exhibited is of the former character, and from that very cause more likely to impose on the uninformed taste of the multitude than the simpler qualities of real excellence to impress us with a just sense of their worth. Such considerations were, doubtless, among the reasons which influenced the determination of the Royal Commissioners on this subject.

We have spoken of design and of ornamental decoration. These are two essentially different things, and it is highly necessary that they should, from the first, be considered as separate and distinct. "Design" has reference to the construction of any work both for use and beauty, and therefore includes its ornamentation also. "Ornament" is merely the decoration of a thing constructed.

Ornament is thus necessarily limited, for, so defined, it cannot be other than secondary, and must not usurp a principal place; if it do so, the object is no longer a work ornamented, but is degraded into a mere *ornament*. Now the great tendency of the present time is to reverse this rule; indeed it is impossible to examine the works of the Great Exhibition, without seeing how often utility and construction are made secondary to decoration. In fact, when commencing a design, designers are too apt to think of ornament before construction, and, as has been said in connexion with the nobler art of architecture, rather to construct ornament than to ornament construction. This, on the slightest examination, will be found to be the leading error in the Exhibition, an error more or less apparent in every department of manufacture connected with ornament, which is apt to sicken us of decoration, and leads us to admire those objects of absolute utility (the machines and utensils of various kinds), where use is so paramount that ornament is repudiated, and, fitness of purpose being the end sought, a noble simplicity is the result.

The primary consideration of construction is so necessary to pure design, that it almost follows that, whenever style and ornament are debased, construction will be found to have been first disregarded; and that those styles which are considered the purest, and the best periods of those styles, are just those wherein constructive utility has been rightly understood and most thoroughly attended to. A dissertation upon difference of styles would be out of place in this Report, as well as an expressed preference for any particular one, since each, doubtless, contains some qualities of beauty or excellence which will justify its use when restrained and regulated by fixed principles. It may not, however, be improper to illustrate by a few remarks the opinion expressed above, since it involves important principles connected with a proper consideration of works coming within the scope of the Report.

To begin with the ecclesiastical architecture of the middle ages: when the style was purest, the construction was most scientific, the arches were best formed for resistance, the groining elevated and simple, the ornament modest and applied to the forms of construction only. As the style progressed with time, it departed from its primitive simplicity: it became more ornamental, it is true, but at the sacrifice of some of its constructive truth: the use of the arch was partly obscured by its being placed under an horizontal arrangement, and supported by perpendicular mullions, and it was gradually flattened to the worst form for sustaining pressure. The groining, at first simple, became a most elaborate system of reticula ion, by its numerous lines reducing the apparent height of the roof, to the entire loss of the sublime effect produced by its elevation and simple groining in the earlier period. At the same time the enormous pendants seemed ready to fall on the heads of the beholder, and to bring with them the flattened arch of which they were the key-stones. The exterior was everywhere decorated, effecting the ruin of the building by the dust and moss which this humid climate soon engendered. In its last period, decoration could be carried no further, and Gothic architecture, which had grown into glory and beauty, from its just and scientific construction, was thrown aside when a florid ornamentation had taken the place of constructive truth. It was succeeded in this country by the Tudor style, a modification of the Renaissance. The Renaissance itself arose mainly from the study of Roman remains, and those often of the worst period of the Empire, when Greek science, skill, and pure taste had fallen before Roman magnificence and barbarism, and before modern discoveries had opened up the Athenian treasures of Greek art. It was introduced, however, by men of enlarged minds, most of them great constructive architects, and by them it was constructively adapted; they embodied in it many of the just principles of the ancient styles; and if the stream of tradition had brought down much rubbish as well as treasure, still the master minds of the fifteenth century gradually separated them, and applied with unrivalled skill and a fertile fancy what was beautiful and good. It was, however, essentially pagan in all its details, and its ornament conveyed no symbolic truths to the hearts of men. In the hands of less skilful masters it soon became decoration without a pervading spirit, ornament merely used as ornament, without propriety as without meaning; and thus, as the Tudor style, it succeeded in this country to the Gothic, that style dying out, partly from the causes above stated, and partly from the change of feeling consequent on the reformed opinions which then prevailed. This debased form of the Renaissance, in its decoration, had already cast off all constructive truth and consistency: much that was bad in the late style was retained and mixed with it; whatever was good was as certainly forgotten. Columns were reversed, the heavy and broad part being upwards, the small part below; they swelled alternately into enormous bands, and were contracted into severing rings, and sometimes they stood upon balls to give a further sense of insecurity. Terminal figures were introduced which had the weight of their entablatures borne on baskets of imitative fruits or flowers. The covering pediments were broken, contrary to all constructive application, or were placed successively one within another: entablatures were enlarged out of all proportion to the supporting columns; and the useful was superseded by the ornamental.

In France first, and afterwards in all the countries of Europe, the Renaissance was degraded into the style known as that of Louis Quatorze. In all that this style differed from the true Renaissance, it differed merely as arising out of decoration. As a style it never had a commencement in construction, as the Gothic and Renaissance had, both of which were founded on an architectural basis; *this* sprang from the love of the Grand Monarque for magnificence and display. In it, all that was constructively true was disregarded utterly and systematically; thus supports became curved and broken in line exactly where they require strength, bearing-rails were severed in the centre where the greatest bearing is, the union of horizontal and perpendicular forms was suppressed, styles and rails as far as possible hidden, veneers applied with the grain across the framing, and every effort of invention strained, not to decorate the due constructive truth of things, but utterly to hide and abolish construction altogether. The ruling principle of the style, as far as it can be said to have had one, was the avoidance of symmetry, and the search after variety by every possible means: for this reason, central forms had dissymmetrical sides, and the most unequal division of parts was the rule of composition. Nevertheless for the purpose which called it forth, for mere magnificence and display, it was admirably adapted, being one of the most suitable styles for the display of gilding, and for brilliancy and sparkle in metal and ormolu work, showy and glittering beyond anything attainable in the simpler forms of the Renaissance or of classic antiquity. From these qualities it has long maintained its hold on the public taste; and its florid and gorgeous tinsel still prevails in three-fourths of the works of the Great Exhibition, notwithstanding its gross contempt of constructive principles.

The ornament of past ages is the *tradition* of the ornamentist, and tradition ever hands down to us things good and bad, both equally consecrated to most minds by the authority of time. But a moment's reflection will show how necessary it is to discriminate before receiving anything on such authority. A church or temple built in a rude age remains undisturbed by some happy chance, a villa or a theatre in a remote provincial town escapes the fatalities of accident or time, some tomb is opened, some overwhelmed city exhumed from the *débris* of ruin that had gathered over it. The ornamental details found therein are copied and illustrated by the notes of antiquarians, or published in the proceedings of learned societies, and are at once regarded as authorities for imitation, it being forgotten that they were perhaps the works of obscure provincial artists, of a barbarous age perchance, or of a people with whom *art*, no longer studied for its principles, had ceased to progress or had rapidly declined.

Such traditional ornament moreover had or had not a local use, a consistent application to domestic, ecclesiastical, or funeral purposes, in fact a local symbolism; but even if it had, this, mostly overlooked, is sure to be soon disregarded; and not only have we ornament of a degraded period, of a declining age, or by inferior artists, but to this must be added, that its symbolic life is totally extinct, and, perhaps, fortunately so, for when revived it is indiscriminately, for purposes totally at variance with its first application and original intent. Moreover, the ornament suited for one material is misapplied to a material different from that for which it was designed. Thus ornament originally carved in stone is used for metal or for wood, or, worse still, for carpets or for dresses. That which was intended to be carved in relief is imitated as the inlay of a floor or the hanging of a wall, and senseless anomalies of all kinds speedily arise from undue reverence for and indiscriminate use of traditional ornament. That this is no forced view of things a glance at the Exhibition will at once show, wherein are to be seen the sacred vessels of the church imitated for secular purposes; the funeral urns of the Greek revived as drinking-vessels for the table; the columns of temples turned into candlesticks, and sarcophagi into wine-coolers; while the decorations of ceilings are applied to carpets, and the carved frieze of an Ionic temple to a muslin curtain: all these errors arising from the indiscriminating use of those materials with which antiquity has supplied us.

Ornamentists may fairly be divided into two classes: the traditional, who superstitiously reverence the remains of past ages and are wedded in practice to existing styles; and those who despise the past and feel themselves at liberty to adopt from the abundant sources of nature a mode and manner for themselves, without regard to the works of their predecessors. The first class simply seek to follow where precedent leads them, and to be able to claim the sanction of authority for their works. These, even when taste duly regulates their choice, are men of limited ideas and small progress. Those of the second class, who pay no deference to authority, who think that ornament is governed by no laws, and who see no principles by which they are to be guided, are little likely to raise the art to the level of past times, and, still less, to advance its aim and widen its scope. The true ornamentist would seem to be one who seeks out the *principles* on which the by-gone artists worked, and the rules by which they arrived at excellence, and, discarding mere imitation and reproduction of details, endeavours, by the application of new ideas and new matter on *principles* which he believes to be sound, or which time and the assent of other minds has approved to be fundamental, to attain originality through fitness and truth. The antiquarian ornamentist, however, will always have a certain reputation, and justly, if he has the taste to select what is best from the great masters of past times. In any case the critic must be bold who speaks against the authority of the fathers of the art; and praise is safe when great names are on the side of the critic. From this class of ornamentists we may at least demand purity of style, that marked eras should be kept distinct, and that the adopted ornament should be fitly applied to fabrics or manufactures of the like nature, and, as far as possible, for the like uses, as those for which the ornament was first designed.

From the labours of the second class of ornamentists, united to that constant search after novelty at any sacrifice of true taste for which manufacturers are so constantly urgent, there has arisen a new species of ornament of the most objectionable kind, which it is desirable at once to deprecate on account of its complete departure from just taste and true principles. This may be called the *natural* or merely imitative style, and it is seen in its worst development in some of the articles of form.

Thus we have metal *imitations* of plants and flowers, with an attempt to make them a strict resemblance, forgetting that natural objects are rendered into ornament by subordinating the details to the general idea, and that the endeavour ought to be to seize the simplest expression of a thing rather than to imitate it. This is the case with fine art also: in *its* highest effort mere imitation is an error and an impertinence, and true ornamental art is even more opposed to the merely imitative treatment now so largely adopted. Let any one examine floral or foliated ornament produced in metal by electrotyping the natural object, whereby every venation and striation of the plant is reproduced, and compare it with a well and simply modelled treatment, where only the general features of the form are given and all the minutest details purposely omitted; and if this latter has been done with a true sense of the characteristics of the plant, the meanness and littleness of the one mode will be perfectly evident, compared with the larger manner of the other. But this imitative style is carried much further: or-molu stems and leaves bear porcelain flowers painted to imitate nature, and candles are made to rise out of tulips and China asters, while gas jets gush forth from opal Arums. Stems, bearing flowers for various uses, arise from groups of metal leaves standing tiptoe on their points, and every constructive truth, and just adaptation to use, is disregarded for a senseless imitative naturalism. In the same way, and doubtless supported by great authority, past and present, enormous wreaths of flowers, fish, game, fruits, &c., imitated *à merveille*, dangle round sideboards, beds, and picture-frames. Glass is tortured out of its true quality to make it into the cup of a lily or an anemone: not that we may be supposed to drink nectar from the flower, but that novelty may catch those for whom good taste is not piquant enough, and chaste forms not sufficiently showy. In fabrics where flatness would seem most essential, this imitative treatment is often carried to the greatest excess; and carpets are ornamented with water-lilies floating on their natural bed, with fruits and flowers poured forth in overwhelming abundance in all the glory of their shades and hues; or we are startled by a lion at our hearth, or a leopard on our rug, his spotted coat imitated even to its relief as well as to its colour, while palm-trees and landscapes are used as the ornaments of muslin curtains. Though far from saying that imitative ornament is not sometimes allowable, still it will at once be felt that the manner wants a determined regulation to exclude it in most of the above-mentioned cases from all works aspiring to be considered in just taste, and to leave it to be adopted by those only who think novelty better than chaste design, and show preferable to truth.

The constant search after novelty has just been alluded to as one of the sources of bad taste in modern ornament. Manufacturers are eager to obtain it at any sacrifice of truth and at any cost. The efforts of those past ages, when taste was most indisputable, appear to have been directed rather to the continually perfecting and refining their designs and inventions, than to creating new ones. Thus in architecture the robust simplicity and grandeur of the Doric order remained unchanged from age to age, architect after architect striving only to perfect its just proportions and the symmetry of its parts, rather than to add any novelty of feature or ornament, until, in the Parthenon, it seems to have arrived at the most perfect development that taste, science, and art could unitedly effect. Even among the more voluptuous inhabitants of Asia Minor, at least until the age when their artists became servants and panderers to the coarser magnificence of Rome, the details of ornamentation were few, and those universally received. The volute, the acanthus, the anthemion, the echinus, and a few frets and guilloches, seemed to pass the ordeal of criticism, not that they might be rejected for more novel treatments, but that the symmetry of their parts might be more justly balanced, the commoner curves rejected for those more varied, beautiful, and refined, and the true import given to their projections. Proportion and symmetry being thus sought after instead of novelty, their ornament has come down to us with authority like that of Scripture, rather than of tradition, and all the after efforts of artists, who have adopted and adapted it, have failed to improve its elegance, or to add to its beauty. Even in the eastern nations we find the same usage prevail; and to this day Indian ornament is composed of the same forms as it was in the earliest known works: the principles that governed ornamental practice in those works seem still to be a tradition with the artist and the workman, and still to produce the same beautiful results, as is abundantly seen in the fabrics and tissues of the Indian department in the Great Exhibition. Now, however, our efforts are of an entirely different nature, and the hunger after novelty is quite insatiable; heaven and earth are racked for novel inventions, and happy is the man who lights upon something, however *outré*, that shall strike the vulgar mind, and obtain the "run of the season." Such patterns as often result from the caprice of accident as from any effort of thought—witness what is called the diorama pattern in cotton printing, which was very popular, yet was the result of an accidental folding of the stuff on the cylinder in printing. Accepted for the season, these fantasies no sooner pass away than the world wonders how it could ever have looked upon them with satisfaction, or tolerated for an instant such solecisms in taste, such strange incongruities, or gross absurdities.

The ornament of past ages was chiefly the offspring of handicraft labour, that of the present age is of the engine and the machine. This great difference in the mode of production causes a like difference in the results. In old times the artist was at once designer, ornamentist, and craftsman, and to him was indifferent the use of the pencil or the brush, of the hammer, the chisel, or the punch: his hand and his mind wrought together, not only in the design, but in every stage of its completion, and thus there entered a portion of that mind into every minute detail, and into every stage of finish, and many a beautiful after-thought was embodied by the hand of the "cunning artificer," many a grace added to the work by his mastery and skill. He worked, not to produce a rigid sameness, but as Nature works:—she produces nothing exactly similar to its fellow, in every turn of every stage of growth, in every flower, and in every leaf, adding a changing grace, a differing beauty; so he varied his labours with every feeling of his overflowing mind. But this is not possible with the stamp, the mould, the press, and the die, the ornamental agents of our days: after the type or model is made, all the products are rigidly the same, whence arises a sickening monotony, a tiresome sameness, unknown in the works of nature and peculiar to these artificial works of man: the varying mind has no share in their production, and man himself becomes only the servant of the machine.

Moreover, the old ornamentist worked generally from feelings of piety, from love of his labours, or from the desire of fame, motives hardly known to the artist of this class in our days, at least in this country. Who seeks fame from the ephemera of a season? Who loves a labour that is so soon to pass away? Who cares for a work that is not to be the child of his own hand, but to be produced in thousands by the aid of machinery? The toil of him of old times was spent upon the thing itself, and not upon a mere model for it: the chalice, the cup, the lock and key, the reliquary, were to be without repetition, and without rivals: he sought to give them their highest excellence, and, labouring from one of the feelings we have described, threw his whole soul into his work, so that it became a thing for future ages to look upon and to prize. Not that handicraft or art-workmanship is utterly excluded from our manufactures; it is only partially so, making more painfully evident how greatly ornamental art has suffered from its new union with machinery. Wherever ornament is wholly effected by machinery, it is certainly the most degraded in style and execution; and the best workmanship and the best taste are to be found in those manufactures and fabrics wherein handicraft is entirely or partially the means of producing the ornament, as in china and glass, in works in the precious metals, carving, &c. This partly arises from the facilities which machinery gives to the manufacturer, enabling him to produce the florid and overloaded as cheaply as the simple forms, and thus to satisfy the larger market for the multitude, who desire quantity rather than quality, and value a thing the more, the more it is ornamented. This state of modern manufacture, whereby ornament is multiplied without limit from a given model, by the machine or the mould, ought at least to awaken in the manufacturer a sense of the importance of the first design. One would think that what was to be produced by thousands and tens of thousands should at least be a work of beauty, and no pains be spared to insure its excellence. The cost of the first design or model must in such a case be a mere atom when divided among its myriad prototypes. It would seem strange, too, that any one could be found to throw away great expense upon dies and moulds, to carry out a design which in itself was hardly thought worth paying for. Yet often in this country artists are paid little better than workmen, and a belief seems to prevail, that knowledge, skill, and taste come by nature: the artist has often no interest in the result of his labours, his name is unknown, his pay is niggardly, and what there may be of beauty and excellence in his work is often spoiled by the alterations of the manufacturer, who makes no scruple of setting his own taste above that of the artist, and altering and changing a design at his sole pleasure. In France, and some parts of Germany, where taste has long been cultivated, and the value of ornamental design is better understood, these relations are better understood also; and in this country, if good taste is to prevail, the manufacturer must learn to appreciate more highly the value of the designer's labours, must seek to foster his talents and stimulate his *amour propre*. Society also must be prepared to contribute more largely than heretofore to public education in ornamental art, and taste must be disseminated by every available means; for it is not only truth, but a truth that should be told, that, notwithstanding our skilful workmanship and our excellent manufacture of most fabrics, we are sadly behind in the design applied to them, and greatly indebted to foreign artists even for what little is good. Moreover our greatest difficulty consists even less in the want of designers than of skilled art-workmen to carry out designs. A design for cotton printing may be spoiled by the "putter-on," or for silk by him who prepares it for the loom. The sculptor may design a statuette, but there are few able to chase the bronze, or to retouch the clay, or to unite the parts when they come forth from the mould. Even where such are found, they are mostly men of slow minds, who enter little into the spirit of the artist's labours, and who work without feeling as without fire. We find plenty of chasers able to imitate the fur of animals, or the texture of draperies, but few who understand the bones and the anatomy of the parts, and fewer still who carry an artist's spirit into their works. In painting, also, the painter on glass and china is generally a mere copyist, or he works too entirely by rote, and without feeling. The lily and the rose which he paints are always the same lily and the same rose, a work of the hand and eye, in which the mind has no share. There are honourable exceptions, no doubt, but with the many art is a mere handicraft. In France, in Germany, in Bavaria, in Italy, this is not the case. There the artist often carries out his own design, and, where he does not, has always at hand a band of skilled art-workmen to embody his ideas, or to complete his labours. The beautiful works in metal by Vechte, Wagner, and Weishaupt, the china paintings of Jacobber, Schilt, Ducluzeau, Haman, and a multitude of others, and the furniture carvings of Lienard, are choice examples of the above-stated truths; while the works in oxidized silver, such as seal and knife handles, paper-weights, cigar-cases, &c., exhibited by Rudolphi, with the bronzes of Méné, Pradier, and a host of other such works, show the skill, taste, and knowledge of the art-workmen of France. In France, moreover, there is a fitness and fancy pervading ornamentation; the ornament, especially where figures and animals are introduced, being specially adapted to the thing ornamented. In England the ornament designed for one work is made to do duty for twenty others: one figure truly plays many parts, and is often used with an inconceivable want of fitness. But the English public, and the English manufacturers as a body, are hardly yet awake on the question of design: Government has established schools of ornamental art in many of our large manufacturing towns for the purpose of spreading genuine taste, and educating our workmen; but they are as yet a forced product, and have hardly anywhere, after ten years of struggle, won the warm support of the local manufacturer. Even in this Great Exhibition, the question of *design* was nearly overlooked, and the works of the designer left without a place: his name was not necessarily coupled with the fabrics or manufactures his skill had designed or decorated, and his reward therefore was left to the good feeling of his employer. No special Jury was named to unite with manufacturers in the various classes in judging of the taste and art displayed in the ornamentation of their fabrics; and that art which, as we have before said, is calculated, when excellent, to raise the reputation of a nation's manufactures, was left to the judgment of those too likely to consider, not its real excellence, but what an untaught multitude would purchase and would prize. In France many large establishments have well-appointed schools attached for teaching drawing and modelling, and the rudiments of science connected with their manufactures. In Germany also, and in Italy, schools and institutions have long been in operation for the cultivation of taste in design; and it will be necessary for this country to enter seriously on the same course, if we are to maintain even our manufacturing reputation before the world.

In estimating the progress of this country in ornament and in art-workmanship as compared with the continental nations, there is one circumstance that must enter largely into consideration. In France, Germany, Italy, and Belgium, in addition to schools for teaching ornamental art, royal and national manufactories have been established for many years. In these no necessary expense is spared to bring to perfection the fabrics wrought in them, both as to the highest excellence of workmanship and materials, and to their embellishment by ornamental design. The best painters, sculptors, and designers, as well as men of the most scientific acquirements in botany, mineralogy, and chemistry, are among their professors; and the works being carried on at the public expense for the attainment of excellence, the cost of repeated failures is unheeded. In such establishments a band of skilled workmen must of necessity be trained to the ultimate benefit of the private manufacturers, and those difficulties which science had found the means of overcoming, or those new processes and new materials which it had brought to light, be spread abroad for the common advantage of all. Moreover, the sight of excellence and of the products of skilled workmanship is one of the greatest stimulants to further exertion, since all art and all manufacture arrive at perfection by gradual advance on past labours. The workman who sees the results of the skill which has produced such works in china and porcelain as are exhibited in the Sèvres room or in the hall of the Zollverein, must feel this stimulus in no mean degree. When it is remembered what one single artist did in this country for the same manufacture, and how greatly Wedgwood and his workmen were indebted to Flaxman, we can well feel what influence a band of artists of like ability, exercising their talents to improve every department of the manufacture, and of these a continued succession, would be likely to exercise over the taste and skill of those in contact with them. Nor is this all: the excellence of one fabric awakens a desire for like excellence in others, and calls forth the same spirit of emulation. It surely cannot be doubted, therefore, that the continental nations, and more especially France, in this manufacture, and through it in many others, have been largely benefited by such institutions; besides the amount of national reputation obtained by them from the display of the choice works which are therein produced.

In these remarks it is not intended to plead for the desirableness of such establishments in our own country, but only to point them out as the means whereby other nations have attained to great excellence. It is no answer to such an argument, although it is indeed true, to say that without these aids the *general* manufacture of such fabrics in Germany and France is behind our own; and that the private show of such works by **MINTON**, **COPELAND**, and others, is, both as to manufacture and design, superior to that of any private manufacturer of those countries. This may arise from various causes; but with the like advantages on our side it may well be imagined that much greater excellence would have been attained, the want of skilled art-workmen being felt and acknowledged by these manufacturers as a great hindrance to the complete success of their manufacture. Moreover, it is but fair to remember that such royal and national establishments, by the beautiful works produced in them, have added largely to the number of rewards won by other nations in this peaceful contention, and have placed at some apparent disadvantage the manufacturers and workmen of our own country. Let us hope, however, that the time is coming when England will seize eagerly every proper means of improvement. Symptoms of it are already abroad; and there seems a likelihood that the Great Exhibition of the Industry of all Nations will be valuable to all in showing short-comings as well as excellences; and to none will it be more so than to the British nation, if it awakens us to a knowledge of our deficiency in ornamental art, and to a hearty endeavour immediately to remedy it.

It has already been stated that this Report originated in the consideration of "designs." It is proper, therefore, that the works of the designer should be examined and commented on, before the manufactures to the construction or for the ornamentation of which they were intended to be applied. From the artists we have a right to expect that true taste, that scientific knowledge, and those sound principles, too often wanting in the manufactured works. The difficulties to be overcome in the various processes, or the limited resources of the manufacturer, together with the influence of the public taste on the demands of the market, *may* form some excuse for the manufacturer if his efforts are imperfect, or directed to sale rather than to excellence. But the designer has so long exclaimed against the bondage which has obliged him to please the public and the manufacturer at the sacrifice of his own better judgment, that he ought gladly to have seized on the present opportunity to exhibit a faith and practice of his own. Now at least he was at liberty to appeal to the few, and, untrammelled by any conditions, to exhibit his own powers, his own knowledge, taste, and better judgment, to lead men to the appreciation of the simple and the chaste as the true source of the beautiful. Another reason for commencing with the examination of the works of the artists was, that if the stream was pure at the fountain, the blame would justly lie with those who afterwards defiled it; or, in plain words, if the designer were proved to have set a good example in his works, false taste, where found, might be placed at the door of the manufacturer; while, on the contrary, some allowance might be made for him if the authorized teacher were wanting in taste and true principles.

Before proceeding with the subject, however, it is necessary to arrange, under some general heads, the various works of the designer, and applications of design, which are to form the subject of this Report. The largeness of the field must be an excuse, if many combinations of design and manufacture are entirely overlooked, others very slightly alluded to, and all imperfectly considered. The many thousand specific applications of design, and the large number of classes and sub-classes into which the labours of the designer enter, render it impossible, in the time and space allotted for such a Report, to give more than a general *résumé* of the subject. The attempt, therefore, has rather been to arrive at general principles than to enter upon the examination of individual objects. At the same time, the principles that are found to guide the designer for one fabric are often so self-evidently applicable to others, that, even thus generalized, the Report has reference to numerous manufactures which have not been specially considered, and to many individual cases that do not range exactly under any one of the heads named in it.

The method adopted has been to declare the general principles, as far as they can be arrived at, which ought to govern the design and ornamentation of any fabric, to indicate prevailing errors and false taste, and to allude sparingly to such works of merit as seem wholly or largely composed with good taste and on sound principles.

The proposed classification divides itself under four general heads:—Decoration of Buildings—Domestic and other Furniture—Domestic Utensils and objects of Personal Use—Garment Fabrics.

The general heads will be again subdivided as follows:—

1. Decoration of buildings, consisting of—
    1st. Architectural decorations, painted, &c.
    2nd. Stone, carved wood, terra cotta, carton-pierre, and other relief decorations.
    3rd. Stained glass.
    4th. Inlaid floors, mosaic pavement, inlaid tiles, &c.
    5th. Paper and other hangings.
    6th. Metal-work.
2. Domestic and other furniture, including cabinet-work of all kinds, and furniture of all materials—
    1st. Stoves, grates, fenders, lamps, gas-fittings, and other hardware.
    2nd. Carpets, portières, table-covers, and floor-cloths.
    3rd. Curtains and hangings.
    4th. Table-linen.
3. Domestic utensils and objects of personal use—
    1st. Porcelain, pottery, &c.
    2nd. Table and ornamental glass.
    3rd. Works in the precious metals and jewellery, clocks, &c.
    4th. Bookbinding.
4. Garment fabrics—
    1st. Woven in patterns of any material, and hand-worked.
    2nd. Printed " "
    3rd. Lace.
    4th. Ribbons.

In reviewing these various classes it may happen that different materials, ornamented by the same means, and applied to the like uses, may be spoken of indifferently; or even varied uses may be comprehended under the same general remarks, where the same principles of ornamentation are strictly applicable, since the object in view is rather to include, and thereby shorten labour, than to maintain the nice distinctions necessary under the several class Reports.

DIV. 1.—*Decoration of Buildings.*

Architectural decoration, painted, &c.
Architectural decoration in carved wood, stone, terra cotta, carton-pierre, gutta percha, &c.

The objects in the Great Exhibition which range under the two first heads of this section belong to almost every known style of ornament, and are so various in their character and uses that it is hardly possible so to arrange them as to bring them under general criticism, or to define any principles which would be universally applicable to their design. They consist, 1st, Of decorative treatments exhibited as efforts of skill. 2ndly, Of restorations of parts of buildings, and of ornamental constructive parts. And, 3rdly, Of works intended to form integral parts of a building, but which are *manufactured* so as to be adventitiously applied. Properly speaking, the design for the decoration of any building, both externally and internally, is the province of its architect, since in this case decoration is essentially a part of architecture. If the principle insisted upon in the prefatory remarks to this Report, that ornament is the decoration of construction, be just, it will be apparent that it is hardly possible to judge of the one without the other. In works wherein the decorator makes his own sham construction in order to ornament it, as well as in those multiplied manufactured "parts" which form the staple *ornament* of a large class of *workmen* in this line, we may admire the skill of the execution, the cleverness of the details, the excellence of the manufacture, or the imitation of early works of acknowledged merit; but to appreciate "decoration" we must view it as a whole in the place for which it was specially designed, and in harmony with the building whose construction it ornaments. Moreover, it must mainly originate in local circumstances, and ought to have an individual significance. Here, however, the moment we enter upon the varied inspection we become sensible how impracticable it is to lay down any general canon for works which differ almost as widely as the beginning and end of time. In other ages of the world, nations have been fortunate in so adapting design to prevailing wants, and in sympathy with existing feelings, as to produce a national style. But in the present day men no longer attend to such considerations; they are wholly without such guiding principles, and consequently are totally without a characteristic style. They are satisfied with the indiscriminate reproduction of the architecture of Egypt, Greece, and Rome, or of Christendom in any, or all, its marked periods. Originality they have none. One man delights in a Gothic villa; another prefers the style of Italy: even India and China have their advocates, who never consider that climate and use should rule the choice, rather than fantasy and whim, and that there *must* be conditions arising from the present state of society, from fiscal regulations, modern habits, &c., which, duly attended to, would, in addition to utility, be likely to result in novelty and beauty.

It is this merely imitative character of architecture which has so largely contributed to decorative *shams*, to the age of putty, papier maché, and gutta percha. These react upon architecture; and, from the cheapness with which such ornament can be applied and its apparent excellence, the florid and the gaudy take the place of the simple and the true. A popular writer describes the wearer of cheap finery as having his jewellery "a size larger than anybody else;" and so it is with the cheap finery of imitative ornament: it is always "a size larger" than it should be—bolder, coarser, and more impudent than the true thing; it excites our contempt by its flashy tawdriness, so incongruous with the meanness and vulgarity it is intended to adorn.

From this *manufacture of ornament* arises all that mixture of styles, and that incongruity of parts, which, perhaps, is itself "the style" of this characterless age. Through it, also, the plasterer and the paper-hanger too often usurp the place of the architect, to the certain dismissal of the mason and the wood-carver; and ornament, perchance in itself unobjectionable, is sure in such hands to be grossly misapplied.

The "designs" for architectural decorations exhibited are few in number, and are very open to the foregoing criticism.

Those on the foreign side are in the French department: they seem the very vagaries of a fantastic imagination, full of fancy, it must be owned, and skilfully executed, but without the slightest sense of utility or of constructive truth. Everywhere ornament is in excess; the architectural construction obscured and overlaid with figures, fruits, flowers, &c., so that they seem more fitted for the scene of a theatre than for any sober purpose of every-day life. Crowded together in such capricious abundance, the ornament can only be that of those cheap imitative manufactures we have above referred to. The "designs" on the English side consist of a few reproductions and adaptations of early styles, on which invention is as much wanting, as in the others it is in excess. Of the works themselves exhibited in this section, the reasons already given will dispose of a large number, since it is impossible to view them otherwise than as specimens of skilful execution, or the reverse; thus, for example, what can justly be said of the ceiling exhibited by A. **Montanari**, of Milan? (Austria, 738, p. 1044). The room which is fitted up for its reception is badly lighted, and otherwise unsuitable, and the reverse of what is requisite for a library, for which the decoration is intended; but that matters little, since, under the best circumstances, it could be truly appreciated only in connexion with an architectural reality. It may deserve praise for its extremely dexterous and skilful execution; but this is quite a separate thing from exhibiting any just principles on which it has been designed. It may be said, however, that, as a ceiling, the decoration is too heavy, both in form and colour. This, which would be even more apparent in a lighter apartment, is a great error in a ceiling decoration, having the effect of depressing it, and diminishing the height of the room—a fault often seen in the richly gilt and massive ceilings of the continental palaces. It may, indeed, be laid down as a rule, that the decoration of a room should diminish in heaviness, in strength, and in gorgeousness as it passes into the ceiling. Then again, as to the numerous ceiling decorations beneath the galleries on the English side: from the same causes it is only possible to speak of the skill of the decorative workman, since to judge of their local adaptation is out of the question: the light and graceful decorations being necessarily placed at the same height as the heavier and more richly treated ones, and of course their due adaptation judged of equally by that height, although, perhaps, the one may have been designed for a much lower ceiling than the other. The like difficulties, arising from causes before enumerated, prevent the proper consideration of the various specimens of wall-decorations. The principles, however, which are given under the head of Paper-hangings, eminently apply to such works.

The restoration of parts of existing buildings calls for little originality in the designer, since it almost wholly consists in the careful study of the decoration which remains, aided by a knowledge of the traditional ornament of the period. Such are the carefully restored spandrel for Hereford Cathedral by N. J. **Cottingham** (63, Main Avenue West, p. 852), part of the tomb of Queen Philippa by S. **Cundy** (60, Main Avenue West), and the wood-carving for the dining-room at East Sutton Place, designed by C. J. **Richardson** (Class XXVI., 207A, p. 751). In such works the taste of the designer is shown in excluding the coarser characteristics of the style, and making use of those only which, if less marked are also less extravagant, adopting its general spirit rather than copying its individuality. Thus in the sister art the unskilful portrait-painter seizes on the most salient characteristics of his sitter, and dwells upon all the individual defects of form and feature: the result is a likeness indeed, but a caricature even upon the homely original. The painter more skilled in his art avoids such coarse renderings, and under his hand even the plainest face is refined and generalised. In the same way a style becomes degraded. The decorators who adopt it overlook the spirit of its general idea, and exaggerate its peculiar characteristics, until at length it is likely to become a mere distorted caricature. Thus it was that the Renaissance degenerated into the Tudor, and the ornament of Louis XIV. was further degraded into the rococo and bizarre style which now goes by that name. A work, otherwise of much merit, may serve as a slight illustration of these remarks: it is the decoration, carved in walnut wood, for the end of a room, in the style of Francis I., exhibited by Messrs. **Holland and Sons** (Class XXVI., 161, p. 745). This skilful work is detracted from, in a degree, by want of due selection: thus the large shell-forms, used in the blocking course above the cornice, are heavy and out of place in such a situation, and should not have been so used, however sanctioned by traditional authority. The ornament of the pilasters also, otherwise well designed and skilfully executed, ought in wood-carving to have been kept in lower relief, so as to have been within the surface of the pilaster itself, instead of projecting beyond, by which it is at once evident that the ornament is applied, and not, as it should be, carved from the solid wood.

Space will not permit, even if it were necessary, to speak of the numerous carved and other works in stone, wood, and marble, for decorative additions to buildings, exhibited in various parts of the Exhibition, since there is little which, from the original or peculiar application of design, calls for especial notice. The errors of such works will often be found to originate in the construction fitted for one material being applied to another; thus, that which ought to have been stone is wrought in wood, or wood treatments are carried out in stone or metal. The costly malachite decoration exhibited in the Russian Court may be noticed as an example of this mistake. Stone doors at all would seem to be an anomaly, but framed after the manner of wood still more so. In addition, the doors, which necessarily produce a sense of extreme weight, are hung to pilasters so narrow as to be quite disproportioned for their support.

It may not be amiss here to advert to the error arising from excess which these works illustrate. Thus, the malachite vases exhibited in this room are improperly supported on malachite pedestals, greatly detracting from the sense of rarity and richness which would result from having only the principal object made of the rare material, and its support in a baser one, while all the enrichment which would arise from contrast is lost also, and the eye is fatigued with the quantity and sameness of colours, which would have been refreshed had a marble of some homogeneous colour been used for the bases instead of the malachite.

Ornaments manufactured from plaster materials, such as gutta-percha, putty, carton-pierre, &c., have no doubt a substantial value in the Great Exhibition, commercially considered. As regards design, however, they are but dangerous subsidiaries, often doing greater injury, from the tasteless, misplaced, and false decoration arising from their use, than good, by ministering to decorative purposes. Apart from that monotonous multiplication of the same forms, necessarily resulting from the unvarying productions of the mould and the die, which has been before alluded to, there are other evils sure to accompany *manufactured* decorations such as those now under consideration. The great cheapness of the substitute, compared with the real material, inevitably leads to excess. Such ornament always seems added or applied, stuck on as it were, and can rarely be made to appear as a part of construction; it therefore constantly carries with it a sense of untruth, till the mind and eye, from habit, become satisfied with it, and at the same time deadened to what is really true and good. Moreover, decoration of such materials must necessarily be patchy and incomplete: when the parts to be ornamented are large, this evil is seen in its most exaggerated form; a florid and gaudy centre has perhaps to be united with coarse corners, either by other ornaments or by the repetition of the centre portion, and all sorts of expedients must be resorted to to "bring in" the parts so as to suit the architectural distribution of the apartment; it can indeed barely be possible that the quantities, or the geometrical arrangement in which the ornament has been originally constructed, will agree with the place to which it has to be adapted, and more or less of make-shift must be the result. One of the most important works in such materials is the centre compartment of a room in carton-pierre, by V. CRUCHET (810, France, p. 1219), which, with all the excellences of the manufacture, exhibits many of its prominent defects, and may serve to illustrate the general faults of such materials. Thus it is decidedly over ornamented, and this is shown not only in the excess of ornament, but in the want of relative scale between the ornament and the constructive forms of the architecture, the former being far too large, as well as too redundant. Scale also seems to have been quite disregarded in the parts themselves, since the fruit and flowers, the birds and game, of one part, are different in size from those of another part. The style, again, is mixed, one part being two centuries earlier than the other. There is, besides, far more pains taken with the exact rendering of fur or a feather, than in perfecting the form of a moulding, or the shape of a panel—the architecture has, in the designer's mind, been subordinate to the ornament, and an ill-formed ellipse, or a coarse and unrefined moulding, appears of less importance to him than the mere imitation of the feathers of his birds, or the fur of the animals of which his ornament consists. Carry this treatment a little further, and it will result in having the game, the fruit, the foliage, and the flowers not only modelled to the exactest imitation, but the skill of the painter called in to add to its naturalism, and the whole painted with the colours of nature; thus decoration will be thought perfect only when it competes with those strange relieved pictures which are exhibited in frames in close juxtaposition with the work in question. Of the artistic and skilful grouping, and of the merit of the modelling of the ornamental portions of this decoration of Cruchet's, there can be no question; but, as has been before said, even these excellences may merge into faults if they are too exclusively directed to mere imitation, and if the design to which they are applied has not the merit of a just perception of use and purpose. One great cause of evil in the use of the materials under consideration consists in the false principle of their application to decorative purposes. It is found, for instance, that peculiar qualities, which are difficult of attainment and an effort of great skill in other materials, can easily be obtained by a new means; instead, therefore, of carefully studying its just adaptation to ornamental production, the effort is only to emulate in excess those peculiar qualities which are trials in the more intractable material. It too often happens, moreover, that the original works imitated were in false taste; and this becomes far more apparent in the copies, since the mind can no longer dwell on them with that admiration which is caused by a sense of difficulties overcome, and which compensated, in some degree, for the absence of good taste in the works they emulate: for instance, the exact imitation in wood or stone carving of the individual details rather than of the general character of objects used as ornament, extreme relief, undercutting, lightness, thinness, and picturesqueness of the forms of foliage and flowers, whereby their natural growth is attempted in carving rather than a due ornamental disposition of their forms—all tending to excess and exaggeration, and to be avoided rather than copied. Another source of error consists in rendering what should be true constructive forms into mere ornament: thus pilasters, and even columns, consoles and trusses intended to support weight, are manufactured in these imitative materials, and introduced only to decorate, until all sense of utility and construction is lost, and ornament becomes the principal instead of the subordinate. Such materials, however, are capable, under proper control, of useful application to ornamental purposes, both from their ready adaptability to various surfaces and forms, and from the cleanness and sharpness with which they can be moulded, as is seen in the works of the GUTTA PERCHA COMPANY (85, Class XXVIII., p. 783), those of JACKSON and SON (p. 730), of BIELEFIELD and Co. (157, Class XXVI., p. 744), and of others, as well as in the work above referred to. It is most desirable, therefore, that the errors to which a false application leads should be carefully pointed out, so as to bring these materials as much as possible within their duly limited use.

Some of the above criticisms will apply to terra cotta also; but this material, partaking largely of reality and allowing of being perfected by the hand after the first mechanical process of moulding, would, under fitting regulation, become a most useful and durable agent of ornamental decoration.

STAINED GLASS DECORATION.

The art of painting on glass, or glass-staining, has come down to us so intimately mixed up with the ecclesiastical architecture of the middle ages, that it is almost impossible to view the one unconnected with the other. It was born of the same parent (the Church), and from the first both were equally devoted to her service. Of Gothic architecture, and of it almost exclusively, stained glass has always formed a necessary decoration: it follows, therefore, that its ornamentation is almost wholly traditional, and has relation to the various periods of the Gothic architecture which it accompanies.

Not that it is necessary, or even desirable, that the epochs of the two arts should, in their revival, continue to correspond; but the periods of each, whether simultaneous or otherwise, when utility and beauty were most fully understood and attained, should be diligently studied in search of the principles that guided the artists of those times, and that which is best should be chosen, irrespective of mere correspondence of epoch or antiquarian authority. Moreover, the errors which the ignorance of an early age evidently occasioned should be carefully separated from the truths, and not considered as of necessity a part of the *style* of the period in which they are found—such, more particularly, as bad drawing and want of knowledge of the human figure; at the same time, that simplicity of treatment which is so highly characteristic of early works, which overlooks all details, and renders a composition from the Scriptures, or a single figure, more as a symbol than as a picture, should, if it is found to be a principle of excellence, be carefully retained.

As is the case with all other manufactures and fabrics, so it is with painted glass: the question of utility, rightly considered, will lead us to some knowledge of what is most suitable in its treatment as a decoration. Glass was introduced into the numerous windows of Gothic architecture to temper the glare of light, and to serve in a manner as a blind, by preventing the direct entrance of the sun's rays, and also to shed that solemn religious light which so well accords with the sacred mysteries of religious worship. The mosaic glass of the early artists of the 12th and 13th centuries was most admirably adapted for this purpose: being composed of many small pieces of full and pure tints, with little white glass, the rays of the sun were broken and dispersed, the light lowered in brilliancy, and the whole effect was homogeneous, rich, and solemn, sufficient light being still permitted to enter for the performance of the religious services of the church. Even compositions of figures were subject to the principle that regulated the whole: the figures were small, so that the colour of their draperies and accessories might be broken up into many pieces to give the same equal distribution as in the ornamental parts of the window. It would seem, indeed, that the painter did not intend to simulate a picture, but rather to symbolize a sacred text or thought, and the figures, therefore, were not so much pictorially arranged, as composed with extreme monumental simplicity; thus they not only partook of the general effect of the window, but the attention of the spectator, impressed with the solemn yet beautiful light, was, at the same time, filled with the holy thought conveyed by the subject, without being distracted by too great an individuality of parts. The representation of shadow, strictly speaking, was not admissible, the composition consisting only of flat forms of the greatest simplicity. For this, even, there would seem to be just reasons: the light being transmitted through the glass to the spectator within, shadow would appear to be anomalous and out of place, since the illumination in such a case emanates from the figures themselves; moreover the simplicity of the shadowless forms was better suited to impress the eye from the distance at which such works must necessarily be viewed. Such would seem to be some of the principles which ought to regulate, and which in the best times did regulate, the design for painted glass. An entirely different view of the art has however sprung up with its revival, and has obtained many advocates, especially on the Continent. It has been felt how greatly art has advanced in the hands of the historical painter since the time spoken of: that the principles of composition, of foreshortening, of perspective, of light and dark, and of the arrangement of colour, then quite unknown, have been discovered and developed; that drawing, then in its infancy and unaided by knowledge, has now arrived at maturity; and that science has given us power over the materials which they possessed not, and enabled us to conquer difficulties which they considered insuperable; and it is asked why the painter on glass should not avail himself of all these advantages, to perfect his art, and render it as pictorial as the works of his brethren. By artists who entertain these views the surface of the window is treated almost as a canvas would be: the forms of the figures are large, even as the size of life: the draperies are massive, and the heads painted with great imitative skill and completeness. Clair-obscur and perspective are studied, and foreshortening and pictorial attitudes in the figures supply the place of the monumental and statuesque delineations of the earlier artists; in fact everything is done to treat the window as a picture.

To the advocates of this style it may be objected, that a picture is specially intended to address itself to the mind and imagination only, while painted glass has a reference to use also; and that, apart from this consideration, each and every art has its own mode of rendering nature—not necessarily implying *deceptive* or complete imitation; thus, for instance, the art of the sculptor is a generalized imitation of form, and even the painter of high art does not desire to make his picture deceptively imitative, but listens with impatience to the remarks of the ignorant, who are apt to praise his work for this quality above others proper to it which they do not understand. An outline of Flaxman's fills the mind with a perfect sense of beauty and with the fulness of a poetical idea; surely, then, the flat and simple treatment of subjects in glass-painting, if such treatment is requisite for its utility and most in consonance with its other qualities, may be found sufficient to give as complete an expression to the pictorial rendering of a Scripture truth as the material and situation of such works require.

Among the works in the Great Exhibition, both manners are adequately represented. Thus the pictorial method is well illustrated in the ably executed window of **Marechal and Guynon** (329, France, p. 1193), of "St. Charles administering the Communion to the Plague-stricken." Here the forms are simple and broad, the masses of colour large, and the effect thoroughly that of a transparent picture, with all its details well drawn, carefully painted, and rounded by shadow; while the composition is arranged with regard to the laws of clair-obscur. But instead of that general and harmonious effect of sobered light, which is so desirable in stained glass for the windows of a religious edifice, the effect is painful to the eye from its extreme brightness, and the window would irresistibly obtrude itself upon the attention of the spectator, and rather distract his thoughts than induce that solemn repose of mind which is so consistent with the place. The great Dante Window, by G. **Bertini**, of Milan (Main Avenue, West, p. 1044), is another example of this method. It is a very skilful work so far as regards the manipulative means, well drawn and painted, and exhausting the resources of the material. As a window, however, it is exceedingly sombre, and would far too much reduce the light in any building to which it might be applied. The colouring is cool and pleasant, in which respect it is better than Marechal's window, which is too hot. It is to be observed, also, that the construction of the window is greatly in the way in these pictorial treatments, and that a false construction has been adopted in both these works, in the latter, indeed, without the slightest architectural fitness. The other method of treatment has also many representatives, some of much merit. Among these, the "History of Samson," by A. **Gerente** (517a, France, p. 1203), a work of great purity as to traditional style, although in adopting the just principles of design the faults of the age have been adopted also, which must be objected to. The texture of colour in the glass, if such a term may be used, has been obtained with great skill by this artist. **Lusson's** window (565, France, p. 1205), competitive for the St. Chapelle, is also a good example of this manner—dust and time, and the corrosion of the glass, have, however, been too much imitated, necessarily perhaps in a restoration, but rather interfering with this otherwise meritorious work. **Holland**, of Warwick, "Life of Christ" (407, Class XXVI., p. 760), I. A. **Gibbs** (North-east Gallery, 75, Class XXIV., p. 707), J. G. **Howe** (67, Class XXIV., p. 707), and Messrs. **Chance** and Co. (60, Class XXIV., p. 706), have specimens of glass of this style of various merit.

It would seem to be a great fault in glass to have a prevailing tint or hue, since by a truly harmonious composition of colour such a result would be avoided.

his defect is visible in the glass exhibited in the North-east Gallery, in some of which a prevailing green, in others a yellow hue, is observable. This is often the case also with the modern French glass, as seen in some of the restored churches of Paris, more especially the pictorial glass, in which a hot red hue is often present, sometimes to a painful extent: the flesh especially is hot, and dirty in the shadows. It is to be doubted, indeed, if, with all our knowledge of the harmony and complements of colours, we have yet attained to the principles by which the old glass-painters arranged their agreeable combinations. Whatever was the method, the effect was coolness of general tone: the flesh had little local colour, the prevailing tints of the draperies and accessories were blue, cool green, and amethyst, and even the red was cool, inclining to crimson. The hot browns of the flesh in the modern glass, together with its opacity, are often very disagreeable, and the effect of scarlet instead of crimson may be seen in the work of Marechal, before spoken of, where the robe of the cardinal who is administering the sacrament (a large mass) is of that hue, and greatly tends to increase the hot and glaring effect of the whole. In the Parisian churches, where ancient and modern glass are both to be found, even when the former is not of the best period, as in St. Germain l'Auxerrois, for instance, it is quite refreshing to turn the eye from the modern to the old glass, showing how far more harmonious the one is than the other.

In estimating the excellences of the one or the other methods of glass-painting which have been spoken of, the superior durability of the earlier method is to be noticed; also the much smaller liability to accidents from the diminished size of the pane, and the much less damage if a fracture do take place: an unlucky blow may immediately destroy the finest portion of a pictorial window, while it could do but small injury to a work on the older principle. These are minor merits, but to them may be added the greatly increased brilliancy of colour occasioned by the more frequent interposition of the dark line of the *leading*, and the lustre occasioned by the slight change of plane, in the smaller pieces of the early method, bringing out thereby the richness of the glass, as the varied facettes of the lapidary do of the precious stone. Indeed it may be doubted if the subject of *leading* has had all the attention it so well deserves. The skilful manner in which this was executed in the early works is apparent from the preservation of the windows, unharmed by the storms and winds of centuries. It is certain that a varied surface was at times adopted in such works, for resisting, as has been supposed, the pressure of the winds: thus, at Haddon Hall, in the long gallery, glazed in the reign of Elizabeth, each window is waved inwards and outwards over the whole surface, and each piece of glass cut to adapt it to this treatment: the result has been great durability, even although the lead itself is extremely narrow. These are, it is true, windows of uncoloured glass; but it may probably point to some such method being used in decorated windows, to enhance their brilliancy and increase their effect.

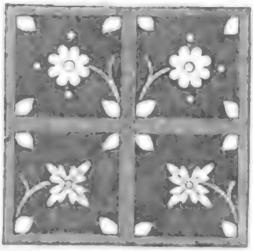
Inlaid Floors, Mosaic Pavements, Inlaid Tiles, &c.

The ornament of this section seems the soundest and most satisfactory in the Exhibition—the most free from false principles, the most thoroughly amenable to true. Although this no doubt partly arises from the conditions of the manufacture, it is, in a degree, to be attributed to other causes. The modern introduction of such works in England was at a fortunate time, when the attention of the ecclesiologists and of able artists was called to the revival of mediæval art, and to the study of the best works of Greece and Italy. The designer, therefore, started upon just principles, and continues to adhere to them, even repudiating some of what must be considered errors in the ancient works which have been handed down to us, such as those arrangements of light and dark inlays, giving the appearance of relief, which are found occasionally even in the best ancient examples. The "designs" exhibited are almost wholly on the English side. Apart from those in conjunction with manufactured specimens, Mr. Digby Wyatt's are the most important: they are varied and fanciful, thoroughly flat in treatment, and consisting mostly of combinations of simple geometrical forms, although there are some of Italian conventionalised ornament. They evidence the careful examination and study which the artist has given to the best antique and mediæval treatments of mosaic. Mr. Minton, of Stoke-upon-Trent (86, Class XXVII., p. 770), makes the most important exhibition of such works from designs of Pugin, Gruner, Wyatt, &c., together with some copies of fine mediæval examples and ancient works of great merit.

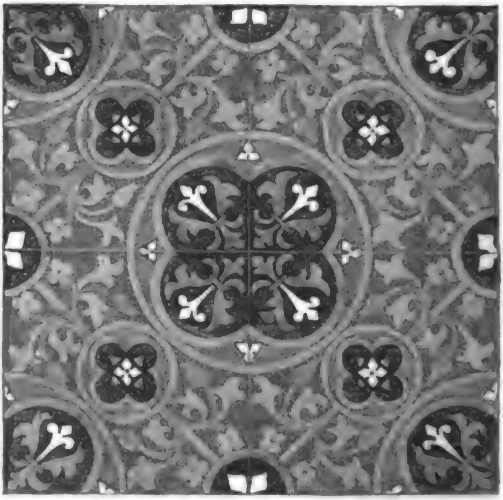
The illustration No. 1 is of an enamelled wall-tile, imitated from one found at Salisbury, and is given here to show the mode in which flowers were used as ornament in such works by the mediæval artists. The flower is displayed perfectly flat, in one colour, and arranged geometrically.

No. 2 is given as a more intricate treatment on the same sound principles, and is from a design by Mr. Pugin.

No. 1.

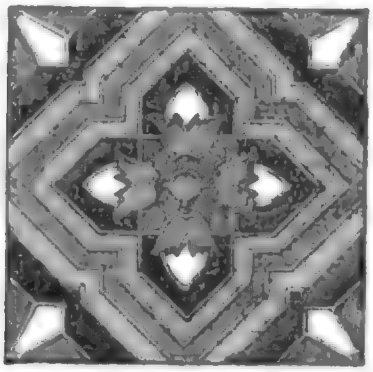


No. 2.



No. 3 is an intaglio and enamelled tile of a Moorish pattern, for covering the surface of a wall with an ornamental *texture*, and with a broken harmonious richness of colour, in very durable materials, for which purpose it is admirably adapted. This manufacturer exhibits also many novel and praiseworthy works in burnt and coloured clay to facilitate the application of design and colour to the exterior of buildings. Among others, a species of Majolica ware, with ornament in relief, coloured with delicate tints, intended to be introduced into friezes, string-courses, panels, &c., and other combinations of the art of the designer with the skill of the tile-maker and the potter, which will enable the architect to break the monotonous surface of brick buildings, and introduce ornamental forms and colour without the necessity of resorting to plaster and stucco, so long the wretched resource for such purposes. From the geological position of London, bricks must always be the prevailing material for building purposes: such means, therefore, for the safe introduction of colour and ornament, are especially desirable, and should be carefully studied, that the most judicious and sound principles of ornamentation may be adopted in these newly-revived materials. It is curious to see how instantly the removal of the excise-duty on bricks has been followed by the infusion of a new life into the manufacture, both as to novel forms and the application of coloured ornament to their surface; it must be remarked, however, that the ornament of each separate brick should be perfect in itself as well as perfect in combinations, a circumstance which has not been attended to in the glazed and coloured bricks exhibited by Mr. Minton.

No. 3.



From the general use of carpets, considered, as they are, as a necessary comfort in this country, inlaid floors are far less used here than on the Continent, and it is on the foreign side, therefore, that the best design applied to such works must be sought. The principle of ornamentation, of course, is the same as that for mosaics and other inlays; care, however, should be taken to select wood without a strongly marked form in its grain, since this is likely to interfere with the pattern of the inlay in general; also right-lined figures are preferable to curved ones, from there being less need of crossing the grain of the wood in cutting.

Many skilful and ingenious combinations of geometrical forms are seen in the works of this kind in Belgium, Austria, Russia, and France; among others, the flooring of the bed-chamber in the Austrian room, of which the border, consisting of violet ebony and mahogany banded with maple-wood, is simple and pleasing in effect; and a floor by De Keyn and Co. (406, Belgium, p. 1163), which has much merit in its design: nor should mention be omitted of the very clever inlays for floors and furniture of Marcelin (606, France, p. 1207), some of which are of the most intricate geometrical character, excellently executed, for borders, panels, frets, &c. Being limited by true principles, these manufactures show less that is meretricious than do most other sections of the Exhibition, and far less tendency to that over ornamentation which elsewhere predominates.

Paper and other Hangings.

If the use of such materials is borne in mind, the proper decoration for them will at once be evident, since this ought to bear the same relation to the objects in the room that a background does to a picture. In art, a background, if well designed, has its own distinctive features, yet these are to be so far suppressed and subdued as not to invite special attention, while as a whole it ought to be entirely subservient to supporting and enhancing the principal figures—the subject of the picture. The decoration of a wall, if designed on good principles, has a like office: it is a background to the furniture, the objects of art, and the occupants of the apartment. It may enrich the general effect, and add to magnificence, or be made to lighten or deepen the character of the chamber: it may appear to temper the heat of summer, or to give a sense of warmth and comfort to the winter: it may have the effect of increasing the size of a saloon, or of closing-in the walls of a library or study: all which, by a due adaptation of colour, can be easily accomplished. But, like the background to which it has been compared, although its ornament may have a distinctive character for any of these purposes, it must be subdued, and uncontrasted in light and shade; strictly speaking, it should be flat and conventionalized, and lines or forms harsh or cutting on the ground as far as possible avoided, except where necessary to give expression to the ornamentation. Imitative treatments are objectionable on principle, both as intruding on the sense of flatness, and as being too *attractive* in their details and colour to be sufficiently retiring and unobtrusive. Some of the best examples, as well of paper as of silk, velvet, and other hangings, are treatments of *texture* in a self-colour; as of flock on plain or satined ground in paper, of tabby and satin in silk hangings, of stamped forms or cutting in velvet, or the same contrast of pattern with the ground in various mixed stuffs. By these means the ornament is necessarily flat, and does not disturb the general effect. With the slightest attention to the choice of form it can hardly be in bad taste, whilst great elegance and beauty often arise from such treatments. Next to these, graduated tints of the same colour produce a safe and quiet ornamentation for such fabrics; or gold upon a coloured ground, where the gold is sparingly distributed, and the colour not too strongly contrasted, since in all cases a general *tone* of surface is to be sought for rather than pronounced individual forms. Further richness may be obtained by the judicious use of two or more colours, either, according to the ancient method of harmony, separated from each other by bands of black, white, or gold, or contrasted and enhanced by their complementaries, and enriched by flock in either case, in the latter by gold. But it is everywhere apparent that the combination of many colours, though it may increase expense from the number of blocks, is far from producing richness in the same degree, while it has often quite the contrary effect, and results only in poverty and meanness. It is necessary, however, to advert to a perfectly different treatment of these materials quite at variance with these rules, and bound by no such principles, by which paper-hanging becomes a pseudo-decoration, the wall being divided into compartments often irrespective of architectural construction, and pilasters, friezes, and mouldings imitated in false relief on its surface, with compositions of pictures, statues, hangings, flowers, fruits, &c., skilfully designed and well drawn, and, it may be, often most ably blocked for the purpose of printing; it is, however, at best but a sham decoration, amenable to no laws, necessarily false in light and shade, often constructively inapplicable, and always impertinent and obtrusive, and should be left to those who, desiring display, are too much wanting in taste to be annoyed at its untruth and extravagance. It perhaps is not quite out of place in the saloon of a theatre, in cafés, or taverns, but ought to be confined to such localities, and only used there until the general taste is so far instructed that the public will no longer tolerate gaudy shams and false magnificence.

The same laws which ought to govern design for paper-hangings would, therefore, appear proper to regulate hangings of other fabrics, tapestries, &c. Although far from looking at ornament in that exclusive spirit which would reject what is beautiful when it does not square with the requisitions of a theory, it must be obvious that pictorial and picturesque treatments for such fabrics are wrong whenever they intrude on the domain of another art. Thus figures, landscapes, fruits, and flowers, when rendered as they would be in works of fine art, are almost of necessity inferior to the pictures they imitate, even when they are as skilfully and wonderfully wrought as in the works exhibited by the national establishment of the Gobelins, where every effort of skill and science has been most successfully used for their manufacture and embellishment. Indeed, it is a matter of doubt whether custom, and the authority of great names and of past times, are not the causes of the continued admiration of such decorations, which perhaps we rather persuade ourselves we like than are fully satisfied with.

With very few exceptions, the exhibited "designs" for hangings appear to be totally unregulated by any perception of rules for their ornamentation, and, even when they happen to be on just principles, would seem to be so by chance rather than by choice. They are mostly florid and gaudy compositions, consisting of architectural ornament in relief, with imitative flowers and foliage. In some of the cleverest designs the flowers and foliage are perspectively rendered with the full force of their natural colours, and light and shade; moreover, they are often three or four times as large as nature, whereby the size of a room would be apparently diminished. The French are the largest contributors, and their designs are characterised by the foregoing remarks; they are, however, exceedingly skilful in their details, the flowers and foliage well understood and artistically arranged, and *blocked* with great skill and knowledge; but as to style they are most objectionable, and lead to the worst results, especially in the common manufacture of such goods.

The pupils of the Government schools exhibit, among other designs, some meritorious ones for paper-hanging. It is evident that their general taste is controlled and regulated by the knowledge of the just principles which should govern the ornamentation of these as well as of the other manufactures for which they have laboured. Being students' works, they can hardly be expected to abound in fancy or invention, and it is sufficient to find that they are well drawn, skilfully executed, and amenable to just laws of composition. In examining the design applied to the manufactures themselves, the same want of just principles is observable as in the works of the designers. It is true that manufacturers must produce works in every style, as well to suit those who are unable to appreciate what is good, as those of more informed taste; but it might be expected, in an Exhibition of this nature—an Exhibition of skilled labour and of the strife after excellence—that excellence would be the rule, and error the exception, whereas the reverse is generally the case. Were it a part of the duty of the Reporter to enter into the clever and skilful execution, the treatment of the pigments, the excellent blocking, or the general manufacture of such fabrics, there would be much to say of the foreign exhibitors, **Delicourt** (France, 1715, p. 1258) and **Zuber** (France, 1536, p. 1250), **Spoerlin** and **Zimmermann** (Austria, 651, p. 1041) of Vienna, and others, as well as of **Townsend** and **Parker** (Class XXVI., 318, p. 758), **Woollams** (ibid., 322, p. 758), and others on the English side; but in the *design* of their papers there is little to commend, and works of passable excellence in this respect are the rare exceptions to their collections. One or two designs, delicate in colour and on just principles, are exhibited by **Fetter** and **Rahn** (262, p. 1375) in the Russian Court, mixed up, however, with others in the usual false taste; and passable designs on the principles herein advocated are to be found occasionally in other collections, evidently resulting from a happy accident rather than a well-regulated choice. The English and foreign manufacturers seem equally at sea: with the exception of a few simple diapers, which hardly call for individual remark, the works of the best exhibitors on the English side, while they are very heterogeneous, are less original, and equally wanting in a sound knowledge of what is properly characteristic for such works.

There are, however, honourable exceptions to these remarks: after passing in review the paper-hangings of the various countries, it is quite refreshing to meet the clever wax-cloth decorations exhibited by M. E. T. **Vivet** (France, 734, p. 1215). The ornament of these works is without shadow or imitated relief, thoroughly flat in its forms, which consist of graceful and flowing lines; the colour is equal in scale, without harsh contrasts, and of semi-neutral hues. There is no attempt at shams, to imitate marble, or oak, or any carving; nor to panel it, which is left to arise out of the architectural forms; but a series of graceful lines, with a quiet uniformity of tint, satisfy the mind and give repose to the eye. Moreover, having laid down certain principles on which manufactures and fabrics should be designed with a view to the true use of materials, and to avoid unnecessary display, by the proper application of ornament, it is impossible to refrain from speaking in high terms of the works contained in the Mediæval Court, manufactured by Messrs. **Myers** (Class XXVI., 523, p. 761), **Minton** (ibid., 531, p. 761), **Crace** (ibid., 530, p. 761), and **Hardman** (ibid., 532, p. 761), under the direction and from the designs of Mr. W. **Pugin** (ibid., p. 761). Some may object to the exclusiveness of the style, and to its too purely ecclesiastical and traditional character, even in domestic works; but for just principles of decoration, for beautiful details, for correct use of materials, and for excellent workmanship, the general collection is unique. Thus, in the paper-hangings, for instance, there is no throwing away of many blocks to obtain richness, when one or two can be made sufficient: there is a perfect flatness and a subdued harmony of colour in all such works; and if Tudor roses and heraldic lions are sometimes too pronounced, and there is occasionally a little excess of ornament, richness is generally obtained at the smallest sacrifice of means, and without any sacrifice of truth. The same may be said of the hangings in silk and wool, and the carpets in this collection, the designs for which are highly commendable for their strict adherence to true principles.

Without having any sympathy with the *application* of decorative paper-hangings, such as those of **Delicourt** (France, 1715, p. 1258) and others, it would be unjust to pass them without praising the artist-like design, the powerful execution, and the great ability displayed in these works by the French artists. In that by Delicourt, besides the skilfully-blocked hunting subject of the centre panel, the details of the parts, such as the grouping of the game and arms on the pilasters, and of the birds and children on the frieze, have great merit, apart from the skill with which the whole has been adapted for block-printing. The same may be said of the work exhibited by **Mader Brothers** (France, 1369, p. 1241), which is an extremely fanciful and clever piece of decoration, and in as good taste as such false treatments can well be. The frieze of children is well designed and ably managed for printing; the landscape of **Zurban** (France, 1369 p. 1241) has also much merit in its details; and the work of **Genoux** has parts worthy of examination.

These decorations bear out the remarks at the opening of this Report as to the superiority of the French working artists. The men who carry out the designer's inventions in France must themselves have a large share of skill and art-knowledge to be able to prepare the design for the manufacturer's processes with the ability so evident in the works just remarked upon.

Among the English contributions in paper-hanging are specimens of the lately-introduced processes of printing by such machinery as is used for cotton goods, and of applying many colours from one block. These are likely to create a style of ornamentation for such fabrics of the most depraved kind. The largeness and flatness of details attainable by block-printing are less suited to cylinder printing than more minute details, and the new processes offer ready means of applying several colours at a small expense; the reverse of what has hitherto been the case; hence the effort has been to impress as many tints as possible on paper, and excellence is reckoned rather by the number of colours than any other quality. Thus we are informed that works are printed in "sixteen colours," in "fourteen colours," &c., the works themselves evidencing the absence of all knowledge of the effective arrangement of colour; while violent, crude, and harsh tints are too often used to give greater impression of this *excellence!* and the result is littleness and extreme meanness; in fact, such papers are, in point of design, much inferior to those printed in two colours by the same machinery. Well-considered design, thoroughly adapted for this process, would enable the manufacturer to unite good taste with extreme cheapness; whereas the only present result is by increased labour to detract from the beauty of the ornamentation. It is impossible, however, not to remark the skilful printing exhibited by our English manufacturers.

EXTERIOR AND OTHER METAL WORK.

The works, in metal, of this section which are exhibited, consist chiefly of constructions for fountains, and of ornamental iron-work in gates and balconies, and for door-panels, lamp-pillars, flower-vases, and tazzas. The best of the metal fountains are so nearly within the limits of fine art, that their consideration may be left to that class. It is, however, to be remarked, that the zinc castings of the French and German founders show how suitable that metal is, as a means of spreading the best art, for any exterior purpose, in a cheap and durable material, as well as of embellishing public works of the above-named character, at comparatively small cost, without the evils arising from oxidation when iron is used. Notwithstanding all that has been said about the incongruity of our climate with public fountains, there are undoubtedly long periods of the year, and those when London is most crowded as well with her own resident population as with visitors, when such works are not only extremely ornamental, but when an exhausting atmosphere would render them of real utility and refreshment. The motion of water, at any season, has a great charm, and is peculiar in its power of giving pleasure even in the simplest jet or fall, agreeably and artistically disposed; and ornamental arrangements for its full display would not only be picturesque additions to our city, which offers so many localities for their adoption, but would afford to our artists motives for combinations of figures with ornamental decoration, and thus, perhaps, be a means of once more uniting fine and ornamental art, which, sadly to the deterioration of public taste, have for so long a time been almost wholly separated. It may be doubted if the public would willingly part with even the tame and commonplace repetitions which adorn Trafalgar Square; and those who have had the pleasure of enjoying the fountains of Italy and France will be quite prepared to judge of the effect which more skilfully-designed structures would have on the public mind here.

Such works in iron as gates, balconies, and panels, are, for the greater part, in cast metal, which of late years, from its capability of cheap ornamentation, has almost wholly superseded wrought iron for these purposes. Where the object is intended to be fixed and immoveable, as a balcony or panel, cast work is not unsuitable, and is capable of much beauty of ornamental design, as we see in panels exhibited by MUEHL, WAHL, and Co. (France, 934, p. 1225). In these the ornament adds to the strength by its numerous articulations, while it is light and elegant in its forms. Works of this kind are generally of a size to admit of casting in one piece, ensuring thereby strength and lightness by continuity of parts. But in cast-iron constructions intended to be moveable, as in the various kinds of gates, a very different character of design is necessary; in the first place, because entire casting is not always possible, both from the difficulty of running the metal into the numerous ramifications of the ornament in works of such increased size, and from the fear of warping in the cooling, as well as the great expense of a mould, which is saved by forming the ornament of a series of parts. This leads to the necessity of framing the work in wrought, and applying the ornamental details in cast iron; but hence results this evil, that the ornament has little constructive use, and is apt to look rather an addition than an integral part of the work. In the park-gates exhibited at the south end of the Transept, great pains have been taken to get over this difficulty, but not with success, since the two metals are joined in parts wholly at variance with constructive strength; in fact, it is a wrought-iron design, partly executed in cast metal. Moreover, cast-iron ornament is necessarily far heavier than that of wrought iron, from the extreme brittleness of the cast metal; this heaviness is sadly opposed to its real constructive strength in the manner usually adopted for putting together; the ornamental parts of such structures being riveted or screwed into the framing, there are smaller points of attachment than in wrought iron; the parts bed themselves less perfectly at the junction, since it is impossible to assist this union with the hammer, and the metal has small tenacity, and easily breaks with any sudden jar: thus there is much less power to support, while there is of necessity much greater weight to bear; and without very careful and well-considered design, making the ornament as far as possible a brace to the work, the whole is apt to be an insecure aggregation of parts, without constructive unity or truth. In large works, cast in one piece, such difficulties are greatly surmounted, as weight can then be made to add strength, instead of detracting from it. In the old hammer-wrought gates, the ornament was not only a truly integral part of the work, but most materially assisted in the general support. Thus great lightness and elegance were, in this case, consistent with great strength, since the ornamental details supplied a means, not only of tying and bracing the work together, but of preventing the front of the gate from drooping with its own weight, to the great hindrance of its use, and which in cast works of this kind has often to be assisted by the use of friction-rollers—a make-shift that the older workmen would have despised. When, therefore, we consider the varied beauty of which wrought iron is capable, its far greater durability, its tenacity and power of resisting accidents, the individuality of design which arises from its being wrought by the hand instead of cast in a mould (thereby leaving the fancy and the feeling of the workman untrammelled), it seems not too much to say that it is to be hoped the use of the wrought metal will again prevail over that of cast for such purposes.

The gates and pilasters exhibited by the COALBROOKDALE COMPANY (p. 659-660), at the north end of the Transept, from designs by Charles Crookes, are an excellent specimen of casting, being wholly of cast iron, each gate in one piece. Much of the false construction alluded to has consequently been avoided, and many of the difficulties overcome. The design of the gates, however, partakes too much of that adopted in wrought constructions, especially in carrying up the form of the centre, at the top, into florid ornamentation, which tends in this weightier metal to sway down the gate, without any compensating beauty or usefulness. The introduction of a heavy panel of ornament below is also rather commonplace, and due regard seems hardly to have been had to the *whole* surface in designing the ornamentation. The pilasters have more originality: the small twisted bars surrounding the centre columns give a lightness, compared with the strength obtained, which adds to the elegance: the striking-plates of the hand-gates, however, should have been ornamentally constructed or banded in with the pilasters in the centre, to increase the strength and resist the jar of the closing. The other great work in metal by this Company is an ornamental dome of cast iron (Main Avenue West, 83). This is a work of much pretension, designed in the natural style, the pilasters representing oak-stems, ornamented with leaves and acorns, and with the intervening branches twisted into an ornamental form: this treatment is mixed with some conventional ornament, here and there, as it were, indiscriminately introduced into the pilasters, having a very patchy effect. The pilasters, also, arising as they do from a single stem, and widening above their base, have an unsteady and insecure appearance, which might easily have been avoided. The great fault, however, is in the setting on of the dome, which from the outside seems to have no constructive connexion with the pilasters, since in it the rusticated treatment is abandoned, and it seems dropped in among the branches, without any proper support. The work, nevertheless, has a certain impressiveness from its size, and its general proportions are well chosen.

There are in various parts of the Exhibition garden-seats and chairs in cast metal, which are principally to be noticed from the great want of due consideration of the material evidenced in their design: thus sometimes they are ornamentally constructed of branches and foliage naturally imitated, or of branches alone; while, in others, carved and flowing lines are given to the back, arms, and legs of the seat, which add nothing to the comfort of their use, and sadly detract from the form properly belonging to such works in cast metal, which should be right-lined, and have a geometric character both of ornamentation and construction. It must be confessed, indeed, that the tendency to consider the ornament before either the requirement of the material or the use to which the work is to be applied, is but too evident in many of the works in metal in this class. Thus, two large lamp-pillars, designed by an architect, and exhibited in the Austrian department, have as much iron in their overcharged bases as would found three pillars, each capable of sustaining the taper upper shaft of the same design. The application of metal to the construction of the building is, on the other hand, an excellent example of just use, construction having had the first consideration, and ornament being entirely subservient; a due amount of elegance has nevertheless resulted from its simplicity, and from the true principles on which it has been designed.

DIV. 2.—*Domestic and other Furniture.*

A very large and important section of the Exhibition is comprised under the head of furniture and upholstery, and such works claim especial attention in this Report both as to their general design and their ornamentation. Almost every nation contributing to the Exhibition has sent to us its share of furniture, so that here, it might fairly be supposed, we should be able to study the conveniences for living which each country possesses, and their various contrivances for ease and rest.

The English nation, more especially, having that peculiar word *comfort* in its language, might be expected to exhibit how that sense of comfort is adequately provided for; and since, as a nation, we have a reputation for what is solid and substantial, that our furniture at least, so mixed up as it necessarily is with our daily life, with our home habits, and with our national mode of living, would, both as to design and ornament, be solid, substantial, sensible, and useful. Our continental neighbours, on the contrary, living as they do more abroad than the English, and being usually presumed to delight in the gay and the ornamental, would be likely to display more fanciful, showy, and decorative works in this Class. In other manufactures, plain and useful fabrics are exhibited, even when they have no pretensions to *ornamental* design; it seems therefore rather unfortunate that in the furniture on both sides of the building, but more especially on the British, the ornamental so largely prevails to the exclusion of the useful, and that tables, chairs, and beds, fitted for convenience, rest, and repose, have been made to give place to what are presumed to deserve the name of objects of art.

English furniture has, until lately, enjoyed a reputation for its excellence of make and thorough usefulness, and manufacturers were wont to rest their credit on good materials and excellent workmanship. In such furniture the doors fitted with the nicest accuracy, the drawers moved with perfect smoothness, and the wood was so well seasoned that a faulty panel or shrunken joint was out of the question: it descended as a possession from father to son, seeming the better for its very age, and, as is fancied of old pictures, gaining richness even from time. But these sensible qualities, in which we undoubtedly used to excel, have on this occasion been less regarded by our manufacturers than decoration and display, and they have mostly selected furniture of a class allowing the largest application of ornament, as sideboards, cabinets, bookcases, and works of the like kind, on which to exercise their skill, too often neglecting their own peculiar strength to rush into competition with their foreign rivals, without the skilled art-workman to execute, or the taste to design, which they possess. Nor is the foreign department wholly free from this misdirected effort to excel, which has resulted in many instances in over ornamentation; thus, there are chairs so decorated that rest is impossible, cabinets and bookcases which take up much room and hold little, and beds so monumental that they remind us rather of the last sleep than of a couch fitted for our nightly repose.

In endeavouring to lay down principles which may serve as general rules for the designer, it will without difficulty be conceded that, in every kind of furniture having a specific purpose, the first consideration of the designer should be *perfect adaptation to intended use;* this may appear so obvious a truism as to want no enforcement, but a walk through the Exhibition will speedily undeceive us, for there we see a multitude of objects offending against this rule; in some of these use is almost entirely overlooked, or has been evidently quite a secondary consideration, whilst in others it partially gives way either to effect or ornament. Thus in the English department a table of costly manufacture has ornament in solid relief on its upper surface, and many of the grates evidently require a glass-case, since fire and smoke would be the worst enemies to such polished marvels. Nor are these faults peculiar to England; on the foreign side may be seen a pianoforte, surrounded by bristling bullrushes, which must always be catching in the dresses of those who approach it, and with hardly a right line in any part of it; and chairs so heavy that they must be fixtures instead of moveables; while of minor incongruities, the instances are too numerous to specify. Manufacturers should also aim at obtaining the greatest amount of convenience and accommodation in the least space, in order that the furniture may be as suitable as possible to the size and uses of the apartment in which it is placed.

Another consideration to be attended to is stability of construction, *apparent* as well as *real;* the first being necessary to satisfy the eye, the last being indispensable to excellence and durability. Thus the legs of articles of furniture, designed in the style of Louis XV., are often broken in the centre across the grain of the wood, or having their base of support far within the perpendicular line of the bearing; a fault which, though not actually rendering them unstable, yet offends the eye as much as if they were really insecure.

The constructive forms, moreover, should not be obscured by the ornament, but rather brought out by it; nor should all portions be equally decorated, but only such parts as friezes, pilasters, capitals, pillars, or panels; herein simplicity is the safest guide to beauty. Over-enrichment, indeed, destroys itself, and it would not be difficult to point out works of the greatest pretension and the most costly workmanship, which are completely spoilt by this fault. Cabinets entirely covered with carving, the very stiles and rails being as decorated as the panels and pilasters: metal chandeliers, with leaves and flowers in as great profusion as in nature: papier maché hidden under a surface of pearl and gold. So extremely prevalent, indeed, is this error, that it may be said to be the ruling vice of the Exhibition. It should be remembered that contrast is one of the first elements of pleasure, and that *repose* is one of the most valued excellences of art: thus simplicity serves as the background to ornament, as the setting to the gem, or the foil that enhances the beauty of the jewel; and the good artist is as much shown by sparing his labour as the bad one by over-enrichment.

It results from the above rule that ornament should arise out of construction; the work, abstractedly, should be constructed, and then decorated; not that it is meant that the ornament should be *applied* to the object, but (as in wood for instance) carved from it; thus the leg formed for support, the pilaster or column for bearing, may be lightened and enriched by cutting away from the block or slab, not by adding to it. In his natural state man is a true workman in this respect, and works on just principles without knowing it. The New Zealander or the South Sea Islander first *forms* his war-club or his paddle of the shape best adapted for use, and then carves the surface to ornament it. The Swiss peasant, or the shepherd of our own hills, does the same. Such also is the case in the Eastern specimens of these works in the Exhibition, as is particularly exemplified in some choicely carved sandal-wood boxes in the Indian Department. Here the natural and the refined taste agree, for the best wood-carved ornament of the Renaissance is on this principle, low in relief, seldom projecting beyond the surface of the pilaster, or the framing of the panel. In this respect the French furniture as a whole is advantageously contrasted with ours, there being less of that imitative treatment, of those bulky bunches of flowers and fruits, which project in such graceless abundance from a large number of the British productions. This arises partly from their far greater knowledge, partly from their better appreciation of the laws of ornamental treatment and arrangement.

Another subject requiring attention from the designer is the judicious choice of the materials from which the works are to be manufactured. Allusion has before been made to the error of adapting one material to the ornament which had been designed for another; but besides avoiding this fault, the material itself should be so employed as to display it to the greatest advantage, and to produce the fullest effect of which it is capable. This remark applies equally to works of stone, wood, metal, glass, or any other material.

Thus, for instance, in wood-carving care should be taken not only to have the relief so managed as to guard the work as much as possible from accidental injury, but the designer should seek to adapt the forms of the ornament to the direction of the grain when it is open or free, and the work should be framed with a view to this consideration; moreover, ornamental carving should not be applied to wood of strongly-marked party-coloured grain, but that which is homogeneous in colour should be selected for the purpose, in order that the shape of the ornament may as little as possible be interfered with by being mixed up with the forms and colours of the grain. It is curious how much costly and skilful labour has been thrown away from inattention to such minor considerations as these. Again, in metal work a careful study of the material will suggest, among other things, the proper treatment of the surface; this is a matter of the greatest importance to the general effect. A due distribution of burnish and mat, of gilding and plain, or of the various kinds of surface tooling or frosted work, is of the utmost consequence—not to save labour, though this may result from it—but to give richness without gaudiness, and to enhance the beauty of certain parts by contrast with others. When the whole surface is burnished indiscriminately, as is frequently seen, the result is a glitter which obliterates form: when the whole surface is mat, the peculiar quality of metal seems lost from the want of burnish.

In some of the furniture exhibited, otherwise of much merit, the ornament is merely conventional, and derived from known examples; while in others, it has been so designed as to have a significance and motive in its adaptation. To such we should naturally allow the higher merit, but conceits and puerilities are so numerous in works of this class, as almost to destroy the pleasure which arises from ornament specially designed. We shall, however, have the gratification of referring to some well-considered works of this kind which are evidently the results of an imaginative and thoughtful mind.

There are not many "designs" for furniture in the Great Exhibition, besides those which are shown by persons exhibiting also manufactured works of a similar kind. In such cases it has been thought most desirable to judge of the manufactured product rather than of the designs; even Lienard (1326, p. 1239) on the French side, and C. J. Richardson (207, p. 751) on the English, the two largest exhibitors, may thus be judged of, since they both exhibit completed works.

These general remarks will serve to introduce the first subdivision of the section—

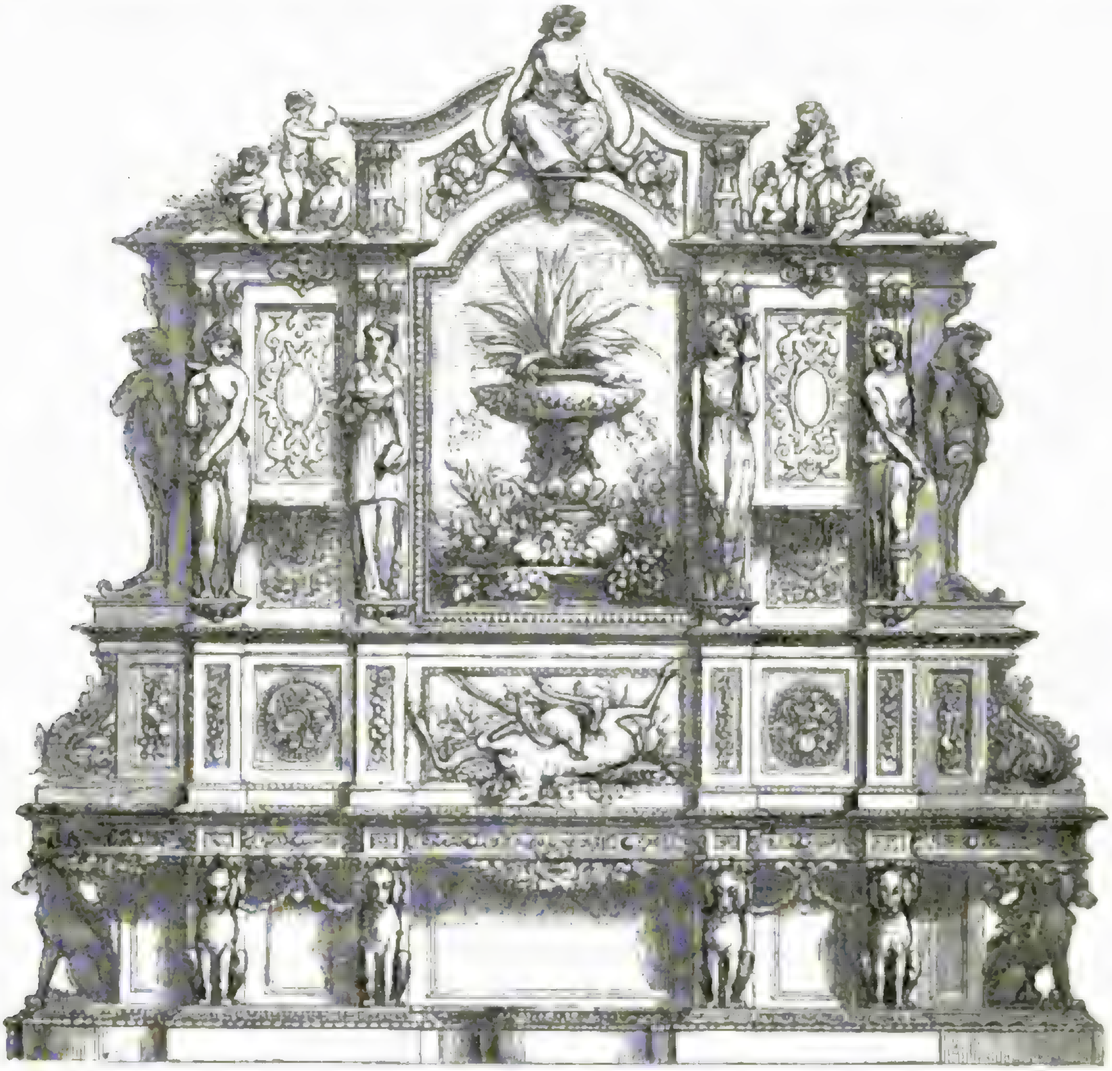
Cabinet-work and Furniture of all kinds.

The furniture of a man's house had need to be well designed, well constructed, and judiciously ornamented, for, from being constantly under his hand and eye, defects overlooked at first, or disregarded for some showy excellence, grow into great grievances, when, having become an offence, the annoyance daily increases. Here at least utility should be the first object, and, as simplicity rarely offends, that ornament which is the most simple in style will be likely to give the most lasting satisfaction. Yet, on looking over the various articles of cabinet furniture exhibited, how seldom has this consideration been attended to. The ornament of such works on the English side consists largely of *imitative* carving; bunches of fruit, flowers, game, and utensils of various kinds in swags and festoons of the most massive size and the boldest impost, attached indiscriminately and without meaning to bedsteads, sideboards, bookcases, pier-glasses, &c., rarely carved from the members of the work itself, but merely applied as so much putty-work or papier-maché might be. The laws of ornament are as completely set at defiance as those of use and convenience. Many of these works, instead of being useful, would require a rail to keep off the household. A sideboard, for instance, with garlands of imitative flowers projecting so far from the slab as to require a "long arm" to reach across it, and ever liable to be chipped and broken; and cabinets and bookcases so bristling with walnut-wood flowers and oak-wood leaves, as to put use out of the question. Now, besides that such treatments are not ornamental, they are not beautiful, and only enter into competition with stamped leather and gutta percha. There is great reason to doubt if this merely imitative carving is ever just in principle, when applied ornamentally to furniture; for, although the masterly chisel of Grinling Gibbons has raised it to great favour in this country, and although it may be tolerated when executed as skilfully as is that on a pier-glass frame by W. G. Rogers (Class XXVI., 195, p. 750), yet it becomes absolutely unbearable under less skilful hands, and when it is lavished in such profusion as we find it on many other works. On the foreign side, as has been remarked, there is far less of this false mode of decoration, and a better sense of ornament prevails; the works are more frequently designed in the traditional styles. In France, a modification of the Renaissance is principally used, and in this the ornament is in low relief, and does not interfere with use; although false construction is a vice of that period, which has not been remedied in modern works, but is sometimes exaggerated.

The style of Louis XV. lingers in some of the French works; its playfulness of line and surface, its varied treatment and mixture of materials, together with its showiness, still command favour with the multitude. In the French Court (and in some works on the English side, probably of French manufacture) it is seen in its genuine character. The surfaces of these works are curved, when practicable; they are veneered in parti-coloured woods, and panels are formed by or-molu mouldings, often in both instances completely at variance with the true construction; and occasionally the panels are filled with porcelain enamels, the whole having at least a gay and sparkling appearance. Some attempts have been made in the English Department to adapt ornament of this period to cabinet furniture, but it has been totally misunderstood. Instead of the treatment above described, the bold scrolls and shell forms used in the decoration of rooms at that period are here seen carved in all their coarseness on furniture. Such works bear out the remark before made, that these forms were especially adapted for gilding, and, indeed, are hardly bearable, except when so treated, or when made of metal. This becomes even more apparent when full-coloured woods are used, such as mahogany; in this material the ornament is even more coarse and heavy than in lighter-coloured wood. Since, however, the vendors of cheap furniture have adopted this manner as a cheap and flashy decoration for their goods, it is to be hoped that it will soon be entirely proscribed, or retained only by such dealers.

Those designers who unreservedly adopt the ornament of past times must, of course, apply it to their works without any peculiar significance or connected idea, but merely for its beautiful forms, elegance, grace, or richness. Where, however, any significant allusion, sentiment, or happy idea can be embodied in the ornament, uniting it with the use and intent of the work on which it is to be placed, it will have a charm which the others want. Not that this want is peculiar to the application of traditional ornament, since the designer in the natural or imitative manner seldom attempts any connexion between his decoration and the work to which it is to be applied. There seems no fitness, for instance, in surrounding the frame of a pier-glass with dead birds, game, shell-fish, nets, &c., although they may be excellent specimens of carving; nor is it clear why eagles should support a sideboard, or dogs form the arms of an elbow-chair; nor, again, why swans should make their nests under a table, at the risk of having their necks broken by every one seated at it: indeed, in most cases, as such imitative forms cannot in the strict sense be called ornament, they almost challenge inquiry as to why they have been adopted, and disappoint us when we find it has been without motive; this is not the case with traditional ornament, which, like the current coin, is accepted at once without inquiry.

The sideboard, carved in walnut, as here shown, and which is exhibited in the French Court, by **Fourdinois** (France, 1231, p. 1236), is an apt illustration of ornament having a just and characteristic significance. This piece of furniture is of rare excellence and merit in design, and of skilful and artistic execution as to carving, and, although of a highly decorative character, is fitted for the purpose for which it is intended. Six dogs, emblematical of the chace, resting on a floor of inlaid wood, support the slab, which has a simple carved moulding along its front, and is inlaid in geometric forms. The dogs are not merely imitative, but are treated as a part of an ornamented bracket or console, thus composed architecturally for bearing and support. Above the slab, standing on four pedestals, are female figures, gracefully designed as emblems of the four quarters of the world, each bearing the most useful production of their climate as contributions to the feast. Thus Europe has wine; Asia, tea; Africa, coffee; and America, the sugar-cane. In the central space between the pedestals, which is rather the widest of the three, the products of the chace are poured out on the very board, and above this the space is filled with a framed picture of rare fruits, giving an opportunity to enliven the work by the addition of colour, without militating against good taste; above the figures, which are treated as statues, the cornice is bracketed, and supports boys with the implements of the vineyard and of agriculture. It rises into a pediment in the centre; this is broken in the manner of the Renaissance, and decorated with a figure of Plenty crowning the group. The upright line of the back is gracefully varied at the sides, and constructively strengthened by carved brackets, above which are terminal figures bearing the implements of fishery on the one side and of the chace on the other. The panels of the pedestals and of the side compartments below are filled with carvings formed of the fruits of various countries, grouped with the instruments of horticulture and agriculture. Two brackets on the side compartments between the figures give an opportunity for placing silver plate in a position for display. The ornamental parts of this piece of furniture are carved throughout in a masterly manner, and in a bold and free style; it is consistent as a whole, and free from puerilities, and, while it is thoroughly fitted for its purpose as a sideboard,



it is at the same time of a highly ornamental character, without any of its decoration being overdone or thrown away. It corresponds in its constructive form with the Renaissance of the 15th century—in the style of its carvings rather with the works of the 13th; the gates of Ghiberti having evidently supplied the idea of the groups of fruit and implements which fill the panels; and it may be remarked as a fault, that it has been overlooked that the relief in Ghiberti's work was suited to metal, the ornament standing beyond the face of the framing of the panel; but in adapting it to wood this should have been modified so as to bring the impost of the carving within the surface; such faults, however, are trifling in a work otherwise of great ability. The care which has been taken to keep all the ornamental details in the same scale throughout is an additional merit, and the wood has been judiciously chosen as to colour and grain.

When we turn from such works as the above to furniture designed strictly in accordance with the rules of a traditional style, we feel that there is often a cold propriety about it which requires consideration before we can admire it; yet among such are some of the best works of the Exhibition. The wardrobe of T. F. WIRTH, of Stuttgard (Wurtemburg, 70, p. 1118); the console-table and glass of A. BARBETTI, of Siena (Tuscany, 91, p. 1298), are excellent specimens in their kind, well designed constructively, and ornamented in exact conformity with the Renaissance style; the cabinet of RINGUET-LEPRINCE (France, 1437, p. 1245) has high merit; the ornamental treatment of a picture-frame by M. J. LIENARD (p. 1239); the cradle in the Fine Art Court (353, p. 842), so skilfully carved in boxwood, by W. G. ROGERS, from a well-composed design by his son, W. HARRY ROGERS, also; and a sideboard by a student of the SCHOOL OF DESIGN AT SHEFFIELD (p. 758). With these exceptions, the best works are in the French Furniture Court, although in them the style is often mixed, and the constructive faults of the Renaissance have been adopted as well as the ornamentation. In other styles, perhaps, the best example of a careful adherence to tradition is observable in the furniture of the Mediæval Court, as in a Gothic sideboard, really fitted to display a service of plate; a carved oak cabinet bookcase, by J. G. CRACE (Class XXVI., 530, p. 761); and other works. These are particularly to be commended for their sound constructive treatment, and for the very judicious manner in which ornament is made subservient to it. The metal work is also excellent, and the brass fitting of the panels of the bookcase deserves to be studied, both for the manner in which it has been put together, and for its graceful lines. The candelabra of the sideboard also are sensible forms, without any unnecessary ornament. Such furniture in old times was often ornamented with mottoes or texts, a practice which might well be revived, as having far more significance than the commonplace conceits of much of the ornament of the present day. It may perhaps be objected that the general forms of furniture in this style want variety, and this is rendered more apparent by the florid lines of many of the works around them; but the principal reason will be found to arise from a due consideration of the true constructive treatment of *wood*, which is ill adapted to curved forms on account of its grain, and requires horizontal and perpendicular lines as the basis of framing. The ecclesiastical character of the works in this Court has been already alluded to. It must be remembered that the spirit of the age from which they have been adopted was to bring a sense of the pervading authority of the Church, and the *outward* forms of religion, at least, into all the offices of daily life. This was altogether changed when the revival of ancient learning and of ancient art destroyed the Christian symbolism of ornament and deluged the Roman Church with decoration derived from Paganism, and consequently entirely opposed to the true spirit in which all ecclesiastical ornament should be conceived. The change in ecclesiastical decoration soon pervaded domestic furniture also, and ornament lost all significance and symbolic life. Some credit, therefore, is due to the revival of a better and purer state of things, and a return to the old paths and avoidance of the present mere sensualism of ornament. Yet it is not on this account, but as examples of careful and strict adhesion to true *principles* of construction and ornamentation, that the works in this Court are so often alluded to; they deserve commendation for their illustration of truth, and as showing what one man, by earnest and well-directed attention, can achieve in the reformation of taste, and in the training and forming of other minds to assist in his truthful labours. Their unity of character, moreover, is not the least among their many excellences.

The cases of musical instruments have been barely alluded to in this section of our Report, although they must be classed under the head of furniture. Such works, exhibited in various parts of the Exhibition, display a vast amount of labour entirely thrown away, and tending only to vulgarize that to which it is applied. Some pianofortes are entirely covered with inlays; some with gilding; some have pillars that support nothing, and carved brackets applied to no purpose. There is little harmony to the eye, however much may be produced for the ear: common sense, nevertheless, would seem to require simplicity in the exterior decoration, that one organ may have rest while the other is occupied. The thought indicated by the ornament is frequently most commonplace, being often that of a whole concert of musical instruments around the one ornamented, or their substitution for brackets, columns, or legs. There seems to be as little invention as fitness in adapting lyres as legs to pianofortes, yet this has been resorted to, whilst any consideration of a better mode of *applying* the support, especially in the case of grand pianofortes, appears to have been overlooked. Some of the best makers, both native and foreign, have contented themselves with carefully selected woods of choice grains, enriched by carved or gilt mouldings only, and have justly relied rather on the merits of their instruments than on the gaudiness of the cases. This is, at least, sensible, since the ornament of such works is quite supplementary, and will less bear overdoing than on many other articles of cabinet furniture.

Inlays of metal, mother-of-pearl, or tortoiseshell, may be introduced with excellent effect in furniture; but they must be used sparingly. Such a marvel of labour as the table exhibited by PEREZ (271A, p. 1346), in the Spanish Court, of course does not come within the scope of this remark; the subdued colour of the wood used, and the forms chosen, are nevertheless so judicious, that as a piece of ornamental inlay it is excellent for its art, as well as from its curiosity as a feat of labour. Some of the buhl cabinet furniture in the French Court may be instanced as showing that an excess of really beautiful ornament tires us, and causes meretriciousness. There are some excellent specimens of geometrical wood inlays for furniture exhibited by MARCELIN (France, 606, p. 1207), and the inlaid top of a table among the furniture by LEISTLER (pp. 1039, 1040), in the Austrian rooms, has much merit; such inlays come under the same general laws as mosaics, which have already been treated of, requiring great simplicity and perfect flatness. The table (112) in pietra dura, by BOSCHETTI (Rome, 17, p. 1286), consisting of a wreath of orange-flowers, bordered by a simple line, is in the purest taste; the more costly one near it is marred by the introduction of a band of architectural ornament, contrasting far too strongly with its ground,—a fault worthy of notice, as it prevails largely in similar works.

The furniture in papier maché is almost wholly of English manufacture; it is derived from the old importations from Japan, but has gone far beyond such goods in its excess of decoration: it is the most gaudily decorated of all manufactures, and seems quite beyond the pale of any just principles of ornament. There is no apparent reason why this material should not be used for chairs, couches, tables, or cradles; but the art of designing for it is not yet attained: as the material possesses peculiar properties of strength and lightness, without needing any framing, it should be considered purely for itself, and the designer must forget all other constructive forms. As to its ornamentation, the sooner it has a thorough revision the better, since at present it is a mass of barbarous splendour that offends the eye and quarrels with every other kind of manufacture with which it comes in contact. The simple lacquered work of India may afford an example for the ornamentation of papier maché. Figs. 2 and 3, Plate 3, are specimens of lacquered ware taken from the tops of small boxes in the Indian Department. The purely ornamental treatment of the forms and their elegant flowing lines, with the agreeable manner in which both gold and colour are dispersed over the surface, is a lesson of richness without gaudiness worthy of the attention of the manufactures of papier maché: and when it is remembered that this ware is of the commonest and cheapest character, it serves to show that vulgar forms and bad ornament are not necessarily connected with cheap manufacture.

Some of the greatest faults in the furniture of the Exhibition are its unsuitableness to uses, and its false construction. Look, for instance, at the costly articles of the Austrian rooms, and it will be found as skilful in execution as it is deficient in adaptation to its intended purposes. The bed looks more fitted for a corpse to lie in state on than for a place of repose; it is a congeries of parts without an object: the footboard is so high and solid that it shuts in the sleeper as in a prison, and completely impedes the free circulation of air; the footposts rise from massive purposeless bases, and dwindle into mere sticks as they approach the heavy canopy; the wood selected is unsuitable for carving, its party-coloured grain blurring the ornamental forms. In the other furniture like inconsistencies appear; in the cabinet large spaces are thrown away, and therefore, though occupying much room, it has little that is available for use; the centre space, with its canopy (though pretty), has no apparent purpose, and it is quite disproportioned to the size of the wings, besides being deficient in the appearance of support. The bookcase has the same fault of room thrown away and of unsuitableness to use, besides being a false adaptation of Gothic stone forms to wood-carving. This latter fault is elsewhere also largely prevalent; it is an error in most of the Belgian furniture. Thus we have a wardrobe which would be more characteristic as an oratory, and a bookcase with arches that support nothing, and buttresses which have no thrusts to resist. Indeed it should be remembered that the *arch* is not a wooden, but essentially a stone construction; it will be evident, on a moment's consideration, that it is a means of obtaining support by a number of separate small parts, the reverse of timber construction. It ought, therefore, to be well considered before being used in wood, wherein it should arise rather from coupled knees or brackets introduced to strengthen horizontal beams, than as an independent form. Its improper use will also be seen in various sideboards on the English side. In these the back consists of a mirror, over which a wooden arch is thrown; the glass having the effect of a void or opening; the thin wooden arch, bearing nothing, not only has a meagre appearance, but, having nothing to sustain its thrusts, is quite as much at variance with the use of the material as it is with a proper sense of construction. One of the best of such treatments is seen in an elegant cabinet and mirror exhibited by Mr. SNELL (Class XXVI., 170), wherein a light inner column and arch, metallized by gilding, is introduced with good effect; even here, however, the pilasters which support the outer arch seem to want brackets at the sides of their base to give more appearance of support, for the introduction of which there is ample space; the small abortive ones which are used serving only the more directly to pointing out this want.

Sham construction is another error alluded to, not only of the kind before spoken of,—the suppression of the true constructive forms, as panels, framing, &c., and giving undue prominence to others,—but also where those portions which are intended for support (as, for instance, columns in cabinets, legs in sideboards, &c.) are made to move from under the parts intended to be supported when opening the doors of the furniture. This is a common case in cabinets designed in the Renaissance style, and has the authority of some of the best antique specimens; nevertheless, it is a constructive fault, and is instanced because it is the source of many like errors of a more glaring kind, as where legs are made to remove, or where the whole front of a cabinet or wardrobe is made into doors hanging to the sides without a framed facia and hanging style, and both the side and centre columns (where columns are so used as decorations) are made to move with the doors.

In reviewing the furniture of the Exhibition, the question of the education of the art-workman again comes prominently under review. While it must be confessed that the general design of the French works in this class are greatly in advance of our own, it is also apparent how much more widely diffused in France is that art-knowledge, which, combined with handicraft, constitutes the true art-workman. Although this is peculiarly seen in works in metal, it is evident in many other branches of industry. Wherever the human figure is used as ornament in English works, it is pretty sure to be faulty: the figure may be well composed, may be evidently designed in good taste, since that is often the work of a superior artist; but in the execution it is almost always disfigured and spoiled. The extremities are finished without knowledge of the internal structure, the fingers, toes, and joints have no bones within the skin, but that "gummy" undecided treatment which evidences the ignorance of the workman. In wood-carving this is equally apparent, even when it consists only of ornamental forms. Very often in such work the "design" of the ornament would seem to be by the same unskilled hand that carved it, since it is mostly out of place, coarse and merely "natural" in style, and rarely reaches beyond the expression of the most commonplace thought, or the imitation of the commonest fruits and flowers. That great power of imitation and skill of hand, however, are not wanting in the English carver, is evident from many examples, and is particularly shown in the beautiful and delicate flowers, &c., of T. W. WALLIS, of Louth (Fine Art Court, Class XXX., 89, p. 825), which are quite equal to the French works in the same style; but even these go no further than imitation, and the human figure cannot be carved by a merely imitative process:—success in rendering either the human figure or animals when in life and motion can only be the result of knowledge attained by a careful study of the structure of the bony framework and of the moving muscles; and it is the want of such anatomical knowledge and of a proper training in art that causes the deficiency we are obliged to notice in the English Department, and compels the carver to confine himself to mere works of imitation, knowing that higher are beyond his powers.

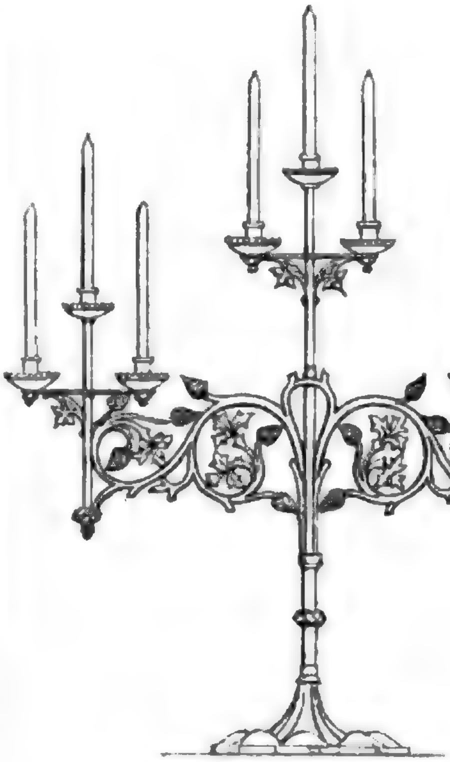
The two figures in the front of the cabinet of RINGUET LEPRINCE (p. 1245), for instance, are unapproached by anything in English furniture; as is the rare excellence of the carvings on the sideboard of FOURDINOIS (p. 1236), and the works of LIENARD (p. 1239). Even where the figure has had a partial study, the imitation is often cold and "mannered;" the letter is followed rather than the spirit, and it is almost impossible to find a workman entering into the feeling and spirit of the artist-designer, and treating the work in a good and bold style. The bronzes of men and animals are perfect instances, in French works, of the power of the workmen to enter fully into the feelings of the artist, and to appreciate style and intention, but the same union has hardly anywhere been attained by the English workman. The Belgian carvers, with GEERTS (p. 1165) at their head (a perfect artist in wood), are advancing in the same direction, and it must be allowed that the Austrian figure carving, as shown in the furniture of LEISTLER (p. 1039, 40), is much beyond ours, while the Berlin casting and chasing of small works is fast rivalling the French, and in some cases is in a much purer style. The carving of Italy is careful, but tame, and inclined to littleness; this will be seen by comparing the style of the children in BARBETTI's table and mirror (p. 1298), a work otherwise highly commendable, with the gusto and vigour—the larger manner and bolder treatment—of some of the French works. The children on a small scale in the bookcase of HOLLAND and SON (p. 745), which contains some otherwise good carving, show the timidity of the English art-workman when he has to deal with the figure. Some very small panels, carved in white wood, on a sideboard by J. M. Levien (p. 751), are in better style, although very minute, but the general want of knowledge is too apparent. This deficiency of power and skill in the human figure is only an additional evidence of the want of better education for our art-workmen. They need to have proper treatises prepared for them, laying down the principles of ornament, and giving them a thorough foundation in practical geometry, form, proportion, and, above all, in anatomy, together with a careful education of the hand and eye; and unless the Government and the manufacturers of this country are soon awakened to our deficiencies, and prepared to make great sacrifices, we must be content to lag still further behind as the world advances, and for the future to be manufacturers of cheap goods, leaving excellence and beauty to our continental neighbours.

Hardware.

Under this head are comprised grates, fenders, fire-irons, stoves, gas-fittings, lamps, and various miscellaneous applications; the whole being largely connected with ornamental design. The works in this section, however, are not more miscellaneous in their use than they are in their style of ornamention, almost every manufacturer endeavouring to exhibit in any and every style. Thus we have Greek candelabra adapted to many uses, Gothic chandeliers and Renaissance lamps, with a pretty large sprinkling of the forms and ornament of Louis XIV. and XV., to which, on the English side especially, is to be added the *natural style* before alluded to, which, adopting foliage or flowers as its leading idea, presents them as they grow, without any constructive or architectural arrangement whatever. Yet even this is encouraging, since it indicates a desire for something more than mere reproductions of the antique, or that *mêlée* of ornament which the ignorant gather from many works, and reassemble without taste or appropriateness; it at least indicates a change. In a great portion of the metal works French taste is found largely to prevail on both sides of the building, nor is this to be wondered at, since, for a long time, the lively fancy and invention of many excellent French artists have been directed to designing and modelling for these goods; ably seconded, also, by trained and educated workmen capable of appreciating their labours, and completing them by skilful casting, chasing, and fitting. But the tendency of the French mind towards display has resulted in over-ornamentation, and it is unfortunate that this fault is rather a merit in the eyes of the world, and has been eagerly adopted by the manufacturers of other nations, more especially of our own, that which is meretricious being retained, whilst what is really excellent in French design, and especially in French workmanship, is overlooked by them, or is unattainable.

Moreover, whilst the most able French artists in metal, eschewing the gaudy style of Louis XV., have returned to a modified form of the Renaissance, and have given it somewhat of newness of character, the English designers for hardware (with a few exceptions) either still adhere to the contorted style first named, or produce works composed of ornaments pirated from all times and all nations, put together without any sense of construction, without selection and without fitness. Such works are a thorough chance-medley that disgrace our manufacturers, and make us look back to the simpler forms of the middle ages with respect and regret.

Let any one examine the characteristic simplicity of the candlestick here engraved (exhibited by Messrs. Hardman, 532, p. 761, from a design by Mr. W. Pugin), adapted as it is for use, standing firmly, capable of being handled, light, yet strong, and compare it with the showy works around it, so *ragged* and tangled with ornament that all characteristic form is lost, branched arms bristling with foliage weighing down rather than bracing and supporting them, with perhaps a bunch of flimsy chains dangling in the way of those who would touch or lift them, or two or three Parian Cupids basking at the foot, or bearing up the candles; and where the hand should grasp the stem to lift the candelabrum, the ornament so sharp and thorny that to touch it would be impossible.

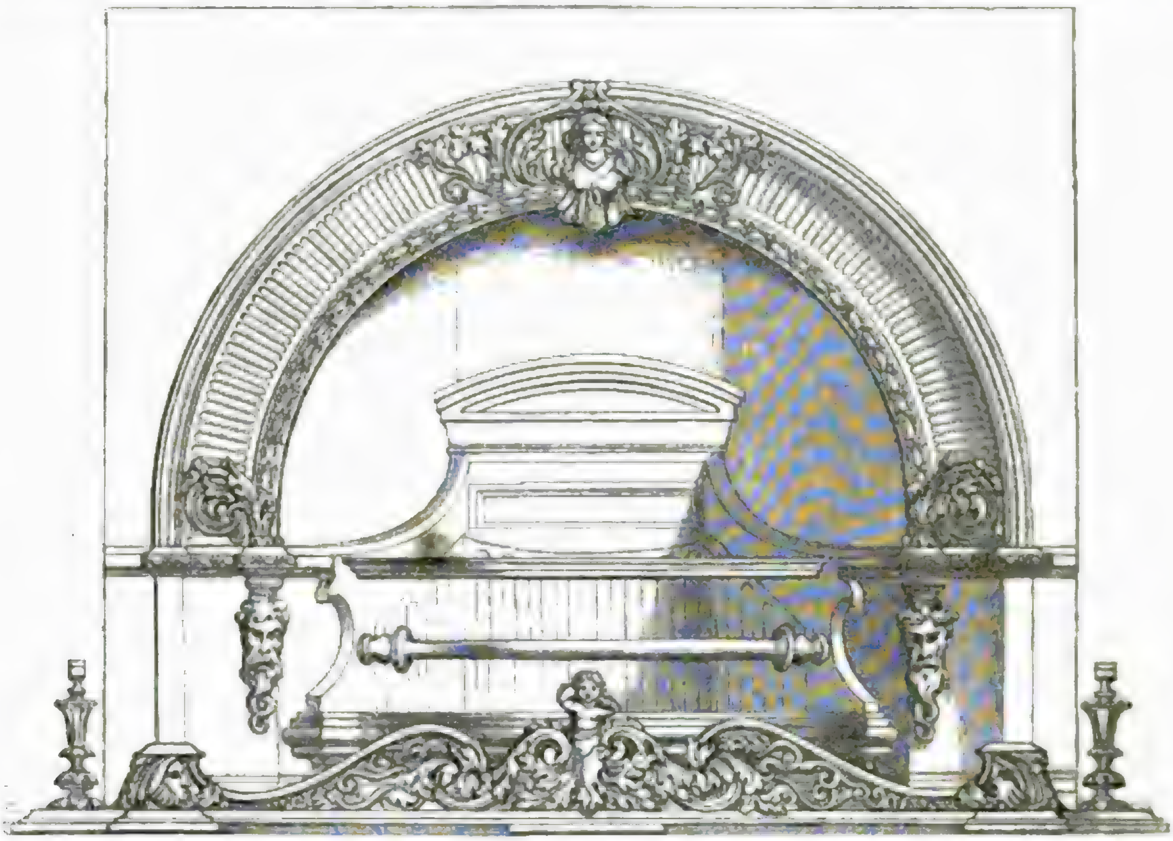


In making such a comparison can we do otherwise than feel that the one is honest, useful, characteristic, and therefore beautiful, whilst the others are flashy and grotesque, full of little prettinesses, which some misname "ideas," put together without any leading motive, and having no definite character or true construction?

The faults of English design for hardware are obvious to every one; the error of the French designers is equally open to the most superficial observer. In the great mass of these works there is no rest for the eye—the whole surface is nothing but ornament. Thus, for instance, the French art-bronzes have justly obtained a wide reputation, and the works of Denière, Pradier, Méne, and other French artists, are sought for all over Europe; but when such become a part of manufacture, and liable to be classed as hardware, art is overlaid with ornament, and the skill of the workman is directed to that which degrades the work, and sadly militates against good taste. Thus, figures designed with much fancy, and modelled with ability and vigour, are vulgarized from the imitation of fur and of the texture of the garments, of buckles, buttons, and ties of the dress, of chain or plate armour or weapons, whilst the homogeneity of the bronze is no longer retained, but various parts of dress are treated in various tints of the metal; and all the different qualities of surface, such as tooling, frosting, and burnishing, in which it is but just to say the workmen are most skilful, are brought into play to *enrich* the effect; while sometimes we have, in addition, combinations of many materials, such as marble, porcelain, ivory, and bronze, united in a single work.

Another class of works are those anomalous candelabra composed of porcelain vases filled with a bunch of flowers in or-molu, a few bearing candles amongst a number of barren branches, the whole being a bush of glitter and burnish. This is the direction which naturalism in ornament takes in France. Such works have a total absence of constructive feeling, and an equal want of proper treatment of metal; to add to their finery, an épergne of artificial flowers is often mixed up with metallic ones, as a centre-piece for the dinner-table. There are many large candelabra in various parts of the Exhibition—in France, Holland, Austria, and Russia—which evidence the wide dispersion of French style, and contain exaggerations of the most frequent French faults. The error, however, does not wholly rest with the designer, since it will be long before he has a public sufficiently educated to relish the amount of plainness which is absolutely necessary to give the true value to each part enriched.

Grates.—Grates rank among the principal works in hardware to which ornamental design is applied, at least on the English side, and there by far the best specimens both as to design and workmanship are to be found: this was to be expected from the general necessity for warmth in our cold and variable climate; an Englishman's love for his fireside having passed into a proverb. It is gratifying also to see that the design and decoration of these goods have greatly improved in the last few years. Some works of great merit are to be found among those exhibited, while the workmanship generally is excellent. There is, however, an evident tendency to do too much, and it is incumbent on designers for such goods carefully to avoid this, and to endeavour to restrain manufacturers from such treatments of the metals as lead to gaudiness and glare, and by which, at the same time, the grate itself is rendered less useful. The great secret, after constructive use has been considered, consists in the proper and judicious treatment of the materials, which offer great advantages for contrast, either with or without the introduction of bronze or or-molu. True excellence will be found to be closely allied to simplicity—a moderate use of ornament and of the burnisher, and the contrast of broad flat masses of plain metal with ornamented or burnished mouldings, with inlays of brass, or with bronze and or-molu ornaments. The arched form which has generally been adopted for grate-fronts is architecturally suitable and agreeable in outline, giving ample opportunity for ornament in the mouldings of the arch, as well as in the spandrels, besides having sufficient surface of metal to contrast with; moreover, it is not likely to interfere with the architectural arrangement of the mantel-piece to which it may have to be fitted. Messrs. ROBSON and HOOLE (Class XXII., p. 609) exhibit several grates designed by Mr. A. Steevens, highly decorative in character, and of great general merit; two especially, fronting on the Central Avenue, designed in the Renaissance style, evince great artistic ability. The one engraved, however, which is exhibited by them, is more constructively simple, and sufficiently ornamented for its office as an article of furniture, while it displays most judicious use of the material. The face is of ground cast metal, the ornamented moulding of pale bronze, with the leafage of brass, and the figure bronzed, while some semi-burnished lines about the fire give a very chaste and tasteful effect; the fender is also of bronze and brass, with the leading lines burnished. Much more ornament than this would raise the grate out of its right place in the scale of furniture, and draw undue attention to it; its sober simplicity is more to be commended than many of the very highly ornamented grates around it. Messrs. STUART and SMITH (p. 603) have also some meritorious works as to design, but from the excessive introduction of burnished surfaces the grates look too fine for use. Messrs. Hooles have avoided this by a large introduction of the ground metal, which contrasts excellently with either burnished or brass *ornaments*, and adds to their beauty by its own repose and sobriety. It can never be too much insisted on, that ornament loses its value when it overloads a work, and that large unornamented spaces are required to enhance and give zest to the decorated parts. As we descend to grates designed by inferior artists, we find excess substituted for excellence, and works of such brilliant gaudiness of surface as to be quite unfitted for their intended use; indeed, the process of keeping them in order would seem to require that a whitesmith formed part of our establishment, or that the housemaid should have a practical education to enable her to take to pieces the elaborate constructions which would come under her care, independently of the skill required to clean them. Messrs. Stuart and Smith have made attempts at the combination of materials with some success, and have also some cleverly designed metallic inlays for hearths.



It is tiresome to repeat what has so often before been said, that use ought to be considered before ornament; yet no section of furniture suffers more from neglect of this rule than that comprised under hardware, not only in the works exhibited in the British, but in all parts of the Exhibition. In some cases this shows itself in applying a form or construction suited for one use, to another for which it is quite inapplicable. Thus some chandeliers in the French Court, which at first sight seem cleverly designed, and a skilful treatment of the metal, on examination are found to consist of a large central lamp, which alone is intended to give light, surrounded by a circle of branches bearing sham candles, not intended or prepared in any way for illumination, but introduced merely to allow of a little extra ornament. From the same cause results the impertinent *application* of figures, in bronze or in Parian; a fertile source of bad taste. These are too often merely added to the work, and not constructively treated, and thus seem to have no real relation to the forms they are connected with. Hence the manufacturer is enabled to adapt the same figure to many purposes, and to the most opposite uses; sometimes at the base of a chandelier, sometimes at the top, and sometimes perched upon the branches. Profitable to the manufacturer this may be, but it is as completely opposed to every just principle of design as to every hope of progress or good taste.

In the treatment of metal the rendering of the surface demands the most careful study, since much of the beauty of a work results from this being properly understood. No doubt the true lustre of metal is only given in the burnished state; but when burnishing is introduced in any quantity, it becomes not only tormenting to the eye but wants contrast to bring out its brilliancy. Moreover, by its glitter it obscures ornamental forms, which rarely look sharp or clear in their details under this treatment. When figures or animals, introduced for decoration, are burnished, their true form is almost undistinguishable on account of this glitter and the reflection from the polished surface, besides the pressure of the tool completely destroying all details of form and surface. Yet many important works (a clock in the Russian Court may be especially instanced) have the figures entirely burnished. The evil caused by a glittering surface in such works is duly appreciated by the French artists, who have wisely adopted bronze as the material for figures in the baser metals, and have overcome the difficulty by oxidation in their works in silver. A medium state of the surface between mat and burnished, though much to be desired, is not always obtainable, nor has it perhaps been sufficiently sought. Bronze, however, from its colour, partially supplies this want; and the mixed metals, and ground cast iron from its duller polish, afford good contrasts to burnished iron or steel.

While our use of burnish often tends to blur and destroy form, the older workmen took advantage of a polished surface to produce ornament; this may be seen in some of the old church chandeliers, of which the central trunk, consisting of a plain turned boss, seems richly reeded when the branches are lighted, merely by the reflection of the lights on the metal.

In most of the modern works, burnished and matted surfaces seem to be used indifferently or at random, instead of applying the burnisher to give variety to recurring forms, or to enhance leading lines. These are often entirely matted or tooled, and those parts burnished which will give the greatest flutter and glitter to the object.

The *natural* taste in connexion with the ornament of hardware has already been condemned. It is as false in construction as it is to all just ornamental principles.

The facilities which modern mechanism gives to the production of ornament, and consequently to over-ornamentation, have also been adverted to in the earlier parts of this Report. It is to be hoped that in view of these facilities manufacturers will see their own interest, and seek the best designs at any cost, since these will frequently be found to combine cheapness of production and simplicity with good taste. There can be no doubt that half the ornament in the Great Exhibition, and consequently the labour expended on it, is in excess; that is to say, that a better effect might have been produced without it; and this wasted labour might have been bestowed on the more careful completion of simpler designs, to the enriching of the manufacturer, and the great advantage of the public taste.

CARPETS.

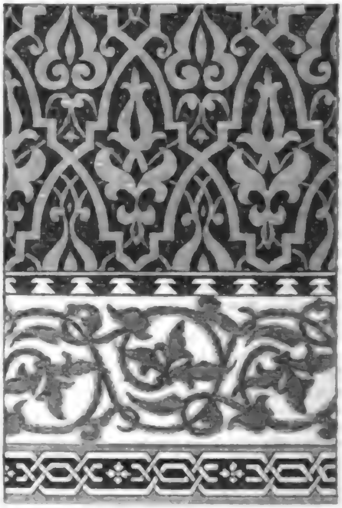
The use of these fabrics suggests the true principle of design for their ornamentation, which is governed by the laws before given for flat surfaces, where the object is rather to treat the whole as a background than to call particular attention to the ornamentation. Flatness should be one of the principles for decorating a surface continually under the feet: therefore all architectural relief ornaments, and all *imitations* of fruit, shells, and other solid or hard substances, or even of flowers, strictly speaking, are the more improper the more imitatively they are rendered. As a field or ground for other objects, the attention should hardly be called to carpets by strongly-marked forms or compartments, or by violent contrasts of light and dark, or colour: but graduated shades of the same colour, or a distribution of colours nearly equal in scale of light and dark, should be adopted; secondaries and tertiaries, or neutralized primaries, being used rather than pure tints, and lights introduced merely to give expression to the forms. Under such regulations as to flatness and contrast, either geometrical forms, or scrolls clothed with foliation in any style, leaves, flowers, or other ornament, may be used, which with borders and compartment arrangements, and the use of diaper treatments, leave ample room for variety and for the inventive skill of the artist. It may be thought impossible or unnecessary to confine the designer too strictly by such laws, and they are, indeed, rather stated from a sense of their truth than with an immediate hope of their thorough acceptance; but at any rate they may serve as curbs to extravagance of design, and as guide-marks to lead back the errant designer to the path of consistency. In speaking of designs for these articles we turn first to France, both as the largest contributor of designs generally, and because the importance of her national manufacture of these fabrics must claim for them our first consideration. Three of her principal ornamentists exhibit designs for carpets; two of them, however, seem to consider any such principles as those given entirely unnecessary: their works might as well be florid designs for the decoration of ceilings, if such a false system could be applied anywhere. Thus one of the most important carpet patterns of one of these artists bears a deep border of architectural decoration shaded in relief, consisting of shields and scrolls, of the Louis Quinze period, with wreaths of flowers rendered imitatively and in perspective. This border seems thrown downward, to form a reversed coving; within the field of the carpet, as in a mirror, is a forest, with the sky seen through the central opening between the branches, whilst amorini, almost as large as the trees themselves, sport beneath their shade or float in mid-air. The principal work of the second is of a like character, with trees and flowers, fountains and statues, earth and sky, mingled on the surface of the design, in total contravention of those laws which have been presumed to be just ones for such a purpose. The third artist, M. CLEROUT (p. 1219), both in his carpet and in his other designs, forms an honourable exception. Flatness, a just ornamentation, and a quiet distribution of colour being the consistent results of his labours. With regard, however, to the two former, it would be unjust not to speak of the great executive skill, the knowledge, and clever arrangement observable in their works. These, however, by their attraction, only increase the evil such designs foster. The results of such false principles are apparent all over the Exhibition, and are plainly visible in the carpets and hangings exhibited by France. To begin with the establishments which, under royal or national aid, have carried these fabrics to the highest pitch of excellence in all that relates to skill of manufacture, brilliancy of colour, and magnificence of design. In the face of the many and rare excellences they exhibit, both of handicraft and scientific knowledge, the chemist and the botanist having united their sciences with the invention and taste of the painter, it is extremely daring to reprobate the ornamentation of these costly works; but the designers who have laboured for them have, by these very excellences, so largely contributed to the spread of bad taste and false principles in such fabrics, that it becomes a positive duty, in the face even of the highest authorities, to object to the principles on which they are ornamented, if we would place carpet designs on the right footing for the future. That the stream is impure at the fountain head has been shown in reviewing the designs, where the artist, exhibiting what should be specimens of his own taste, has fallen into the false taste of the public, or rather outrun it. In the manufactured products we see the result; the principal carpets exhibited combining a mixture of ornament with natural or imitative flowers, designed with the greatest skill, coloured with the tints of nature, and gracefully and tastefully disposed; the ornament however, is purely architectural, and in shaded relief, without any sense of flatness; and consists largely of the broken curves, the coarse scrolls, and the shell forms of the Louis Quinze period. In the carpet from the manufactory at **AUBUSSON** (France, 1499,) the contrasts of colour, both as to tints and light and dark, are of the most violent kind; distressing the eye, and distracting the attention from any works which might be in juxtaposition with it. The carpet from the **GOBELINS MANUFACTORY** is less objectionable in its contrasts of light and dark, and is highly skilful in its arrangement of colour, but it has the same erroneous use of it, the same adoption of the ornament of another material, the same florid taste and want of flatness. It may be said that these works, designed for the gorgeous magnificence of palaces, can hardly come under sober rules; that they are essentially intended for display. Even allowing this to be the case, such specimens may well serve as warnings of the danger of adopting the like style for more general uses; and even in a palace, the chaste simplicity of its statues, and the subdued hues of the works of high art which should adorn it, could stand little chance of vying with the richness and lustre of fabrics so over-decorated; and the princely inhabitant would certainly share the attention of the spectator with the gaudy carpet which covered the floor.

The English designers contribute less to the Exhibition than their French neighbours, and, although their works are behind the others for skill and execution, some are in a far more sober and just taste. The designs exhibited by the students of the Government School of Design are of this number; being the works of students, it can hardly be expected that they should abound in invention, and we ought to be satisfied to find that good principles prevail in them. There is a good design exhibited by J. K. **HARVEY** in the Fine Arts Court (Class XXX., 119), and two or three of inferior excellence in other parts; but it may be fairly said that our carpet designers, as a body, have not sent evidence of their skill to the Exhibition, but are to be judged of rather by the fabrics themselves. With the exception of France, already remarked upon, no other nations have contributed any designs.

On turning attention to the manufactured goods, they will be found to consist of such a confused mixture of styles, and to exhibit such a total want of consistency, that it is at once evident the designers, both at home and abroad, are amenable to none of those *principles* which have been explained as governing the decoration of carpets. It is true that among the number of works exhibited there are many of great skill and ingenuity of decorative treatment, of rich combinations of colour, and which nearly approach to excellence; but it is nevertheless obvious, even from their extreme variety of style, that designers and manufacturers feel themselves bound by no laws, and perfectly at liberty to adopt any or all modes of ornamentation, without regard to what is suitable for the material or the uses which the fabric is meant to subserve.

The French designs applied to carpets are largely characterized by the works already remarked upon, the prevailing faults of these being the prevailing faults of the large majority of their works—architectural relief ornament, perspective treatments, want of flatness, crudeness of colour, harshness of contrast, and want of relative scale in the ornament, pervading the greater number of their works. Three imitations of Persian rugs from the **NATIONAL MANUFACTORY** at **BEAUVAIS**, from their flatness, quiet contrasts, and broken hues of negative colour, show to great advantage in connexion with the works around them. Nor can it be said that the other European exhibitors follow any sounder principles of design, either in their national workshops or in the general labours of their manufacturers. The prevailing taste of France seems to be that of the Continent generally, but with less excellence of details, skill of arrangement, and knowledge of art; and although here and there works of much merit may be exhibited, the absence of true principles is everywhere apparent.

The English carpet manufacturers are large exhibitors, and on the whole the decoration of their best goods may be characterized as less extravagant than the foreign ones, not, however, that there is here any acknowledgment of sound principles, or complete repudiation of false ones. Thus, sometimes, as in the carpets of the Mediæval Court, and in those exhibited by Messrs. **NEWTON, JONES,** and **WILLIS**, a flat floral ornamentation and geometrical arrangement has been duly attended to, but the contrasts are too strong, or the necessary sobriety of colour is not obtained. Sometimes floral decoration has been used, as in the carpets exhibited by Messrs. **TUHERVILLE, SMITH,** and Co. (Class XIX., 318, p. 571), **WHITE** and Co. (Class XIX., 343, p. 572), **HENDERSON, WIDNEL,** and Co. (Class XIX., 201, p. 567), **BROWN, MACLAREN,** and Co. (Class XIX., 114, p. 564), **WATSON, BELL,** and Co. (Class XIX., 337, p. 572), and by Messrs. **JACKSON** and **GRAHAM** (Class XIX., 390, p. 573), all which have much merit, but the flowers are often far beyond the natural size, the colours are bright and gaudy, and flatness is not attempted; in short, imitation and not ornamention has been the rule of the designer. The last-named manufacturers exhibit a carpet designed by John Lawson, which, as greater attention has been paid to ornamental requirements, is given in the accompanying impression. In the carpet itself the border is about half its width too narrow for the centre, but this is not seen in the woodcut; the colour of the centre consists of gradations of a neutral red, the forms of the border are red on a dull white ground. While it is one of the most commendable of such fabrics, it will serve to illustrate the error of indiscriminately applying the ornamentation of one material to that of another. Thus the design, taken from the excellent work on the Alhambra by Mr. Owen Jones, and there used as a wall decoration, where its "up and down" treatment was characteristic and proper, is no longer so when applied to a carpet, since this requires an "all-over" treatment, or an arrangement towards the centre, a consideration which does not seem to have entered into the mind of the designer. Messrs. **WHITE** and Co. (p. 572), and Messrs. **WATSON, BELL,** and Co. (p. 573), exhibit carpets of great merit, imitative of those of India and



Turkey, and it is only necessary to turn to them from the surrounding works to be convinced of the justness and truth of the Eastern style and application of colour to such fabrics; indeed a most careful examination has confirmed a strong feeling as to the great superiority of the designs of Indian and Turkish carpets, both in the arrangement and general tone and harmony of the colours, and the flat treatment and geometrical distribution of form. The Turkish carpets are generally designed with a *flat* border of flowers of the natural size, and with a centre of larger forms conventionalized, in some cases even to the extent of obscuring the forms, a fault to be avoided. The colours are negative shades of a medium or half-tint as to light and dark, tending rather to dark, with scarcely any contrast, and therefore a little sombre in character. Three hues predominate and largely pervade the surface, namely, green, red, and blue; these are not pure but negative, so that the general effect is cool, yet rich and full in colour. The colours, instead of cutting upon each other, are mostly bordered with black, the blue has a slight tendency to purple, and a few orange spots enhance and enliven the effect. The distribution of colour in these fabrics is far simpler than in those from India, which last have sometimes a tendency to foxiness, from a larger admission of warm neutrals, as brown and brown purple; they also admit of a much greater variety of colours than the Turkish. The colour of the Indian carpets, however, is so evenly distributed, and each tint so well balanced with its complementary and harmonizing hue, that the general effect is rich and agreeable; the hues all tend to a dark middle tint in scale, and white and yellow are sparingly introduced to define the geometrical arrangement of the forms, such arrangement being the sound basis of all Eastern ornament. The illustration given in Fig. 1, Plate 1, is from an Indian rug, and will illustrate the various principles, and the tone of colour contended for. A large silken carpet and a smaller one, exhibited by the Honourable the East India Company (p. 917), are fine examples of the skill and taste which are evidently traditional in the Indian races.

Having spoken thus highly of the decoration of such goods in India, it is painful to observe the attempts ignorantly made to vitiate the sound taste of the native artists. It has no doubt been done by those who are unaware of the true knowledge and just principles evident, more or less, in all the Indian manufactures; but it is not the less necessary to be commented on, since a school of industry seems actually in operation at Jubbulpore for teaching the reformed Thugs to make carpets in the worst European style, and at Bangalore the same teaching seems in operation. It is to be hoped that, when the admiration elicited by the display of the Indian fabrics at the Great Exhibition is re-echoed back to the land that produced them, this strange error will at once be remedied. Even if good, such patterns are not consonant with Indian tastes, and it is perhaps fortunate that they are really so extremely bad that they may fall at once before the better knowledge which the European judgment of the merit of Indian ornament will call forth and support.

The gross errors to which imitative treatments have led in the decoration of carpets have been already referred to in the general prefatory remarks, and need hardly be insisted on afresh after the definite principles which have been just given; neither need more be said on the error of adopting unchanged the ornament of other materials; it therefore only remains to remark that a certain vagueness of form and absence of flow of line in the Turkish carpets, which sometimes approach monotony, might be remedied by the introduction of strap ornament in the borders, and of diapers of flat floral ornament on the central field, under the same true principles of colour and contrast that these works evince, which, uniting the flowing and varied lines of European decoration with sound Eastern taste in tone, colour, and geometrical arrangement, would suit our climate and uses, and banish some of that trash and crudity so evident on all sides, and which has its climax in the cheap manufactures of these articles. One thing is certainly to be learned from the works referred to, namely, that bright colours are not necessarily rich or beautiful, but that tone is a great source of richness, and has at the same time the farther merit of keeping such goods in their true place in the scale of furniture. No nations exhibit greater richness of what may be called upholstery, or more gorgeous costumes, than those of India and Persia, and the wisdom displayed in the negative tone and subdued colour of their carpets is worthy of consideration, as a means of enhancing and supporting the richness and costliness of their other fabrics and their personal decorations.

Almost all that has been said of carpets is applicable to druggets and felted goods for the same uses, and the principles of their ornamentation, under certain modifications, may be applied to floor-cloths and painted cloth for furniture covers, as well as to printed, felted, and woven fabrics, in various materials, for table-covers.

Floor-cloths are not so much used in this country for dwelling apartments, as in halls, staircases, lobbies, and other approaches, and richness and fulness of colour are, therefore, in general, less needed. The laws which regulate mosaics and inlays for floors will, in some degree, rule these works also, except that wood inlays, especially when large, require a design capable of being framed in its construction, and of having due regard to the shoulderings of mortices and tenons, a construction obviously unnecessary in floor-cloths. It is, therefore, requisite to guard carefully against mere imitations of such designs, and more especially to avoid all imitations of carpet patterns. Frets and guilloches for borders, and geometrical combinations for the inner field, with a centre, may be adopted when the work is large, as in the cloth exhibited by Messrs. Smith and Baber (Class XIX., 371, p. 573), which has much merit, although it is too violent in its contrasts; while all-over patterns of simple geometrical diapers, in quiet, graduated tints, have the best effect in cloths for general purposes. The painted cloths for furniture follow a little too much the old Japan colouring, and are heavy and monotonous from their darkness. There are good diapers on some of the French cloths exhibited, and on some of those of Göhring and Böhme, of Leipsic (3 Zollv., 164, p. 1111); but their cloths for the ceilings of carriages are wormy in line and unpleasantly crude in colour. The table-covers in woollen, cotton, flax, and silk, either woven, printed, or felted, of which there are a great variety in the Exhibition, are often characterized by the same faults as the carpets—imitative flowers and architectural relief ornament, with vases, baskets, &c., forming too frequently the details, whilst the contrasts of colour are sometimes of the most violent kind. Thus there is great richness in a cloth with a border decorated with the flowers of the Brugmansia, exhibited by White and Sons (Class XIX., 343, p. 572), but the requisite flatness is not obtained; and there is much merit in a Gothic pattern, with a well-coloured border, exhibited by H. and T. Wood (Class XIX., 352, p. 572), but the architectural decoration introduced is objectionable.

Curtains and Hangings.

The ornamentation of textile hangings follows the same laws, and is amenable to the same general principles, as that of other wall decorations, flatness of treatment and subdued contrasts of colour being the only sure guides.

The richest, and at the same time the most sober effects in silk, are produced merely by the processes of weaving, as of satin figures on a tabby ground, in a self-colour; and ornament properly suited for this treatment of the silk is generally in good taste, and shows the full splendour of the rich material. Next to this, graduated tints of a self-colour, as gold on straw colour, or even ornament in one colour, on a ground formed of the natural golden tint of the silk, where the contrast is not too violent, has a good effect, and shows to advantage beside those over-decorated works which are covered with natural flowers in many colours; since the lustre and gloss of the silk, and the richness of colour consequent on these qualities, are seen to the greatest advantage in the flat masses of such ornament, heightened as they are by the duller ground, while smaller parts and varied tints interfere with these inherent qualities of the material.

A hanging exhibited by Messrs. Mathevon and Bouvard (France, 1349, p. 1240), decorated with bunches of flowers, on an ash-coloured lilac ground, displays great ability in the designer, combined with thorough knowledge of the powers of the loom, and it has been executed with equal skill by the weaver; it is, indeed, a choice example of the style; yet its lustre and beauty, and fitness as a hanging or curtain, are not commensurate with the costliness of its production, and it cannot compete for apparent richness of material with a plain mulberry-coloured hanging, ornamented flatly in satin and tabby, that hangs beside it. Had these flowers been treated flatly, arranged geometrically, and coloured in simple tints, they would not have been so artistic, but they would have been far more truly ornamental, and more suitable for hangings.

There are some well-designed fabrics among the Prussian silks, exhibited by G. Gabain (Zollv. (1), 119, p. 1055), consisting of an heraldic treatment of the Prussian eagle, on a red ground, with the ornament in gold. The silk hangings of the Austrian bed are likewise in good taste. With these must be named the hangings of the Mediæval Court, and those in mixed materials, executed for the Duke of Devonshire by Messrs. Reynolds, of Dublin (Class XII. and XV., 266, p. 498, 499), consisting of fleur-de-lys and shamrock, in silver, on a subdued crimson ground, or in gold-coloured silk, on a watchet ground. The hangings decorated with ornaments from the Alhambra, exhibited by A. Destrieux and Co. (France, 164, p. 1181), are in good taste and on good principles, as are also some in mixed fabrics, in the same style, by Akroyd and Co., of Halifax (Class XII. and XV., 130, p. 491).

The *natural* treatment of flowers as the ornament of textile fabrics is nowhere seen to greater disadvantage than in the rich altar-cloths in gold brocade exhibited by French, Austrian, and Russian manufacturers. The coloured and shaded flowers instantly vulgarise and give a commonness to this essentially rich material; while diapers of colour, or a different texture produced by weaving, or silver threads woven with the gold, as in some of the Russian fabrics, have a rich and true effect.

The consideration of chintzes comes under the head of hangings: and upon these fabrics it is quite necessary to make a few remarks, since their decoration seems at present to be of the most extravagant kind. Overlooking the fact that the lightness and thinness of the material will not carry a heavy treatment, and that, in addition to all the principles which have been shown to regulate designs for hangings, the use of imitative floral ornament is peculiarly unsuitable on account of the folds, the taste is to cover the surface almost entirely with large and coarse flowers—dahlias, hollyhocks, roses, hydrangeas—or others which give scope for strong and vivid colouring, and which are often magnified by the designer much beyond the scale of nature. These are not only arranged in large groups, but often cover the whole surface, in the manner of a rich brocade. Nothing can be more erroneous, or more essentially vulgar, as would at once be evident did not fashion blind us for a time, and a feeling for costly labour and difficult execution prevail over truth and good taste.

Moreover, it is scarcely possible in such distributions of colours, whether arranged or woven, to arrange them according to just or scientific laws; for although this is attainable when colour is in simple flat tints, and subordinated to geometrical groupings, when the tints are broken up and gradated into shades, and distributed with regard to flowing and naturally-dispersed forms alone, the due quantities for harmony, the juxtaposition of complementary and harmonizing tints, and true balance of parts, easy in any simple or symmetrical arrangement, becomes difficult or impossible. The present mode of ornamenting these fabrics seems to have arisen from the false spirit of imitation—a desire to rival the richness of silk; but it is overlooked that the texture, naturally light, requires lightness and elegance of form and colour; that, as a *summer* fabric, richness and fulness of hue, as tending rather to a sense of warmth, is out of place, and that, on the contrary, fresh and cool light grounds, with flat ornamental forms, either "all over" or in "up and down" bands, or diapers of floral ornament, on a simple texural ground, are the true principles for the decoration of chintzes.

Before completing this Report on furniture, it is necessary to say a few words on muslin curtains, of which there is a large display in the Exhibition. These fabrics should, of course, have a perfectly flat treatment, whether purely ornamental forms or flowers are used for their decoration. The best effect for borders is obtained by a symmetrical arrangement of flowing lines, which may be large in pattern, from the lightness of the material; while a diaper treatment, or small sprigs arranged with large and regular spaces over the central field, are the simple rules for their decoration. It would seem hardly possible to err much in designing for a fabric which admits of such small variation, the contrast of the thick work with the more filmy ground being the source of the ornamental form, and colour being rarely used; yet, perhaps, in the whole Exhibition, there are not more glaring mistakes than are made in the decoration of these goods. In the Swiss muslins, the effort seems to have been directed rather to curious skill in workmanship than to taste in design, and some of the most costly goods are in the worst conceivable taste—immense cornucopias, pouring out fruits and flowers, palm-trees, and even buildings and landscapes being used as ornament. Even when this only consists of flowers, they are used imitatively and perspectively, foldings of the leaves, and in some cases the actual relief of fruits, being attempted. Although the same faults occur in the English manufactures, these, on the whole, slightly incline to better taste, especially in some of the woven curtains from Nottingham, and in the fabrics exhibited by the Utrecht Company (Class XIX., 265, p. 570), but there is a sad want of good design in this class.

Except that curtains allow of an "up and down" treatment, which table-cloths do not, most of the same rules apply to damask table-linen as to white muslin curtains. The ornament of damask linen arising, as it does, merely from the gloss obtained by various distributions of the warp and woof in weaving, ought to be extremely simple in form; yet even in these goods we find buildings, landscapes, vases, baskets, fruits in relief, and flowers perspectively treated as the details of decoration, while one designer has copied a centre-piece of precious metal, the property of H.R.H. Prince Albert, in the table-cloth upon which it is meant to be placed. These faults are present, not only in the Irish linens, but in those of France and Saxony also There is a good design, in the German Gothic style, applied to a cloth exhibited by D. Birrell (Class XIV., 27, p. 511), and some well-considered adaptations of Greek ornament in the borders of some damasks by A. H. C. Westerman and Sons, of Westphalia (1 Zollv., 544, p. 1081); but the general manufacture of such goods wants serious revision. A border of flat ornament, consisting of flowing lines or flat floral treatment, carefully studied as to the distribution of quantities; a diaper geometrically arranged over the inner field, either of floral or ornamental forms, with a judicious interspace (the diaper being rather dispersed than crowded), and a central form, give the best general distribution for the surface of table-linen. Proper attention should be paid, in designing the border, to the quantity allowed for turning down over the edge of the table; and care should be taken, when heraldry and heraldic devices are introduced, that they should be strictly flat. Landscapes, solid and shaded forms, perspectives, and architectural relief ornament, should be carefully avoided. Although the principles which govern the decoration of these fabrics appear to be simple and self-evident, there are few manufactures where a greater amount of error prevails, the nearest approach to purity of style being floral treatments, imitatively rendered.

In concluding our remarks on the design of this section, it is worth calling attention to the different relative importance, in an ornamental point of view, of the various articles which are comprised under the head of the furniture of an apartment. These are the work of various manufacturers, each endeavouring to give the greatest amount of decoration to his own works, without duly considering their relation to other fabrics. Thus the carpet manufacturer ornaments his articles so showily that they outvie the hangings—the wall decorator, or paper-stainer, his goods, till they emulate the cabinet furniture—whilst the upholsterer overlays his share of the furniture with florid carving, with or-molu and inlays, or with rich broideries of silk or velvet, so as far to outshine the rare workmanship of the jeweller or the goldsmith, or the art of the bronzist, the sculptor, or the painter, with which they are mingled.

All this arises out of error; each article of furniture has a due share of importance—a relative value as decoration—beyond which it should never be forced; and the designer for each should have this truth strongly impressed on him in all his labours. We may suppose it easily conceded that the carpet, bearing the relation of the groundwork for objects, should have a quiet richness of surface and texture, intruding in the least possible degree on the eye or the observation; the wall decorations, the next in importance, being entirely of the nature of a background, should be subordinate to the cabinet work, which, in its turn, should hardly be forced into undue competition with the skilful works in glass, porcelain, metal, or the fine arts, for which it serves merely as a means of display or arrangement. Yet how often is this order entirely reversed, and the simplicity of fine art out-shone by the gorgeousness of mere furniture! Where the educated taste of a decorative artist is not sought for, this too often arises from want of taste in the purchaser, who selects each object for itself, and not on full consideration of this principle of subordination; but were the designer really alive to the truth of the principle, such gaudy and false ornamentation would hardly be applied to inferior fabrics. Jewellers are careful that the setting be a proper foil to the more valuable stone, but those who have the means of richly decorating their dwellings often make such a show of the setting that it overpowers the gem.

DIV. 3.—*Domestic Utensils and Objects of Personal Use.*

The third section of this Report is devoted to the examination of design applied to domestic utensils and objects of more immediate personal use. Although there is not any exact line of demarcation between such works and those more properly ranging with domestic furniture, the division is sufficiently accurate, and is convenient as permitting classification under the separate heads of

1. Porcelain and pottery.
2. Table and ornamental glass.
3. Works in the precious metals, &c.
4. Bookbinding.

It is to be remembered, however, that the Report has reference only to the decorative art applied to such works, and that unornamented objects of utility are consequently not included.

It will at once be evident, that whatever is comprehended in this section ought to display the greatest purity of form and the rarest excellences of ornament, while they should be characterized by the utmost refinement and finish, since they are daily under our hands, and continually subject to minute personal inspection. Their utility, moreover, should have special attention, and convenience and usefulness be carefully studied. Here the ornamentist will have full scope for the highest efforts of his ingenuity and taste; and when working on the most precious materials, may add by his labour even to *their* value and richness.

Moreover, in those classes in which use is a first requisite, as is largely the case in china, pottery, and glass, the purest forms should be sought, allied to the greatest convenience and capaciousness; and the requisite means of lifting, holding, supporting,—of filling, emptying, and cleansing, should engage the attention of the designer, before the subject of their ornamentation is at all entered upon.

PORCELAIN AND POTTERS' WARE.

There is hardly any nation, however primitive its state, with whose works we are acquainted, that has not numbered among its manufactures some kind of potters' ware; rudely made and barbarously decorated perhaps, and imperfectly fired, but sufficient for the simple domestic purposes of people in an early stage of society and civilization.

As nations advanced in culture, their pottery improved also, both in elegance of contour, in beauty of decoration, and in manufacturing excellence; so that fictile fabrics alone will often mark the standard of national civilization, and indicate the progress of a people in the arts of life.

This has been the case not only with the Greeks and the Eastern nations, but with the modern Europeans also, both of Italy, Germany, France, and England. It is unimportant that in Europe the improvement of these manufactures has, until of late years, been dependent on the patronage and assistance of princes, since, at the period of the first impulse to excellence, this was largely the case with all works of costly production. It is sufficient to notice that the pottery faithfully reflects the taste of the time; that its improved manufacture and decoration has been coincident with general culture; and that the style and progress of art, its motive and object, are as vividly depicted on the pottery as in the pictures and statues of the age. Thus when pagan subjects began to be treated among the artists of Italy, from the revival of learning and the spread of a knowledge of the literature of Greece and Rome, this change was immediately stamped as indelibly on the pottery of Urbino as upon the pictures of Raphael and his galaxy of pupils. In the same way, when the luxurious court of Louis XV. became interested in the manufacture of porcelain, and encouraged it with royal munificence in the workshops of Sèvres, all the glare and glitter of that luxurious court, its debased art and theatrical prettiness, were at once impressed upon the works of that manufactory.

In this view of the ceramic arts there is much that is hopeful in their present position, since not only is there a manifest progress in the last few years in the general manufacture of porcelain and pottery, both at home and abroad, but a decided improvement in their decoration. We seem to have nearly passed through the stage of mere imitation; the antique has been carefully studied, not so much with a view to the mere reproduction of the elegant forms of its utensils and of their decoration (too much the custom during the latter end of the last and the commencement of the present century), as, from the examination of the vases and tazzas of antiquity, to obtain the geometrical bases of their construction, and the principles on which the Greeks applied ornament to their surface. Hence has resulted an improved elegance and refinement in modern porcelain; and the beautiful details of Moresque ornament, or the richness and elegance of the Renaissance, have been adapted to its decoration on the same just principles that guided the artists of Greece and Etruria in ornamenting with their own national and significant ornaments the beautiful works which time has spared for our admiration.

The designs for porcelain or pottery are few in number and of small importance; they are, moreover, the works of students, and in the present Report need not be adverted to. The works exhibited it will be desirable to class for consideration under two heads, generally broadly distinguishable, without, however, having special reference to peculiarities of manufacture or of material, whether as hard or soft paste, as earthenware and porcelain, since these will have proper attention in the Report of Class XXVII. They may fairly be divided into ornaments and works of utility. It has elsewhere been said that manufactures may be so over-decorated as to be degraded into mere *ornaments*; yet when works are produced simply with that object, they may not only be admired as addressed to the purpose of giving pleasure by their beauty, but by their production they often sensibly exercise a useful influence on the general taste of the manufacture. This is nowhere more evident than in the beautiful and valuable collection of porcelain exhibited in the Sèvres Court, the products of that celebrated manufactory. There is not a more interesting department in the whole Exhibition, nor one which more fully illustrates the wisdom of a judicious application of the *best* art to manufacture. Here we find the taste of the first artists assisted by the science of able chemists, and, under a judicious direction, united to the most skilful workmanship and manufacture, and the result is that the fabrication of porcelain is carried to the highest state of excellence. The greatest part of the display, however, consists of works which must be classed as *ornaments*, such as vases, caskets, chalices, tazzas, &c. The forms adopted are pure, and those pure forms rarely interfered with by the reliefs. The details of the decoration, the modelling of the reliefs, and the painting,—whether these consist of figures, flowers, or simply of ornamental forms,—are of rare and felicitous excellence in many cases, and of high merit in all. The finished perfection of these choice works must have exercised a great influence on the other manufactures of the country, not only by forming a band of workmen educated to perceive excellence as well as to produce it, and capable of giving assistance in many other branches of manufacture, but by their effect on the general cultivation of the public taste. Nor do such establishments benefit the country that supports them alone, they diffuse taste abroad, even into other lands. Thus the improvement of our own general manufacture of china has already been adverted to, and yet it is but justice to say that it owes much to the labours of the national establishments both of Sèvres and Dresden; not only that their works have in some cases served as our examples, or guided our manufacturers by the principles of their decorative treatments, but from the stimulus to improvement which has resulted from the contemplation of rare works, and of that perfection which arises from a manufacture occupying itself rather upon efforts of skill than upon general production, and able to employ itself upon them irrespective of expense and regardless of cost.

Yet the danger of producing mere ornaments is fully illustrated even in china ware; more particularly in the works of the **Royal Dresden Manufactory** (3 Zollverein, 174, p. 1112), since, as far as is shown in this Exhibition, the porcelain manufactured therein would seem never to have got beyond this result. The works have none of that purity of form which almost of necessity arises out of constructive utility; the reliefs, governed solely by the imitation of natural objects, and not by the requirements of use or the rules of art, are quite unsuited to the material; and the colour has none of that judicious subordination to the effect of the whole which is seen in many of the productions from Sèvres. The surface is often covered with purely imitative flowers in high relief, glowing and brilliant as the tints of nature, yet looking gaudy as ornament, and, from their filmy projections, liable to injury with every touch, and their preservation a source of constant anxiety to the possessor. Even the May-flower pattern,—a production of great beauty, on the principle of a diaper of form and colour,—from its minute hollows, is quite incapable of being cleansed, and from the thickness which it adds to the form, contradicts the true effect of porcelain, which should unite lightness with capacity. Imitation seems to rule, and not ornamentation. It may be, and no doubt is, difficult to form a tree with all its flowers and foliage out of porcelain, but nothing is arrived at when this is effected; it certainly has no utility, it is not ornament, and the more truly imitative it is rendered, the less it would be regarded, unless our attention was specially called to it as a wonderfully difficult effort of labour.

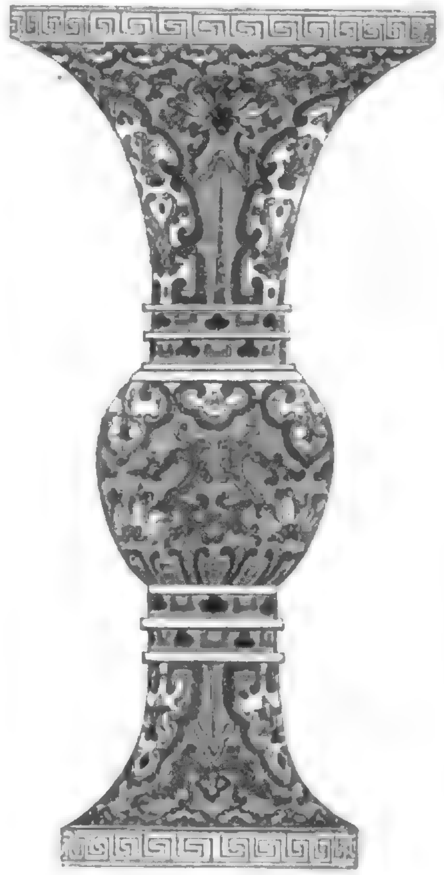
Altogether, a rococo air pervades the porcelain from Dresden, partly resulting from the style which was in vogue when the manufacture was at its zenith there, and largely from the production of works merely ornamental, from which it obtained so large a share of its celebrity. It still clings to the contorted constructive forms and extravagant prettiness of the style of Louis XV., which have been almost entirely laid aside in the establishment at Sèvres: antique shapes, with a more classical style of decoration, having supplied their place.

Among the most beautiful works in the Sèvres Court are the elegant tazzas, covered with moresque ornament in green and gold, and in blue and gold, on the natural white ground of the material. The two vases in unglazed bisque, decorated with figure subjects, painted by M. Roussell, after the designs of M. Amory Duval, are chaste and beautiful specimens, the colour being carefully subdued, so as to harmonize with the delicacy of the form of the vases. The Labour Vase, by M. Klagmann, sculptor, is a good example of figures in relief as ornament, so applied as not to interfere with the general lines of the form. It is a vase of large size, in white bisque, very artistically designed and modelled, and is an evidence of many difficulties of manufacture, arising from its size, skilfully overcome. A casket, enamelled with white figures on a blue ground, the work of M. Haman, is also an example of great beauty. When we consider the choice paintings on porcelain and in enamel executed at Sèvres, not only from the old masters and others, but original works also, we shall be sensible of the great impression they must produce on the workmen, and the emulous efforts of manufacturing skill they must call forth. The figure paintings of Ducluzeau, Thurgot, Beranger, Laurent, and others, with the flower-pieces of Jacobber, Schildt, &c., must be allowed to have exerted this influence in a high degree. In our own country we have skilful enamellers, as may be seen in the exhibition of such works in the Fine Art Court; but those artists are not connected with the potteries, nor employed by the manufacturers; in fact, their art is too costly for such uses, unless where, as in France, a nation pays for that which is of great value for a nation's improvement.

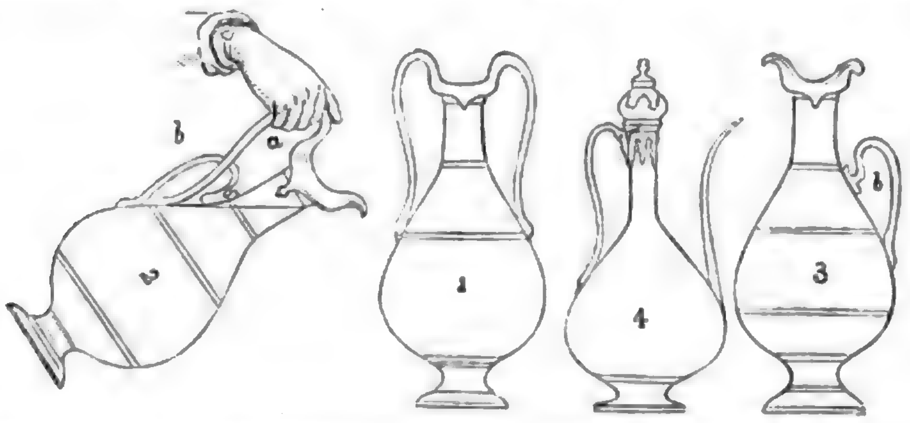
The skilled French artists who have been enumerated are the successors of a line of others, who, for nearly a century, have laboured to improve the manufacture of porcelain, aided by a band of workmen trained in the same school, to assist them in their efforts—with what eminent success has been sufficiently shown. In England our china painters are not artists, and but few of them seem to have artists' feelings, nor until of late years have they had opportunity of gaining the necessary instruction. The painters on china copy fruit, foliage, and flowers well; but when such labours are original, they too often consist of but slight variations of some stock and stereotyped forms and colours, which the workman uses over and over again, without novelty either in grouping or drawing. In the power of painting the human figure they are mostly deficient, and few of them are able to execute subjects of which flesh forms a part. The modellers also have been sadly deficient in knowledge of the figure and of its anatomical details. In both these particulars, however, they are slowly improving, and the introduction of parian and other materials for statuettes, which is beginning to form a large branch of business in the potteries, and which, as yet, is nearly peculiar to England, has been of service in showing them their defects, and in urging them to amend them. The Schools of Design established in the potteries, in which some of the principal manufacturers take an earnest interest, have already, produced some results, and energetically supported, will no doubt be of essential value to the workman and to the manufacturer. This is abundantly evident in the statuettes exhibited by Messrs. **Copeland** (Class XXV. 2, pp. 713, 714), and Mr. **Minton**, (Class XXV. 1, pp. 709-711), as well as many other British manufacturers. These statuettes, often reductions from the works of eminent sculptors, are completed far more successfully than would have been possible a few years ago; and when we consider the difficulty of putting them together by properly and skilfully adjusting the parts after they come forth from the moulds, and the further care required from their extreme shrinking in the firing, many of them may be regarded as highly successful results. Still there is room for improvement; the *completion*, in the details of the joints, features, and extremities, is not quite equal to some of the bisque figures that have been produced at Sèvres; and it is yet a desideratum (which may, however, arise from the spread of statuary porcelain) to unite in one person the artist and the workman, as in the case of the bronzists of France, as well as many of the foreign workers in the precious metals.

The Royal Manufactories of Berlin and Bavaria have avoided many errors prevalent in the china-ware of Dresden, and have rather followed classic models. The works exhibited, however, are deficient in originality; the vases are of the most common classic forms—overloaded with ornament, and having landscapes and pictures painted in compartments on their surface. The Dresden enamel-painters on china rank next to those of France; and **BUCHER** (3 Zollv., 176, p. 1112), and **WALTHER** (3 Zollv., 177, p. 1112), in their copies of paintings by the old masters, evince a perfect knowledge of their art. **TAPREMA**, in Russia (318, p. 1376), and **NIGG**, in Austria (615, p. 1038), exhibit skilful enamels on china; but the porcelain from these countries has no peculiar originality or excellence to recommend it.

In considering the question of design, as applied to that division of pottery and porcelain which more especially comprises works of utility, constructive form should have the first attention; and in such works as are intended for vessels of capacity those forms should be adopted which, while they are most elegant, are best fitted for containing or holding. Such articles, moreover, being of continuous use, the power of ready cleansing is of great importance, and should have due attention from the designer. It is to be remembered, also, that the means of receiving that which is to be contained is as necessary as its ready out-pouring; since it is hardly desirable to have to apply a funnel to fill a pitcher or jug intended for constant use, although this may be permitted in a bottle, which is required to keep its contents cool, or to be carried about, and subject to spill them by jolting, and therefore needing a smaller aperture. Moreover, a jug, or pitcher, which will admit the hand to cleanse it thoroughly, must be more suited to daily use than one which will not. A due consideration of utility would regulate the form in many other cases; as, for instance, in cups and other drinking vessels, it might be most graceful to curve the top edge outward, but since such a form is likely to overflow the person in drinking, however superior in elegance, it should not be adopted. When utility is considered before ornament, numerous truths of the like kind will be arrived at, which are entirely overlooked when the order is reversed; thus relief, when used, should be extremely low, and without indented hollows in the composition, as well as without undercuttings, in order to give facility for cleansing; but while this is required for utility, it is necessary for elegance and beauty also: the Greeks were fully aware of it as an important truth, and in their pottery abstained from reliefs, or kept them to the lowest impost: the vases of Etruria have generally their line unbroken by the ornament, and the reliefs on the celebrated Portland vase are so extremely low as entirely to preserve its outline. In the same spirit our great Flaxman worked to improve this fabric, as may be seen in the examples exhibited by Messrs. Wedgwood; the style being still a tradition in their works. The Eastern nations are sensible of the same truth, and their decoration of pottery is on this principle, being entirely subservient to the lines of the form. The antique Chinese vase for cut flowers, exhibited by Mr. **ALCOCK** (p. 1419), and here engraved, will illustrate this, as well as the fitness of form to use. The neck narrow at the bottom, whereby the stalks would be compressed and supported; the enlarged bulb, to contain sufficient water for their nourishment, and at the same time to serve as a boss for the hand to grasp, is of a piece with the proper consideration of the decoration. This is not painted, but is of the nature of an inlay, being *cloisonné* enamelled over the whole surface; that is, the enamel colours are filled into a coffer of metal standing on edge around the ornamental forms, the line of the vase being carefully preserved.



The application of handles is another important point connected with constructive design. The easiest and most convenient means of lifting the weight, when lifting only is required, and of lifting and pouring when both are requisite, being the question to be determined. Too often this is arrived at more by chance than by calculation. We see, for instance, the form of an Etruscan vase, such as is shown in figure 1, adopted as a pitcher; the original having two handles, formed for its occasional removal only; for its new purpose, a spout is substituted for one of the handles; perhaps it is to serve as a ewer, requiring raising and reversing at every effort to pour,



and yet, so changed, it is acted upon by the hand and wrist at the greatest possible disadvantage, the hand having to lift the weight, as it were, at the end of a long lever, and reverse it by the power of the wrist, as is shown at *a* (fig. 2), while a much less power applied at *b* (figs. 2 and 3) would suffice to reverse the pitcher and pour forth the fluid. The height of the handle is of less importance when the contents have to be delivered from near the bottom, as in the Eastern form at fig. 4; since the slightest tilt of the vessel would begin to empty the contents through the spout, which would not be the case if they had to be discharged from the top. These hints will serve to show how important the proper consideration of the insertion of the handles is in such works, and how errors arise from merely adopting inconsiderately a form fitted for one use for another purpose. It would carry the subject too far to increase examples, but these suggestions followed out would lead to multiplied instances of false adaptation, and may serve to induce a more careful consideration of the subject. In the application of colour to porcelain and earthenware, the surface never should be wholly, or indeed largely covered; the material has a purity that should be decorated, not obscured. A due consideration of this simple rule would condemn a vast amount of bad taste, such as completely metallizing the surface of china by gilding, changing china into imitative marble, or covering the field of many utensils with pictures, landscapes, or flowers. The Greeks decorated their pottery in bands, introduced to mark the change of curve, or to separate the various surfaces: the eastern pottery is in the same way decorated in bands, or where the surface is more covered, it is merely with a diaper, which leaves the material sufficiently visible.

Landscapes and pictures are almost always out of place in pottery, and it certainly is objectionable to cover the centres of plates and dishes with pictures and views; not only because it hides the surface, which it has been before said it is desirable to retain, but because utility would be better served by the absence of any decoration in the part which receives the viands, to satisfy that sense of cleanliness only to be obtained by the white unchanged surface of the material.

There is still another subject to be referred to, which consists in the imitation of the ornament peculiar to one age and one purpose on the utensils of another age, and which are intended for totally different uses: or applying the ornament of one material to the decoration of another, which last fault, in speaking of other manufactures, has already been often strongly animadverted upon. The revivals of Wedgwood were, in a degree, in this spirit; and although they produced a vast change for the better in the forms of our pottery, and placed a salutary curb on the extravagance of the style that then obtained, they were but the resurrection of a dead art; and the funeral urns of Etruria, being inconsistent with modern uses, have a cold formality quite inconsonant with the feelings of the time. An attempted manufacture of these vases, decorated with the beautiful outlines of Flaxman, of which a large number are exhibited by another house, can have only partial favour, as they can serve no other purpose than as ornaments, and will never enlist the sympathies of the general public in their favour.

The abuse of the ornament of other materials to unsuitable purposes is shown in many ways in this fabric; among others, in copying engravings and pictures on to various utensils. In one case the most sacred symbols of religion serve as decoration for the borders of plates, while the centres of them, and of the dishes of the same set, consist of angels, copied from an illustrated prayer-book, flying in the midst of a blue heaven diapered with stars. Such incongruities, improper in any case, are sadly and strangely inapplicable to a dinner-service. It has been well said, that "symbolical ornament demands perfect accordance between the use of an object and its decoration;" but can anything be more inharmonious than such sacred symbols mixed up with a festive dinner? Such incongruities are ever arising from unthinking imitation.

When, however, due allowance has been made for faults, failures, and short-comings, it is impossible not to feel that the general manufacture of china has made great progress in this country. There is a greater selection of pure forms—a less gaudy treatment of the whole surface—than heretofore; and where works are founded on past styles, their most meritorious qualities are selected, their faults rather avoided, whilst the power of the art-workman has visibly increased. Thus, in the beautiful dessert-service from the manufactory of Mr. MINTON (Class XXV., 1, p. 709), whilst there is much that is derived from old Sèvres patterns, it has been, by judicious adoption, rather than imitation. If the figures are a little crowded, they will be found exceedingly well modelled; and the purity of their white material, contrasted with the delicate hues of the colours combined with it, has a chaste effect, the furthest possible removed from gaudiness. Indeed, the great merit of the works from this manufactory is the restrained use of colour, and the general delicacy of the decoration. Some of the small figures on the centres of the plates are excellent specimens of the china-painter's art, and there is almost a total abstinence from landscape, or mere pictorial subjects, on these utensils. As to the imitative renderings of flowers on china, it is hard in this case to object to their want of conformity to principle, since the beauty and purity of the surface of china is so suitable to such art that here, if anywhere, their use may be overlooked. The porcelain both of Messrs. COPELAND and Messrs. ROSE (p. 711, and Class XXV., 47, p. 727), holds a high place also for form and colour; and some of the most successful of the larger efforts at enamel-painting on china in England are exhibited by the artists in the employ of these manufacturers, as well as some excellently-finished statuettes. The application of porcelain to decorate the jambs of fire-grates has produced some well-designed slabs from both Messrs. COPELAND and Messrs. MINTON; although, perhaps, one of the best designed of such works, with certainly some of the best English flesh-painting, is to be found in some jambs attached to a grate exhibited by Messrs. STUART and SMITH (Class XXII., 102, p. 608). An application of the design of some jewelled embroidery from the work of Mr. C. J. RICHARDSON, to ornament a flask, exhibited by Messrs. COPELAND (p. 712), gives a rich treatment, although contrary to the sound principle of not covering up the surface of the material too entirely; but in another specimen exhibited the whole merit of the adoption has been lost by introducing a landscape amid the lines of the form, making it appear how much chance and how little principle has governed the choice. One or two plates in Mr. Copeland's collection have great merit in their design, the width of the ornamental margin being well considered and the centres judiciously plain.

The general manufacture of pottery in France includes some artistic adaptations of design to brown stone-ware, and of colour to its surface. The collection is exhibited by M. MANSARD (France, 1342, p. 1240). Although belonging too entirely to the class of *ornaments*, and objectionable from the false relief sometimes adopted, the application of art of a superior kind to common materials deserves much praise, and is worthy of attention, as showing how much might be done by a like attention to the manufactures of such wares at Lambeth and Fulham. Of the Palissy ware exhibited, little can be said in this Report; for although evincing much skill, it is so entirely opposed to all utility, and even beauty, and so completely a work of mere curiosity, that the difficulties overcome do not redeem it. The true Palissy ware did not consist of such unmeaning reliefs as are here applied to plates and dishes. The porcelain exhibited by M. LAROCHE (France, 1287, p. 1238), contains some plates of meritorious design, as well as one or two elegant tazzas. In Bavaria some plates, designed by KAULBACH (64, p. 1101), are very judicious in the treatment of their ornamental borders; although the pictures from Reynard the Fox, painted on their centres, must be objected to. Some jugs, designed in the old German style, are pleasing, from their varied surface.

GLASS.

Among the many beautiful materials which the earth has yielded to the industry of man, to add to his comforts and increase his enjoyments, glass holds a prominent place. If we regard its use in the fabrication of utensils to contain the fluid portions of our food, it is most especially valuable, since its surface has the power of resisting the action of almost all liquids, and, as a material, it unites strength with extreme lightness and great capacity. Its perfect transparency is another rare quality, whereby the purity and clearness of the liquid it may serve to contain is immediately manifest, enabling the satisfied eye to minister indirectly to the pleasures of taste. Moreover, whilst it is one of the most cleanly materials, from its extreme smoothness and hardness of surface, it is also most easily purified, and its pristine brilliancy is restored by the smallest possible effort of labour. Besides all these varied qualities, the materials of which it is composed are of the least costly kind, and the processes of its manufacture extremely simple; so that it is fitted for general use, and within the means even of the poorest purchasers.

For the purposes and utensils above enumerated, the qualities ascribed to it, properly understood and duly considered, will lead to a discovery of the principles which should govern its design and decoration. Of these, the foremost are its brilliancy of surface and its transparency, both which should ever be preserved with the greatest care in all right treatments of glass. And yet, strange to say, these qualities are not only often disregarded, but there is a strong tendency to contradict and destroy them: thus we see wine-glasses and decanters, water-bottles, carafes, and drinking-vessels of many kinds, not only with the surface covered with ground ornament, but sometimes wholly and entirely changed and obscured by grinding, so as to render them perfectly opaque: or, we have colour most injuriously applied to destroy purity, and prevent a proper enjoyment of the glowing lustre of the liquid contents; whilst sometimes the material is wholly or partially opalized; in the one case making it into a spurious porcelain, in the other into a species of japanned hardware, without the toughness and tenacity of that manufacture. Another excellence of glass is its lightness, as compared with its power of containing: the maintenance of this quality is opposed to the heavy and deep surface-cutting to which glass is now so frequently submitted, especially in water-jugs and decanters, and in the pieces of dessert-services. This cutting is intended to enhance the jewel-like and prismatic effect of glass, but it is opposed to its true qualities for such purposes, and should only be resorted to in handles, stems, or bases, where transparency is unimportant, where constructive thickness is necessary, and the grasp in holding may be aided by the facets of the surface. Yet it has been the fashion to carry this practice of cutting to an extreme, tending to vulgarize, as far as possible, the simple and beautiful material: in some of the works exhibited it has been applied even to the bowls of wine-glasses.

The more simple mode of manufacturing glass is productive not only of the most beautiful shapes, but of its best qualities: and blown glass unites thinness, translucency, and pure surface, to forms which combine the greatest symmetry with varied curves; that is, the sphere, resulting from the circular motion of the workman's instrument, elongated by the breath and weight, into the ellipse and its combinations. These blown forms may be ornamented by narrow bands of engraved ornament, of which flatness and symmetrical distribution are requisite qualities: in wine-glasses and drinking vessels it ought to be reserved for those parts of the bowl which do not interfere with a perfect sight of their contents. Any gilding or enamelling can only be admissible under the same rules. In all cases, elegance of form should be the first consideration, to which cutting, gilding, or engraving should be entirely subordinate. The relation of the stem to the bowl in wine-glasses is another point of some importance. The practice has of late obtained of making them of such extreme tenuity as to produce a sense of fragility and insecurity, which is quite as great an error in taste as the contrary fault of heaviness and thickness.

Like porcelain, a section of the manufacture of glass is devoted to the production of what can scarcely be called by any other name than *ornaments*. But while the production of porcelain ornaments has been fostered by princes, and, through the clever artists attached to royal manufactories, has arrived at great beauty and rare excellence, reflecting back an improved taste on the design and decoration of the general manufacture, glass has not been favoured with such advantages; and the specimens of Bohemian and Hungarian glass in various parts of the Exhibition, notwithstanding the rare beauty of the materials of the manufacture, can hardly be instanced for the merit of their design. The mode of manufacture, by casting in clumsy masses in wood or metal moulds, and reducing by cutting with the wheel, is contrary to the best qualities of glass, which consist of lightness and elegance. This alone causes many of the faults of the manufacture; since the true characteristics of glass are lost, and are replaced by qualities too apt to degenerate into the meretricious and the gaudy. Thus transparency is merged in rich colour, and this, again, overlaid with gilding: or the surface is flashed with opal, cut away by grinding to the coloured under-surface; sometimes giving the appearance of porcelain, sometimes even that of the inferior manufacture, papier mache; whilst, occasionally, the whole surface is frosted by grinding, and tinted in crude colours, the appearance of glass being entirely lost, and only its worst quality, that of brittleness, remaining: whilst the forms adopted are often as inelegant and rude as they are unsuited to the material to which they are applied. The tall chandeliers exhibited among Count Harrach's glass are examples of these remarks; at first sight they resemble papier mache, from the excess of gilding on the dark ruby glass; and when examination determines them to be glass, the deeply-indented horizontal throatings of the mouldings of the shafts give a sense of dangerous insecurity and ill-adapted construction. This is far less seen in the smaller works of the same kind, but it is, nevertheless, the natural result of a wrong application of constructive forms to the material, and of an improper over-decoration of the surface: whilst it would appear that the true adaptation of such glass for the above purposes has not yet been obtained, its use in the manufacture of lamp pillars, knobs, and handles, lock furniture, and finger plates, has been more successful, and seems likely to be attended with more tasteful results.

When glass is used for large objects, such as chandeliers and candelabra, where construction is required, its known brittleness is rather at variance with the constructive application of the material, and it seems in the principal branches and supports to require not only a hidden metallic structure, but even the appearance of it to the eye, to overcome a certain sense of insecurity.

In upright standing candelabra the work should arise out of some other material as a base, and it is exceedingly objectionable to base a glass superstructure on the same material, supported on foliated or other forms of the nature of feet. In hanging chandeliers a construction entirely of glass equally quarrels with the sense of security; the chandeliers of the last century illustrate the error of such constructions—their long bent branches appear weak and brittle, and the full beauty of the glass is not brought out by the lighting; the present mode, which treats glass rather as a string of jewels assisting to hang up the branches, is more consistent with its true use and best qualities; for while in masses it constructs ill and has not its full brilliancy, lustre and prismatic beauty are obtained by loose pendant forms cut with proper facets, so that every motion, however slight, contributes to the splendour of the work by the varied reflections of the lights. In such works coloured glass should be introduced sparingly, and it should always be translucent, opalized coloured glass hardly ever having a judicious effect.

In referring to the exhibited works in the manufactured material, the first place is due to the glass fountain of Messrs. Osler (Class XXIV., 20, p. 700). It is a matter of regret that a production so unique in this material should not be entitled to praise for its design; the truth is, that, works of the like magnitude in glass never having been before attempted, and the designer being consequently thrown on his own resources, he should have seized the opportunity so offered, and, striving to forget what had been done in other departments, treated the material for itself alone, and consistently with its own proper requirements. Instead of this there is an attempt to mix architectural stone forms with others that have become almost conventional in glass, and the result is inconsistent and unsatisfactory. The glass pillars are far too slight for the heavy inverted canopy, and both those canopies are too large for the basins above, very inharmonious in their contrast of lines, and unfitted for the agreeable display of the water; the glitter of the jewel-formed ornaments with which they are covered being confused with the motion over them of the natural element, instead of serving to show out its brilliancy and clearness; indeed, it is evident that the main source of error has been in supposing glass, and especially cut glass, a suitable material for a fountain; it is at once seen that this is not the case; instead of its being a proper foil for the sparkling water, glass emulates its sparkle and lustre, and the result is a failure from want of contrast.

The unsuitableness of glass, when on a large scale, for self-construction is also seen in this work, and is partly felt in the large and otherwise elegant candelabra exhibited by Messrs. Osler (*ut suprà*), the property of Her Majesty, especially in the horizontal indentations of the architectural moulding of the bases, which induce a sense of liability to break arising from the known brittleness of the material, as has been before alluded to in the works from Bohemia; in other respects they are in good proportion and beautiful in material, and the gilt bases on which they stand supply the want of a metal foundation before remarked on; the colourless quality of the glass is extremely beautiful. It is hardly possible to estimate properly the effect of cut glass except under the influence of the light for which it is adapted, an influence which has been noticed even in the case of metal chandeliers, and which would be much more marked in its effects on the prismatic forms of glass; but loose pendant pieces attach together in long sweeping lines are well adapted for this purpose; and the general forms of such works as exhibited by Messrs Osler (p. 700), Messrs Apsley Pellat and Co. (Class XXIV., 33, pp. 701, 705), by Perry and Co. (Class XXIV., 36, p. 705), and others, are good, although they do not satisfy the mind as to construction, and sometimes appear to want simplicity. It has been necessary to diverge a little from the classification at the head of this section to take notice of the above works and others of the like character; in returning to the objects more especially included in this part of the Report, the table glass exhibited by Mr. J. G. Green (Class XXIV., 32, p. 701), deserves especial notice, both from the general excellence of the forms, and from his large adherence to those principles which have been considered as best regulating the true use of this beautiful material. In his blown-glass jugs, water-bottles, and wine glasses, some of the purest forms derived from Greek utensils have been selected and adapted to the material and to present use; they are decorated with ground ornamental forms in bands, and although the ornament is sometimes too redundant and dispersed, it is in the right direction. Many of the forms exhibited by Messrs. Pellat, and by Messrs. Richardson of Stourbridge, have great merit, while the beautiful applications of glass to door-handles, and the extreme purity of the material obtained by Messrs. Pellat, of itself gives it a high ornamental character in such works. Messrs. R. Harris and Sons (21, p. 700) have some finger-plates in glass that point out a beautiful use of the material; one with a diaper in silver on a blue ground is chaste in effect and clever in its design. P. J. Lahoche, of Paris (1287, p. 1238), exhibits some goblets and glasses of pure blown forms, simply ornamented and in good taste; but on the whole the best white glass, both in form and ornamentation, is to be found on the English side.

The design of the Bohemian glass, both of Count Von Harrach, (587, pp. 1036, 1037), the largest exhibitor, as well as of Messrs. Kolb, of Prague, and of other manufacturers, Foreign and English, is tending rather to injure than improve public taste from over decoration. The richness of the material, from the brilliant colours that may be produced in it, renders it liable to this fault, which is greatly increased by the gaudy extreme to which the ornamentation is carried, too often applied to coarse, unrefined, and inelegant forms.

Works in the Precious Metals.

The design and ornamentation of works wrought in the precious metals deserve especial attention in this Report, since in this department we may expect to find the highest *art* applied to the richest and most costly materials. Moreover, in such manufactures more than in any other the labours of the artist and the ornamentist seem to concur, and are often so intermixed that it is difficult to designate their several provinces, or to determine where art ornament diverge from one another. Here we have a field wherein we may study the right application of each, and understand the due limit within which each is available for the purposes of manufacture.

However, in the highest range of his art, the ornamentist may be merged in the artist, there is a distinct difference in the principles of the two arts, a difference which becomes more apparent as the ornamentist descends from labours of such high requirement to those more strictly within his own province. Art has its childhood in a careful imitation of nature, and grows into an abstract imitation, or generalization of nature's highest beauties and rarest excellences—still, however, imitatively rendered—and nature, thus selected, becomes the vehicle for impressing men with the thoughts, the passions, and the feelings which fill the imaginative mind of the artist. The generalized imitation of nature is the language in which these imaginative abstractions are embodied and expressed, and this whether the artist be sculptor or painter; the landscape painter even proceeds on the same principles, and endeavours by a selected *imitation* to reproduce the aspects of nature in harmony with certain feelings which fill his mind, and which he wishes to impress on the mind of others. In its lower phases art relies more and more on imitation, seeking to give pleasure only by the reproduction of beautiful objects or beautiful combinations, until, in its lowest development, art, if it can be so called, rests contented with mere *imitation*.

In considering in a like manner the scope of the *ornamentist*, it will be evident that in his highest aims he is assimilated to the *artist*, so that it becomes extremely difficult, nay impossible, to separate them, or draw any line of distinction between the one and the other. Thus the beautiful shield which embodies the description given by Homer of that of Achilles, designed by Flaxman, and exhibited in electrotype in the Fine Arts Court (365, p. 843), and that skilful specimen of embossed work, the shield by Antoine Vechte, in the collection of Messrs. Hunt and Roskill (Class XXIII., 97, p. 686), are at one and the same time works of art and works of ornament. From this high range the occupation of the ornamentist descends by imperceptible degrees; not as in the case of the artist through the more and more close *imitation* of nature, but by selecting from her whatever is beautiful and graceful, irrespective of her individual embodiment of these qualities, and adapting them to give pleasure separately and apart even from any wish to recal the objects themselves from which he has sought or obtained them; his effort is to give the most characteristic embodiment of those natural objects (viewed in relation to some peculiar quality, form, or colour, or some particular adaptation required), rather than to imitate; indeed he departs more and more from *imitation* as he diverges from the path of the artist to occupy his own separate province as an ornamentist. These are truths to be continually borne in mind, as they constitute the only cure for that false style of ornament so largely pervading the manufactures of the day, and already so frequently alluded to under the name of *naturalism*, consisting of the mere *imitative* rendering of natural forms as ornament, and which is nowhere more largely exhibited than in works in the precious metals, and in the affiliated manufacture of plated and Sheffield wares.

While it is not possible, therefore, in works in the precious metals, entirely to separate the artist from the ornamentist, still for the purposes of description their separation is marked with sufficient distinctness. A great cause of the faults exhibited in these works seems to be, that they have received their design rather from the artist than the ornamentist; thus we have figures having no constructive connexion with the work ornamented, but rather of the nature of statuettes perched wherever a ledge or shelf offers accommodation for them; these are generally as *imitatively* treated as the material used and the powers of the artist permit, and are applied to inkstands, candelabra, and works of the like kind requiring a purely *ornamental* consideration. Many centre-pieces, racing-cups, and testimonials are treated merely as groups would be by the sculptor, although the lowest style of his art has but too frequently been adopted, and imitations of textures, chain and plate mail, and such laborious littlenesses, made a point of, rather than that nobler view of art, which, discarding miniature and strictly imitative details, seeks by grandeur of form and largeness of manner, to make us forget the scale of the work in the dignified style of its treatment. Now, if it is proper that these works should be consigned to the hands of the artist, he is bound to treat them according to the laws of his own art, not only by a noble style, but also by making them as groups truly statuesque, combining the parts so that they form an agreeable whole in all possible directions of view. Above all, the *thoughts* which, as works of *art*, they serve to embody, should be such as are worthy of being illustrated on metals of great value, which enriched by true art are enhanced in worth a hundredfold.

If we contemplate some of the inventions of the artists, and some of the thoughts which they have wrought out, we shall be indeed surprised that such puerilities could be dwelt on long enough to execute them as works of art, and still more that manufacturers, so shrewd as they generally are, should be found to engage in their production, were it not sufficiently evident that there is a large and wealthy public whose taste does not rise above such *art*, proved by its becoming patrons and purchasers. What can justify the employment of the precious metals, and what ought to be the more precious labours of artists, upon huntsmen and ploughboys, to render them with all the coarseness of their garments and the texture of their hose? or who, but the givers of a testimonial, relying on the known taste of its receiver, would require art to be degraded into the mere imitation of a hedge-row occurrence on a hunting-day when the sport was successful; knee-breeches and top-boots being as important items in the groups as the hounds, horses, and the portraits of the individuals whose good fellowship it commemorates? It is such art in the more precious metals, employed on such thoughts, that leads, in the imitative manufactures, to the many paltry inventions which are found to prevail therein. Rachel at a well in a rock under an imitative palm-tree draws—not water, but ink: Burns' shepherdess would find the same black fluid in the formless well by her side; a grotto of oyster-shells with children beside it, contains, not a light, but an ink-vessel; the milk-pail on a maiden's head contains, not goat's milk, as the animal by her side would lead you to suppose, but a taper. Such works are akin to épergnes with the hippopotamus and his keeper; or Paul and Virginia under a palm-tree that upholds the glass for flowers on its top; or Apollo dancing, supporting at the same time a glass épergne twice his own size; and inventions of equal or greater *novelty* wrought out with great waste of skill and labour. Even when we arrive at really artistic works in this style, of which happily there are many, it is more than doubtful whether the ornamentist would not be more suitably employed upon them, and an ornamental and architectural construction first obtained, ere art was called in to aid in their completion. It is not pleasant to add, that the above strictures more especially refer to English productions. It is true that such works have often a local significance or an individual importance, causing their exhibition here, and making it less likely such should be exhibited by the foreigner than plate of a specific use, or ornamental works whose characteristics are more general; but it is impossible to deny that the taste of the class who purchase or commission these works abroad must be higher than our own.

In France, for instance, we find testimonials and prizes taking the shape of art rather than of massive metal. The President of the Republic, in contributing a prize to the winner of the Chantilly races, presents a shield, on which are four reliefs, illustrating racing in various ages of the world; and when the *workmen* of Montluçon and the inhabitants of Lot desire severally to present testimonials to Generals Changarnier and Cavaignac, the weight of silver is of far less importance in their eyes than the rare beauty of the art-workmanship. These works are exhibited by M. Froment-Meurice; and the two latter, two beautiful swords, are choice examples of design and chasing. Moreover, it is worthy of notice that in such works the artist does not consider his vocation a separate one, but regards the utility while he perfects the art. In both the above sword-hilts, the ornament (group of figures) has been so thoroughly adapted and composed for its purpose as a handle, that it is perfectly accommodated to the grasp; which is the case also with a beautiful short sword, ornamented with the history of St. Hubert, executed by M. Marcet, and exhibited by MARREL BROTHERS (France, 331) in the same department.

When the amount of those works exhibited by the gold and silver smiths of Great Britain is regarded, an amount whose value is to be estimated by its weight in *tons*, it must be owned that there seems ample encouragement for more skilled labour; but the slightest glance will serve to show how largely the mere weight of metal enters into the estimate of value by the possessors of plate here; and, on the contrary, how little fine art is considered to add to its worth. And yet art would give a more real and permanent value than mere material, and tend at the same time to separate the precious metals from the plated substitutes which ape their richness, but which would never engage the hand of the artist in such rare and costly efforts of skill; indeed, it is a curious fact, observable in the imitative manufactures, more especially in those where the production is very easy, and the sale likely to be extended from the cheapness this induces, that, instead of being employed on art, of the best character, in the first type, it is often of the most wretched description, notwithstanding one might suppose that the cost of the first model, even if high in itself, would be trifling dispersed over a multitude of copies; but it is probable that the style of the work in such cases is suitable to the general taste of the purchaser. Thus the electrotype process, by which means the rarest specimens of art can be, and have been, reproduced, applied to general manufacture, or where original works have been attempted, has been too often used on the worst art and the most puerile ornament. The same is observable in works formed by stamping in dies, and even, though in a less degree, in those cast in moulds, and afterwards chased; and it is only when the same man's mind invents the work which his hand executes, that the highest skill is seen conjoined with the most beautiful art.

It must be owned, however, that our countrymen are greatly deficient in the treatment of the precious metals as the medium of art. The truth seems to be, that here one artist designs the work, and perhaps makes the mode., whilst another is employed to produce it in the metal. Thus we find works designed with great ability, and modelled with much knowledge, and evidently by artists of great professional excellence, yet these works are completed in the metal with every possible littleness of imitation, serving only to degrade and vulgarise the art it is employed upon; and this frequently is caused by the surface treatment and the mode of execution, wherein imitation has taken the place of art. Thus the true artist does not produce the texture of the fur of animals hair by hair, but gives its general expression by some conventional rendering, by the indications at the parts where the skin folds, or by tooling to emulate the lustre of its gloss. In the same way true art does not imitate the materials of our dress by the threads of its manufacture, but indicates them rather by the shape and contour of the foldings. Yet in the works under examination, the surface is often subjected by the workman to a most laboured treatment, labour without knowledge, which dwells more upon hairs and threads, upon details and buttons, than on the form of a joint, or the bones of an extremity: the one is a labour that requires no exercise of thought, nothing but mere dexterity; the other requires a workman not only educated into a knowledge of the parts, but who can enter into the feeling and intentions of the designer. This dwelling with complacency on mere labour, and evident satisfaction with its tedious felicities, can only arise from the habit of giving the models of the superior artist into less skilful hands, to be completed in metal.

Again, in the higher works in silver the foreign artist has had the boldness to regard the material, rich and costly as it is, merely as the vehicle of the art he adds to it; and that lustre and brilliancy, which is one of the great excellences of the rarer metals, he subdues by acids to prevent the glare from interfering with the forms of art. To the eye, silver, so treated, might be so much zinc, did not the informing mind and the beautiful art enshrined in it at once bespeak the valuable metal which alone is capable of rendering such a noble return to the artist's labours. The metal so used serves only to display the art; but our workers in the precious metals have not yet arrived at such a state of virtue; the value of the mere silver is too great in the eyes of the public to be given up, and the full glitter of its polish must be sought to satisfy their feeling of cost and magnificence. From the same cause it is, no doubt, that figures well designed and artistically modelled, are loaded with toolings and burnishings, are matted and frosted, and every other expedient attempted, to show the silver rather than to exhibit the art.

Another defect of the works in the precious metals, as exhibited on the English side, may be traced to the same cause—the separation of the work of the artist and the silver workman: hence casting and chasing are the means of production here, whilst the foreign artist himself uses the hammer and the punch, and beats out with his own hand the creations of his fancy or the inventions of his skill. Casting and chasing in their proper application are means only of producing and perfecting a thing, after the design and model have been executed: even in the hands of the artist himself they are but completing and perfecting processes; the work, as far as invention goes, is already done before it is committed to the mould; and the chaser does but perfect what the caster has produced, with the more or less excellence, according to the art-knowledge which he possesses; but by the embossing process, called *repoussé*, the artist himself produces the work by punching the plate of silver on a soft matrix, and continually annealing it in the course of his labours. By this embossing process the mind of the artist is working with every stroke of the craftsman's hammer; and not only does his own hand work out every characteristic quality of the surface, whether of flesh or of drapery, and his knowledge supply every essential detail, but thoughts seem to arise out of the very method and means of working, and each stroke on the punch may prove a suggestion leading to new fancies, or be followed out into more happy details. Even from the accidents of annealing—constantly necessary during the work—the colouring of the metal in the furnace calls up new thoughts, like those which arise in the mind of the poet watching the glowing embers, and the artist at once embodies his new-found fancies. Chasing has none of these suggestions; as before said, it only perfects: whilst embossing is to it what etching in the hands of the painter is to engraving. The very means in the one are suggestive in every stage of the progress; while the other is only a more or less complete copy of a previously-designed original. The beautiful and skilful works of Antoine Vechte, both the shield before alluded to and the vase representing the story of the Titans (p. 686) which accompanies it, with the beautiful centrepiece wrought in silver partly by the same process, the work of Wagner, exhibited at the entrance of the Court of the Zollverein, are rare specimens of this mode of working, and its suggestiveness will be at once understood by those who are at the pains to examine them, since they all three have parts only partially finished, such parts remaining as it were in the state of sketches, and speaking in this state so strongly to the inventive fancy of the artist, that he who looks into them feels a strong desire to work out the thoughts and fancies they cause to crowd upon him. The iron shields exhibited by LE PAGE MOUTIER (France, 1364, p. 1241), are also fine examples. This mode of workmanship tends also to a unity between the ornaments and the objects ornamented, whilst chased work and cast figures, too often necessarily wrought apart, and applied to the group or thing ornamented, have oftentimes a contrary tendency. In reviewing the question of works in the precious metals, there seems a coarseness and florid style pervading English works, showing itself in groups "in the round" in imitative art, in bold and overcharged relief, in coarse ornamentation, and in enlarged scale; whilst in France, the only other large exhibitor, and in the works of Wagner, in Germany, and of certain French artists on the English side, there is much less of this grandiose coarseness, particularly in the art not specially devoted to purposes of manufacture. At the same time they have, perhaps, in some cases rather too much ignored the consideration of the material, and treated it entirely as a medium for the art. This was not the case with the mediæval goldsmiths, or with those of the 16th century, who, whilst adding exquisite art to rich materials, so treated the general surface as to obtain at the same time the richness and lustre of the precious metals. One thing that we neglect, however, which our French neighbours do not, is the use of enamels; and the varied treatments of surface by oxidizing, parcels-gilding, burnishing, niello, &c.

The use of enamelling as an ornamental addition to the surface of the precious metals has been confined, with one or two exceptions, to chalices, patens, reliquaries, and other ecclesiastical goldsmiths' work, founded on ancient and mediæval examples; and there are some good specimens of Champleve enamelling in the collection sent by Mr. HARDMAN, (522, p. 761), as well as in the works of KEITH (Class XXIII., 121, p. 694), and SKIDMORE (Class XXIII., 23, p. 694), and in France in those exhibited by M. POUSSIELGUE-RUSAND (1405, p. 1243); but the most artistic examples of the use of enamelling are in the elegant mountings of rock crystals, agate, and lapis-lazuli, as cups and flagons, by Mr. MOREL (117, p. 693), of Burlington-street, which for felicitous design and beauty of execution, equal the rare examples of the 16th century. It is understood, however, that these are the works of a French artist. Mr. WEISHAUPT, of Hanau (1 Zollv., 412, p. 1073), in the tastefully-designed chessboard which he exhibits, has also made an artistic use of surface enamelling, both in the dresses of the chessmen and the ornament of the table; while the choicest specimen of the combination of many materials to form a rich and beautiful work is seen in the shield of Faith, presented by His Majesty the King of Prussia to his godson, the Prince of Wales; it was designed by CORNELIUS AND STÜLER (p. 110), and executed by Hossauer, Fischer, and Mertens: and is rich, without the slightest tendency to excess. The subjects, from the Scriptures, in silver, are ably executed in low relief, and carefully chased; the single figures of the Apostles beautifully designed, as are the accompanying enamels. The ivory forms that frame in the compositions towards the centre, and surround the outermost rim of the shield, not being continued through the compositions of the outer margin, there is a slight appearance of its wanting constructive framing in that part, and there are three different scales of figures in the compositions. With these slight exceptions, it is both a beautiful work of art and a rare example of the skilful combination of precious materials, as well as of unity of intention in the whole composition.

The natives of India have long been skilled in the art of enamelling both on metals and for jewellery: the works exhibited in the cases of the East India Company contain many interesting specimens of this art—both applied to the surface of domestic utensils, as flagons, cups, &c., and to necklaces, bangles, and articles for personal adornment; the portion of a dagger-case given in Fig. 1, Plate 3, is beautifully ornamented with enamelling, and is not only a choice example of the art, but of the Indian treatment of flowers as ornament. An enamelled incense-burner of large size, and the flower-vase inserted in the remarks on pottery (p. 1645), both from China, and exhibited by Mr. **Alcock** (p. 1418), are beautiful and choice productions in this art.

If we can allow such works as testimonials, racing-cups, centrepieces, and others of the like character, to be given up to the treatment of the artist, there is still a large number of other articles in the precious metals and their representatives having a defined purpose as utensils, and strictly devoted to a use, which must belong to the domain of the ornamental designer, and be subject to all the laws of his art. Of these, utility should be the first consideration. They should be composed on geometrical forms and have a symmetrical construction. Capacity and mobility, in most cases, will have to be regarded, in connexion with proper stability and solidity: and it should be remembered that, as domestic *utensils*, they are not to be placed under glass shades, and therefore will require constant cleansing and polishing, and that, not at the hands of the silversmith, but of the butler or his assistant. This alone ought greatly to regulate the treatment of surface, which should be such as will best display the beauties of the metal, and yet not render it liable to injury under such cleansing. Then again, it is usual to make the handles and knobs points of ornamentation, and this not improperly; but it should not be forgotten that they are to be grasped for lifting, and should be convenient for that purpose. And neither in these, nor, indeed, in any other part of the ornamentation, should the relief be so bold, or project so far, as to be liable to accident or entanglement in the use of the articles. Some of these remarks may seem almost uncalled for, but are not so: nor are the errors recited confined to English manufactures, but are equally evident in those of France. Thus it is impossible to justify large and florid groups of dead game, of fish, of fishing utensils, or the like imitative treatments, as the knobs of dish-covers, or the handles of tureens; however beautiful in design or excellently chased, they are not convenient for use; nor can the hand be safely brought in contact with the metallic toes of a pheasant, the tentaculæ of a lobster, or the twigs of a fish-basket, any more than stags with their branched antlers can well be laid hold of to remove a venison dish. Faults of this class chiefly arise from the natural or imitative treatment, which has to answer for so large a growth of errors.

It has before been remarked that the figures introduced into the ornament of metal-work are too often merely applied or stuck on, not arising out of the work as a constructed whole, and this more especially in those works which have been usually committed to the skill of the artist; but if not to be tolerated in those works, in objects of utility they are far more out of place, and *ornament* requires that figures should have an ornamental construction. It cannot be too often repeated, that imitative trees and foliage, flowers that are like the growth of the hothouse electrotyped, and which dangle and shake with every movement, as much almost as would their prototypes on their natural stems, are not ornament, are in the worst possible taste for any useful purpose, and have a flimsy and tinsel-like appearance, as much beneath the impressive effect in metal of even mere plain surface, as they are wide of any pretensions to fitness or propriety as works in metal at all. This naturalism is evidently a heresy of the artist's, and should have no quarter at the hands of the ornamental designer. In the section devoted to hardware, the treatment of metallic surface has already been the subject of remark; much of which will apply here also; but in connexion with this imitative art, it may be remarked that the frosting, which it renders almost necessary for its display, is even more opposed to the brilliancy of metal than that oxidation so useful in showing art-treatment.

In jewellery, used for personal adornment, the fancy has full play, and the invention need be but slightly curbed by a consideration of use, such works being in their very intention ornaments; where precious stones are employed, the first object being to display them to the greatest advantage, the designer should be careful that neither gold nor enamel interferes with them, and that there is sufficient motion in the parts to bring the light into play on their surface. In mourning ornaments, bracelets, brooches, &c., M. **Meurice** has shown himself a skilful artist; here, indeed, the fancy of the French art-workmen has full scope, and in such smaller works in metal as cane-heads, seal-handles, buttons, snuff-boxes, &c., the most delicate workmanship is found combined with artist-like design and pleasing inventions, both by this exhibitor and in the articles displayed by **Rudolphi** (France, 1465, p. 1246), **Gueyton** (France, 1619), and others. It only remains to remark upon some of the works for domestic use exhibited in this Class which have not already been spoken of or alluded to. One of the choicest works of utility is the tea-service of **Eck** and **Durand** (France, 1211, p. 1235), which deserves attention for the architectural arrangement of the whole as an harmonious composition, and for the beauty and elegance of the individual forms and their ornamental details; it is a thorough study of ornamentation; the figures, where introduced, are perfectly parts of the composition, and are oxidized to show the beautiful workmanship employed upon them; the ornament is in low relief over the surface generally, and parcels-gilding has been used to give expression where the treatment became confused by a little excess. The plateaus on which the cups, cream-vessels, &c., are arranged, are treated with ornament in niello, and every effort has been adopted to give variety to the surface without interfering with the general repose of the whole. Constructive use, moreover, has been well considered; the composition consists of a raised central urn, from which the water flows through several vents into four teapots arranged below, whilst chalices for sugar, cream-pots, &c., are grouped lower down in the arrangement, the bottom having spaces for the cups designated by circular groups of ornament in niello; the only difficulty is to conceive how so massive a piece of plate is to be filled at the top with hot water, and conveyed into the drawing-room, without discomposing its general arrangement: in addition to which, it certainly has the fault of being over ornamented, notwithstanding the great care that has been taken by low relief and otherwise to prevent such an appearance.

The work on the English side which most nearly corresponds with the last-mentioned is the centrepiece, the property of His Royal Highness Prince Albert, exhibited by Messrs. **Garrard** (Class XXIII., 98, p. 689); this also has been designed with a proper sense of architectural arrangement, and is elegant in its general forms, especially the central tazza, while the low relief ornament on its surface is well considered and in good style; being entirely treated in gold, it has a tendency to monotony, counteracted as far as possible by a very judicious use of burnished surface. The portraits of animals introduced, although very cleverly modelled, do not harmonize with the general treatment. This collection contains also some well-designed salt-cellars, vegetable-dishes, and candlesticks, whilst even some works in the florid and nearly discarded style of Louis XIV. look almost satisfactory, compared with testimonials and racing-cups of the character before alluded to. Messrs. **Hunt** and **Roskell's** (Class XXIII., 97, p. 686), principal centre ornament and plateau exhibits some cleverly-designed figures well modelled and with much appropriateness of subject, and it groups well as a composition. Many of the figures in the round, however, have too much the appearance of separate groups placed on the ornament and not forming part of it, a mode of treating such subjects which must be considered objectionable: this firm deserves great praise for exhibiting the shield and vase of M. A. Vechte. Messrs. **Elkington's** (Class XXIII., 1, p. 672) application of electrotyping to the reproduction of art and ornament has been successful as showing its perfect adaptability to this purpose. The "hours clock-case," designed and modelled by Mr. **John Bell** (Class XXII., 641, p. 661), is a good example; it is an artist-like work of much fancy, and is a great improvement upon the worn-out commonplaces which the constant demand for such works abroad has occasioned; it deserves notice as a work of art, but is wanting in the symmetrical and architectural arrangement necessary to bring it properly into the province of the ornamentist. The repetitions of Mr. Bell's graceful statuette of Eve (Class XXII., 641, p. 166), Mr. Cheverton's reduction of Theseus (194, p. 832), and of some mediæval examples of silver work, show the perfect applicability of the process. By this art also, in other hands, the shield of Æneas, designed by the late Mr. W. Pitts (Class XVIII., 97, p. 687), a work of great merit, and the still more excellent work of Flaxman, the shield of Achilles, have been presented in metal, and every one must admire the beauty of relief, the richness of composition, and the classic feeling they exhibit; it is equally a subject of regret that they were never completed as works in metal by the hands of these artists themselves. Had they worked on the metal by the embossing process, which has been before enlarged upon, there is no doubt that the transference of the art from one material to another, from clay and plaster to metal, would have had a much fuller adaptation than mere repetition permits of, and would have placed these shields, as works in the precious metals, on a rank with the noblest labours of past ages.

The beautiful art-workmanship, elegant forms, and the ornamental treatments of metal in the small chalices and dagger-handles exhibited by Marrel Brothers (France, 331, p. 1193), should be alluded to, as well as the execution of the cup by Le Brun, exhibited by Eck and Durand (p. 1235), since the art employed upon them is of the true character for such works; but it is not necessary to lengthen the Report by specially adverting to many other works which, while they contain much individual merit as efforts of skill, or even separately considered as efforts of art, are not consonant with the view herein taken of such labours; at the same time it must be remembered that many of the foregoing remarks are intended to apply to the views adopted in treating such works as testimonials, racing-cups, &c., not to disparage the ability of the many talented and skilful artists who have laboured upon them, rather indeed to show that what is often expended on mere material ought to be apportioned to the labours of the artist, and that by the means employed to work out their inventions they are overlaid with littleness and spoilt in production. Indeed, in England, the general impression resulting from an examination of the works in the precious metals would be, that the endeavour of the manufacturer was to give the greatest quantity of metal with the smallest amount of art, which is not so observable on the Foreign side; the view intended to be promoted in this Report is, that art gives value to the metal, not the metal to art. A remarkable contrast in some respects to our own goldsmith's work is seen in the collection sent by the Honourable East India Company (p. 927), herein the least possible amount of metal is so treated by delicate hand-labour, by exquisite pierced work, enamellings, and inlays, combined with such a thorough consideration of the treatment of surface by buhl-work, &c., as to give the greatest amount of skilled workmanship with the smallest quantity of the material; and even in their commoner works (inlays and incrustations of silver on iron) there is such a due consideration in the first place of beauty of form, and such varied and beautiful ornamental arrangements of the details, that they well deserve the consideration of the ornamentist.

The Eastern nations largely practise the art of inlaying both in metal and in other materials, and their weapons of war are decorated with inlaid work, and with delicate chasings of the most fanciful and varied character; this is seen in the works of that class exhibited by the Company; they abound with ornamental inlays, &c., often extremely elegant, and always designed in strict accordance with true principles. Thus, the ivory inlays of gun-stocks, given in figs. 1, 2, 3, and 4 of plate 2, have all the elegance of the Renaissance, and the flowers adapted from nature, and traceable even to their originals, are yet perfectly conventionalized, flat, and symmetrically arranged—indeed, the proper *ornamental* treatment of flowers (the search after what is beautiful and *characteristic* in their form and colour, and not the *imitation of them*) is always attended to in Indian ornament, as a reference to the floral forms in each of the three coloured plates will prove. Almost all the arms exhibited are more or less ornamented, containing a store of suggestions most valuable to the manufacturer, and a rich mine of study to the ornamentist: among other qualities these works display is the tasteful distribution of the ornament, the sense of just quantity; it is rarely that a border contains too much or too little ornamental form, that a diaper is too crowded or too vacant, too large or too small; a reference to the inlays of plate 2, or to the textile fabrics in plate 1, equally illustrates this truth. Nor is this excellent art applied only to costly goods; the same just principles are evident in the cheapest and the lacquer workboxes (of which a specimen is shown in figs. 2 and 3 of plate 3), a manufacture of the cheapest kind, show the taste and skill of the Indian workmen equally with the more costly enamelling of the dagger-case (fig. 1) on the same plate. The inlays of silver in iron, for various domestic and personal utensils, such as hookahs, flasks, bottles, tazzas, &c., are not only simple, beautiful, and correct in their appreciation of quantity, but strictly ornamental, and abounding in suggestions of great value to those who will attentively study them: a single specimen, the inlay of a hookah, is given in fig. 5 of plate 2: the same principles, applied to a great variety of forms, are exhibited in many works in the Indian Court. There can be no doubt of the superior workmanship of some of the best European inlayers, but in much of the ornament, and in all the true principles for its application, they had been forestalled by the natives of our Indian possessions, and by other Eastern workmen. The inlaid and incrusted arms of M. Le Page Moutier (France, No. 1364, p. 1241), and M. Zuloaga, of Madrid (Spain, 264a, p. 1346), are beautiful specimens of ornament and workmanship, while M. Falloise, of Liège (Belgium, 384, p. 1163), and M. Roucou (France, 1689, p. 1257), are successful exhibitors of inlaid work applied to other ornamental purposes. These inlays and incrustations are a means of most agreeably diversifying surface with ornamental tracery and beautiful lines without interfering with the general forms of objects, and deserve more attention than has been given them by our artists.

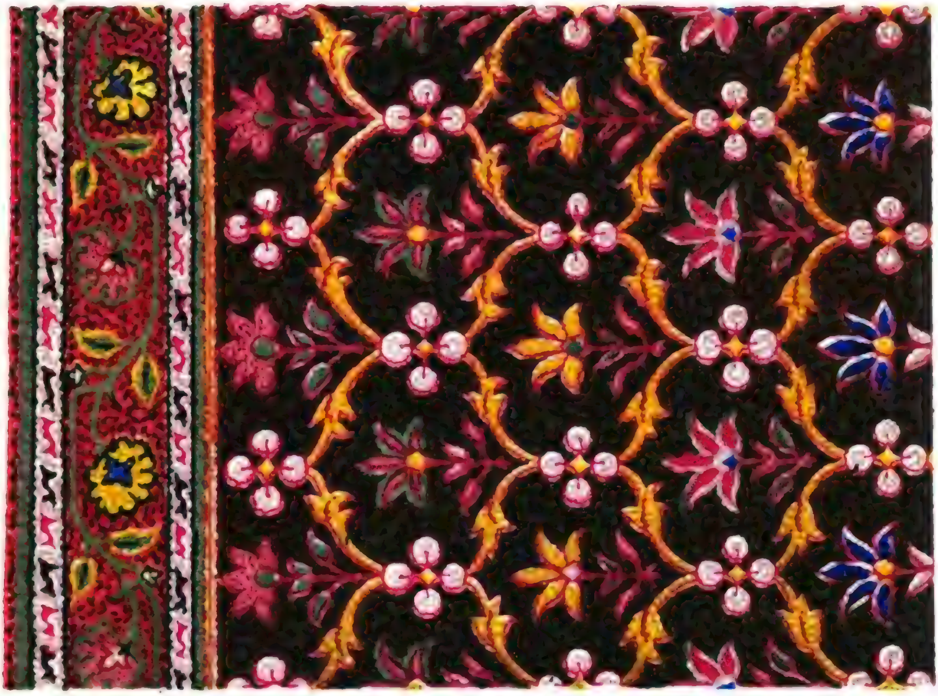
Works in plated metal have been little alluded to in this part of the Report, but it is to be remembered the object is rather to remark on design and style generally, and that the rarer efforts in the richer material will always set the taste in the imitative productions. The art applied to gold and silver in its turn descends to plated wares and manufactures in the baser metals; indeed it has rather been the object to show how completely a false view of art tends to assimilate the costly with the cheap; and it is not too much to say, that in many respects the exhibitions of the Sheffield and Birmingham manufacturers vie with the labours of the gold and silversmiths, whilst in so far as they sometimes recur to the purer examples of past ages they are occasionally in the better taste of a better instructed age.

BOOKBINDING.

The concluding subject of this section has reference to bookbinding, and the "design" applied to that branch of industry. In the Exhibition there is not a very large display under this head; but a few remarks are necessary to counteract a direction of such labours apparent even there, and much more largely seen in the general works of the time. This consists in overlooking the only true intent of the art—the appropriate protection of literary works—in order to make it a vehicle of such gaudy ornamentation and decorative display as shall serve to attract to their contents, the outside garb being a presumed measure of the inner excellence, a practice not more degrading to art than it really is to literature. Such attempts induce the use of crude and harsh colours, and lead to excess in gilding, to heavy and coarse imitations of carved work in leather, gutta percha, and even less durable materials; to perspectives and pictures on covers, to improper and inconsistent applications of metal work, and numerous other objectional practices, which, as they do not tend to utility, and are opposed to the true spirit of the binder's labours, must be avoided if the art is to attain to

PLATE 1.

Fig. 1.



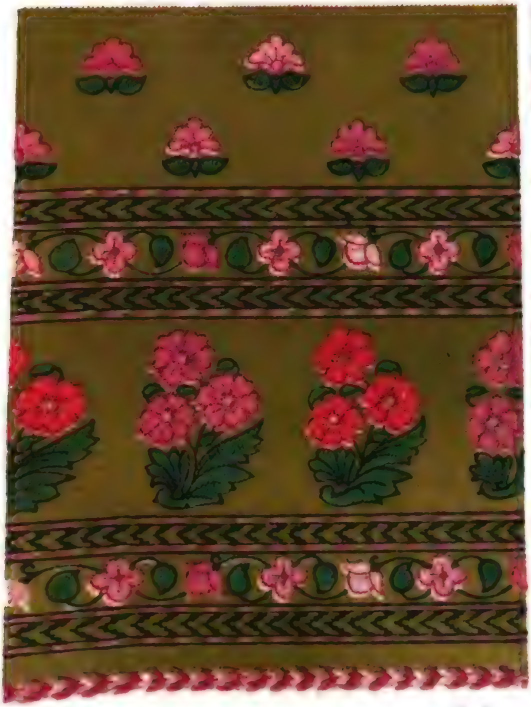


Fig. 2.

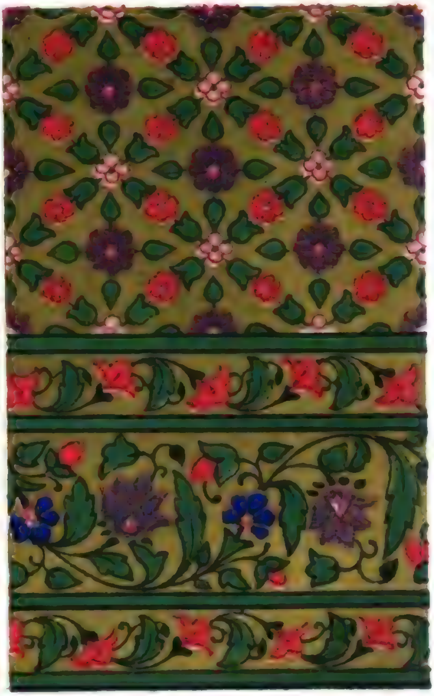


Fig. 3.

Day & Son. Lithrs to the Queen

PLATE 2.

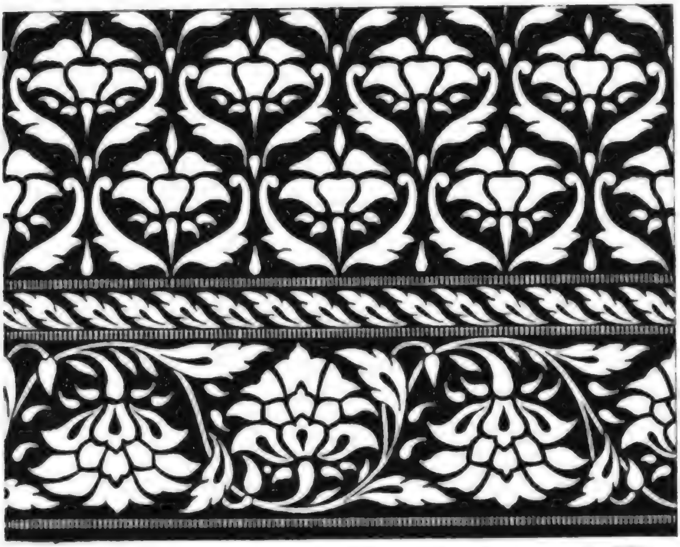


Fig. 5.

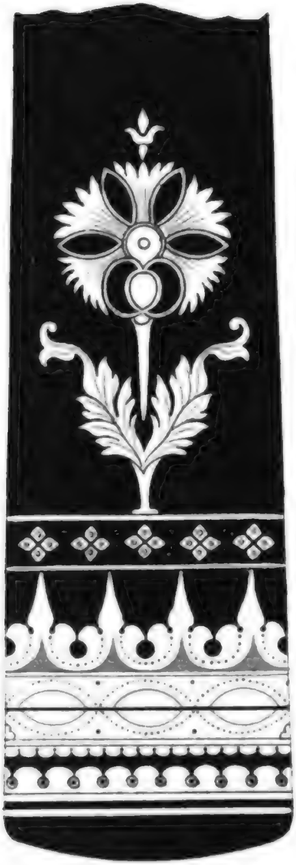


Fig 1

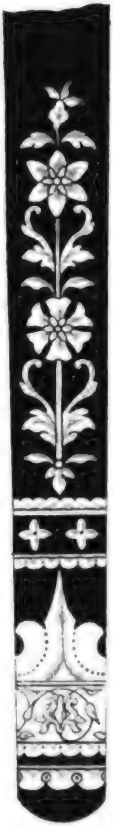


Fig 2.

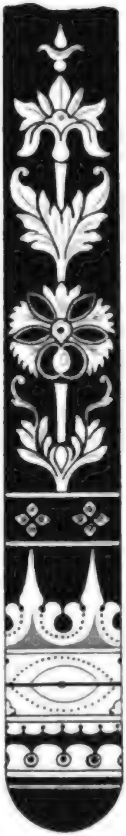


Fig. 3

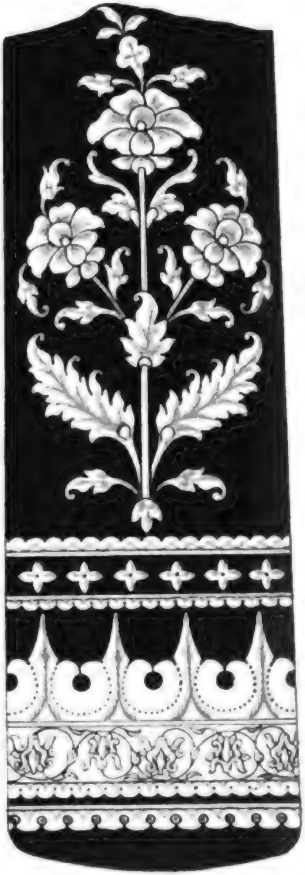


Fig 4.

[illegible]

Fig 1.

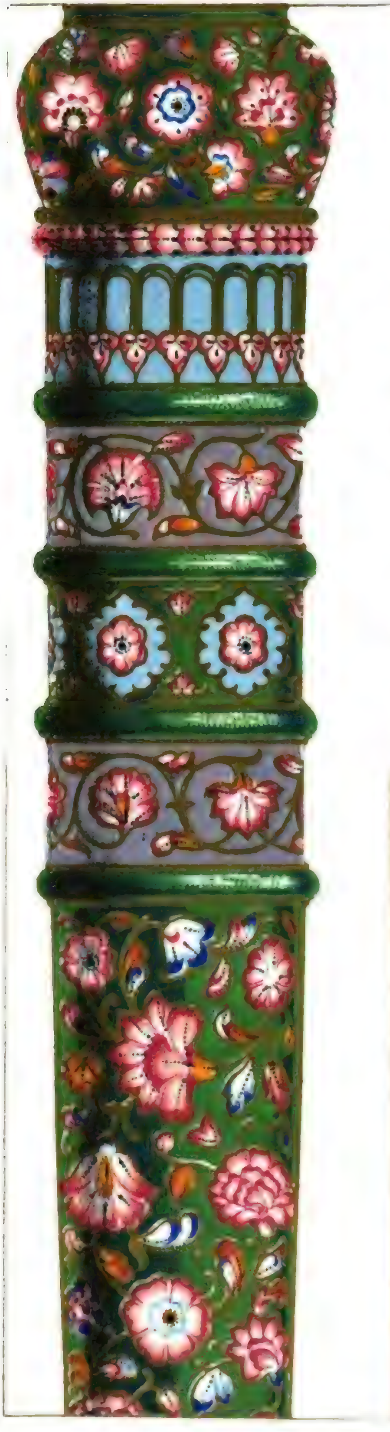
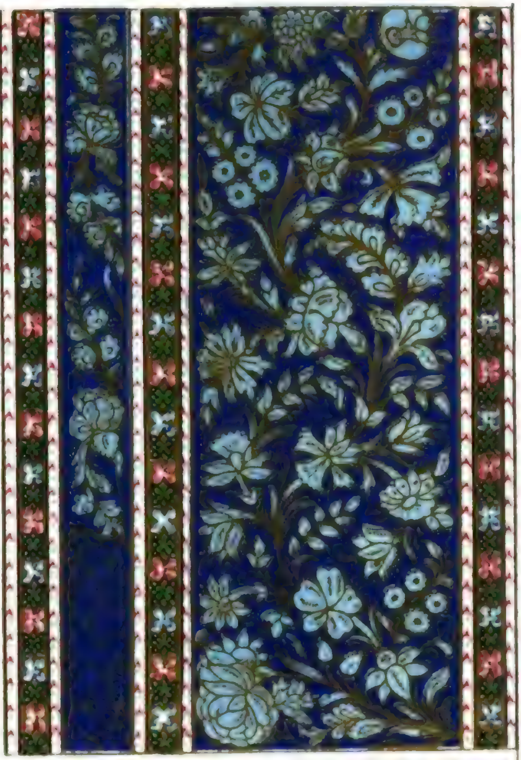


Fig. 2.



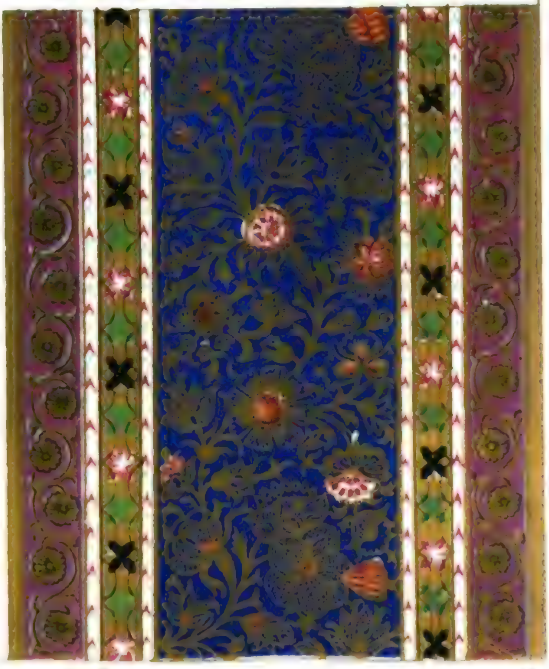


Fig. 3

[illegible]

the simple excellence of the mediævalists or to the chaste richness of the binders of the sixteenth century. It is no doubt admissible, nay desirable, that the outside decoration of a book should have some reference in its ornament to the inside contents; but still the details chosen should be amenable to ornamental treatment, should not be mere conceits, and, as has been so often reiterated, should not be mere reproductions of the ornament proper for a totally different material. Thus a painter's palette, with its range of tints prepared for study, let into the cover, can hardly be supposed the appropriate binding for a work on colour, apart from the impossibility of any symmetrical arrangement of the object itself, or of the tints upon it, for its newly adopted purpose. Neither is the perspective delineation of the apse of a cathedral a proper ornamentation for the cover of a "Church Service," any more than the host of treatments in the same direction, consisting of the fronts of cathedrals, oriel and rose windows, and stone tracery of many kinds, so often adopted for such purposes. In all tooled work and block impressions, bookbinding requires flatness of treatment as one of its first principles; interiors of churches, perspectives of tunnels, and even figures, pictorially used, are quite out of place. Heraldry and heraldic devices should be displayed flat, and even strap-work, or mere combinations of lines, should not be arranged so as to give the appearance of projection, any more than coloured materials or mosaics should give the appearance of relief, although the fine old Grolier bindings and other works of the *Renaissance* period sometimes offend against this rule. Another class of errors arise from mere imitation of details without full consideration of their intent and use. Thus, formerly, when the heavy Church Services were really bound in boards and richly ornamented, hinges were a necessary appendage, as well as bosses, by their projection beyond the surface to protect any delicate carving, rich tooling, or rare metal work inlaid into the cover; and, at present, in books of constant use, of large size, which require great strength, and come under the same conditions, the use of these appendages is desirable and appropriate. But that which is proper for a copy of the Scriptures, or a Church Service, for the lectern, is hardly suitable for a book for the pocket; yet these miniature works are *ornamented* with hinges and bosses, sometimes really in metal, and sometimes only imitated as tooled work on the surface of the leather. Even in some works, where their introduction is appropriate, their intention is at times overlooked or disregarded; thus in a choice metallic binding of a book of "Hours," by Madame **GRUEL** (France, 857, p. 1221), the figure of the Virgin Mary in the centre, whilst it has a higher relief than is suitable for a book-cover, projects moreover beyond the impost of the decorative bosses at the corners of the cover, which ought to serve as its protection.

The "designs" for bookbinding are principally those exhibited on the English side by Mr. D. **WYATT** (Class XXX., 30, p. 832) and by **LUKE LIMNER** (Mr. B. **LEIGHTON**) (Class XVII., 24, p. 538); the works of the former gentleman, whilst they are rich and decorative, and on just principles as to flatness, are somewhat overcrowded and a little deficient in simplicity, which is rarely the case in the best works of the binders of the sixteenth century. The works of the last-named exhibitor may be better judged of by the bindings from his designs in Class XVII.; while they evidence much fancy and invention, they show a strong tendency to the picturesque, and are at times wormy and meagre in style.

Among the works exhibited may be mentioned, for good design, the bindings by M. P. M. **LORTIC** (France, 1652, p. 1256), "L'Orloge des Princes," decorated with a diaper of fleur-de-lys on a dark ground, and a "Catholicon," although this latter is rather deficient in the proportion of its margins. The works of J. **SIMIER** (France, 693, p. 1212), and J. E. **NIEDREE** (France, 665, p. 1211), have also merit, although it consists rather in adopting the style and labour of the past than in any peculiar novelty. This is more or less the case on the English side also, the best works being imitative of old German, French, or mediæval bindings. "The Illuminated Book of the Middle Ages," as bound by J. **WRIGHT** (Class XVII., 139, p. 544), has much merit, although wanting in a nice adaptation of the ornament to the corners. "The Glossary of Ecclesiastical Ornament" is also good, although the whole surface is too generally covered, and the margins too narrow for the size of the diaper. The cover of "Thomson's Seasons," by **LEIGHTON** (p. 538), is one of the best designs of Luke Limner, and the washable enamel binding, in variegated colours, by J. S. **EVANS**, (Class XVII., 8, p. 537), has merit in its application of colour if not in novelty of design. Messrs. **DE LA RUE** (Class XVII., 76, p. 543), in works of actual bookbinding, as well as in much that is allied to this branch of industry, exhibit some specimens of good design, the ornament being composed of combinations of leaflets symmetrically arranged on flowing lines of stems, showing how a principle duly carried out is sure to result in giving a novel and distinctive character to design. There is a harmonious unity about these works, but they are a little frigid and inclined to poverty, which does not, however, necessarily belong to the style adopted. Some fancy papers, exhibited by this firm, are greatly to be praised; the ornament (in various styles) is most agreeably distributed, the forms flowing and elegant, and richness attained without gaudiness. Some of these patterns would work well in silk or poplin, or even be suitable for printed fabrics; and it is in this manner that the design of one manufacturer, properly understood, *may* apply to another, where there are many qualities common to both, and no principle infringed in such adoption.

DIV. 4.—*Garment Fabrics.*

Perhaps there is no subject which comes under review in this Report of more importance than the consideration of design as applied to garment fabrics, since the amount of skill and labour engaged in their production forms so large a part of the industry of the world. Moreover the design applied to apparel must exercise a great influence over the general taste of the public, and persons who have been accustomed to consider gaudy, florid, and large ornament suitable for articles of clothing, will hardly be capable of judging correctly of what is true, beautiful, and appropriate, in the ornament of the domestic utensils and furniture of their dwellings. The great sources of error in designing for garment fabrics are over ornamentation, and attracting undue attention to the ornament—which may arise from many causes; thus from the violence of contrast either of light and dark or of colour, from overcharging the colour, or from the ornament being too large for the fabric. All these causes, however, are modified by the material. Thus muslins and barèges will bear more pronounced contrasts than the more solid or more absorbent textures of jacquonet muslins or de-laines. Silks and de-laines, again, will bear greater fulness of colour than the drier surface of cotton; while woven patterns in silk, formed by tabby and satin in a self colour, will bear much larger figures than are applicable to either woven patterns in varied colours, or the same printed on cottons or silks. Thus, the pattern inserted (G F, fig. 1)—half the size of the original—is from a printed barège, and will give the largest scale of pattern which appears suitable for the open texture of this material; it would, however, even in the reduced size of the woodcut, be far too large for a Swiss cambric, although it might be even larger than the original size of the pattern on a self-coloured figured silk. These observations will show the necessity of the designer carefully attending to texture, lustre, &c., in preparing his design, and illustrate the difficulty of adopting without adapting the ornament of one fabric to the decoration of another. The flowing lines, agreeable distribution, and flat treatment of the details will illustrate other points in these remarks. See also the pattern of a de-laine (G F, fig. 2), and of a muslin (G F, fig. 4). Though the relative scale of the pattern, however, is a most important consideration, it is difficult, even after the above considerations, to arrive at any absolute rule on the subject, since the person and the stature of the wearer of a garment must have some weight in determining the suitable size of

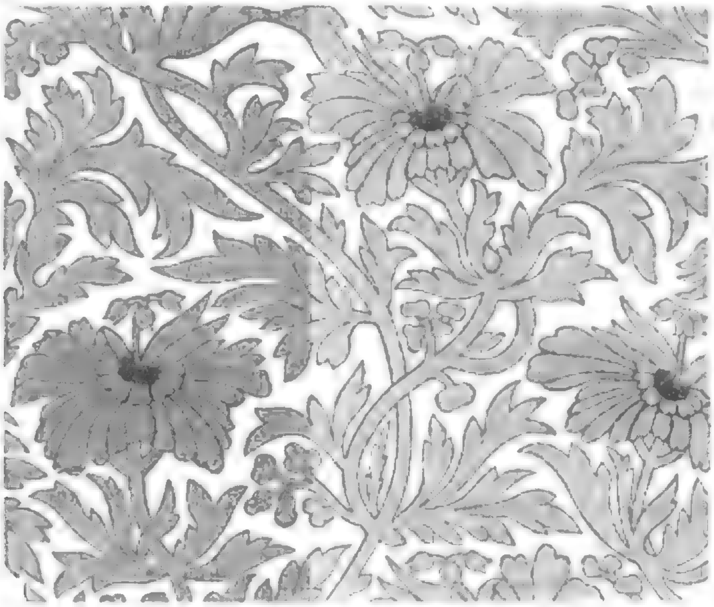


Fig. 1.

the pattern. Generally speaking, however, ornament for such fabrics should consist of small, rather than of large forms—should be treated flatly, and without light and shade—and inclined to subdued contrasts of colour, and of light and dark. A geometrical rather than a dispersed * arrangement of the forms moreover would be found the most agreeable to the eye, and the most consistent with sound principles, some of the best patterns being formed by diapering sprigs, leaves, flowers, or often even simple geometrical forms, regularly over the ground. That such patterns are essentially in good taste is shown by their constant reproduction for the more cultivated class of customers; whilst the sprawling trails and coarse imitative treatments brought out from year to year as the novelties of the season, pass away and are forgotten, or are thrust cheaply on the market at a low cost, to catch persons whose taste is regulated by their pockets, rather than by their cultivated senses. To see the above principles carried out fully and completely, it is necessary to call attention to the garment fabrics exhibited by the EAST INDIA COMPANY (p. 917): these are almost wholly designed on the principles here presumed to be just ones; the ornament is always flat and without shadow; natural flowers are never used imitatively, or perspectively, but are conventionalized by being displayed flat and according to a symmetrical arrangement; and all other objects, even animals and birds, when used as ornament, are reduced to their simplest flat form. When colour is added, it is usually rendered by the simple local hue, often bordered with a darker shade of the colour to give it a clearer expression; but the shades of the flower are rarely introduced: the "cloth of gold figured in the loom" (fig. 3, plate 1), and part of an Indian scarf (fig. 2, plate 1), illustrate fully these remarks. The ornament is geometrically and symmetrically arranged, flat in simple tints, and bordered as above described, with darker shades of the local colour. The principle of colour adopted is a balance of the complementaries red and green, in both cases with white introduced to give points of expression, and to lead the eye to the symmetrical arrangement of the ornament: in figure 3, purple is introduced to harmonize with the gold ground, a harmony very frequently used in the rich tissues of India; in fig. 2, variety has been obtained by introducing two reds, giving an interchange of a lighter tint in every other flower in the border. The borders of these scarfs are beautifully illustrative of the simple and graceful flowing lines which characterize Indian ornament: and in fig. 2, we can observe the difference between the Eastern and the mediæval patterns; while the same principles are acknowledged in both, the latter are often stiffer and more angular than the graceful sprigs of this border. Both these works show how much beauty may be obtained by simple means when regulated by just principles, and how perfectly unnecessary are the multiplied tints by which modern designers think to give value to their works, but which increase the difficulties of production out of all proportion to any effect resulting from them, nay, often even to the absolute disadvantage of the fabric. If we look at the details of the Indian patterns we shall be surprised at their extreme simplicity, and be led to wonder at their rich and satisfactory effect; it will soon be evident, however, that their beauty results entirely from adherence to the principles above described. The parts themselves are often poor, ill-drawn, and commonplace, yet, from the knowledge of the designer, due attention to the just ornamentation of the fabric, and the refined delicacy evident in the selection of *quantity* and the choice of tints, both for the ground, where gold is not used as a ground, and for the ornamental forms, the fabrics, individually, and as a whole, are a lesson to our designers and manufacturers given by those from whom we least expected it. Moreover, in the adaptation of all these qualities of design to the fabrics for which they are intended, there is an entire appreciation of the effects to be produced by the texture and foldings of the tissue when in use as an article of dress, insomuch that no draught of the design can be made in any way to show the full beauty of the manufactured article, since this is only called out by the motion and folding of the fabric itself. An expression of admiration for these manufactures must be called forth from every one who examines them, and is justly due to merits which are wholly derived from the true principles on which these goods have been ornamented, and which result from perfect consistency in the designer.

In reverting to the general question of design for garment fabrics, it may be remarked that the making up of such goods for use should have due consideration in the general direction of the pattern. Thus, while "up and down" treatments in stripes and trails are proper, the horizontal direction of pronounced forms is not to be admitted, since, crossing the person, the pattern quarrels with all the motions of the human figure, as well as with the form of the long folds in the skirts of the garment; from this reason, large and pronounced checks, however fashionable, are often in very bad taste, and interfere with the graceful arrangement of any material as drapery.

In designing for garment fabrics, it will generally be found that the simplest patterns are in the best taste. The efforts, however, both of designers and manufacturers, have been too often directed to difficulty and complication, rather than to produce the greatest effect with the least possible means. Thus we find the number of blocks used in printing any pattern, or of colours in weaving, or the number of cards required to produce a certain design, dwelt upon, rather than the excellence of the design itself, and gaudiness and ugliness are estimated, if expensive and troublesome in production, rather than beautiful simplicity at small cost. As simplicity is one of the first constituents of beauty, it will often happen that simple patterns are far the most beautiful, and that one printing, or weaving in one colour, is in good taste, while every multiplied difficulty becomes further removed from it. It has before been said, that calling undue attention to the ornament is a great error in designing for garment fabrics: there needs, in the larger masses of the dress, a sense of what a painter calls *breadth* or repose, which is only attainable by great simplicity, by flat or diapered treatments of small forms, by uncontrasted light and dark, and delicate tints of colour: those difficult patterns of many parts are too apt to offend against the above requirements, and to cause the figure to stare upon the ground and attract attention to itself, to the destruction of the true decoration of such fabrics.

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* By dispersed, is meant the attempt to distribute the pattern over the ground, without any apparent arrangement.

In examining the designs for garment fabrics, both British and Foreign—many of them of great merit—two things immediately strike the observer, namely, that while there is great evidence of the interchange of ideas between European designers and manufacturers (the same patterns or modifications of them being seen on both sides of the Building), it is impossible to fix on any general principle or principles that have circumscribed the efforts or regulated the taste of European designers as a body, or of any one of them as an individual. Thus we have the same artist exhibiting patterns consisting of natural imitations—patterns founded on symmetrical and geometrical arrangements—flat and shaded treatments—trails dispersed over the surface—or sprigs diapering the ground—minutely small or coarsely large forms—indeed, showing his abilities indiscriminately without any apparent preference, in any and all styles and in manners most opposite. The case is entirely different in the Indian *fabrics* exhibited (for there are no designs), whether carpets, embroidery, or for garments; three or four leading and governing principles being prominent in all such works. These appear the result of science, the other of chance; and it is singular, in this age of desire for novelty, that no manufacturer or designer has thought of seeking excellence or singularity, and therefore celebrity, by a rigid adherence to some fixed rules of design; seeking beauty of form and arranging colour in compliance with their dictates, and repudiating that off-hand lawlessness which is the universal practice. In view of this general dereliction, this equal indifference to principle, it becomes desirable to examine the causes of failure, and to endeavour to impress the value of the principles which have been neglected, rather than to offer especial remarks upon the designs exhibited in this section, and since, without the insertion of many illustrations, it would be impossible to advert to the fabrics themselves, to consider designs and ornamented fabrics at the same time.

In the section on the precious metals it has been stated that imitation is not one of the principles of ornamental art generally, but rather one of the elementary bases of fine art, and it is now desirable to give another distinctive difference between the two which will serve still more to define their respective provinces. It is, that geometry, not necessary as a principle of art, is essentially required as the basis of ornament; thus the grouping and arrangement of art is picturesque and dissymmetrical, and consists rather of unequal quantities, except in some of the works of the early artists, which had an ornamental source. Ornament, on the contrary, has a geometrical distribution, and is subject to symmetry and correspondence of parts, and it may be truly said that it is confounding these provinces, and a departure from this true foundation on the part of the ornamentist, that has caused so much bad ornament in the various manufactures of the Exhibition, and in none more than in the textile fabrics. Thus it is not possible to cover a large space with a repetition of small ornament, without *some* symmetrical arrangement developing itself, however studiously we may endeavour to avoid it, the necessary "repeats," for instance, leading to the development of the square. In such *dispersed* patterns, therefore, some amount of symmetry is produced by chance; thus the pattern (G F, fig. 2) has not been founded on any geometrical lines, yet a four or five-fold repetition would develop a regular arrangement of parts, some determinate recurrence of the berries, for instance, subject to a symmetrical law of lines. In such a case, then, the geometrical law of recurrence is arrived at adventitiously, the necessity inducing it being ungoverned by the controlling will of the designer, who therefore has neglected all the beauty resulting from a proper choice of the regulating form

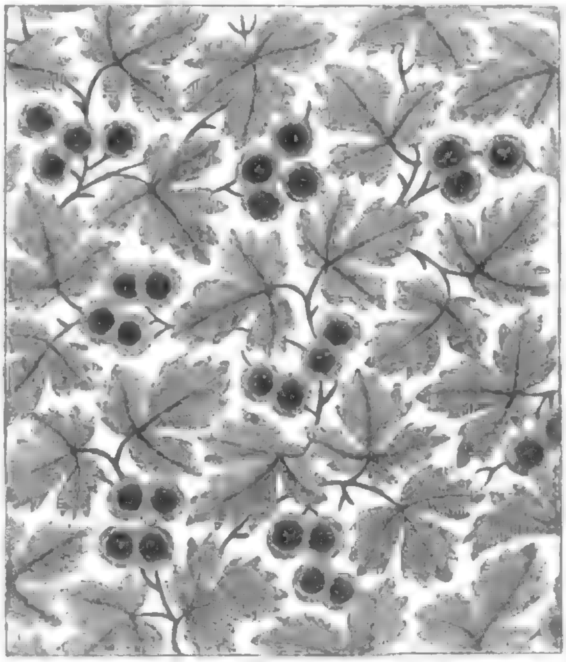
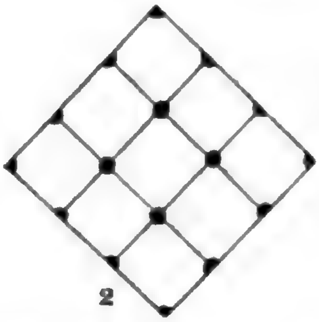


Fig. 2.

Moreover, if a repetition by means of blocks or cylinders wholly without a symmetrical arrangement is an impossibility, would this not lead us to infer that symmetry is a law of nature not lightly to be broken through or disregarded; and should it not induce us to search for those geometrical figures which give the best distributions of quantities, and the arrangements most pleasing to the eye? In fact, we ought not to attempt to overcome this law, but to accept it, and so regulate it as to give effect to other qualities essential to beauty, such as proportion, quantity, grace, and harmony of colour.

Having shown then that symmetry, regulated by geometrical forms, should govern the distribution of ornament, a little investigation would lead to the causes why certain symmetrical arrangements please more than others; thus the square of equal sides and equal angles (fig. 1) is the simplest and least varied basis of distribution, the most obvious regular figure, and at the same time the most inelegant and commonplace; simply changing the direction of the lines, however, and placing the square lozengewise, as in fig. 2, gives a decided improvement; variety is partially joined to perfect symmetry, and a more pleasing arrangement of the forms and quantities is the result (fig. 2). Then again, if we not only change the direction of the governing lines, as in the last figure, but their angle also, as in fig. 3, and adopt the equilateral triangle and the lozenge which is its plural, we have a further variety, in the interchange between the upright and perpendicular spaces of the quantities, and the result is a still more elegant distribution arising from the mere variation of arrangement of the same simple details. Having arrived at these facts as a starting point, viz., that symmetry is a necessary condition of repetition, and that symmetrical beauty is largely influenced by the angle or combination of angles which govern it, we may pass from the right angle, and the angle of sixty degrees, which forms the equilateral triangle, to study arrangements under various other geometrical combinations, founded on other polygons and on ordinate lines from the various intersections of the sides of polygonal figures; such as hexagons, octagons, &c., of an equal number of sides; or



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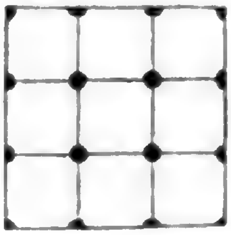

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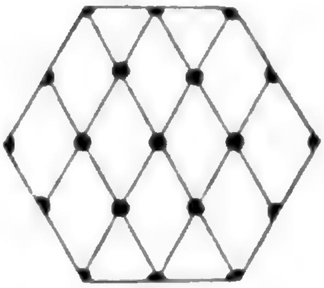

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triangles, pentagons, &c., of an unequal number, developing many beautiful symmetries and proportional arrangements.

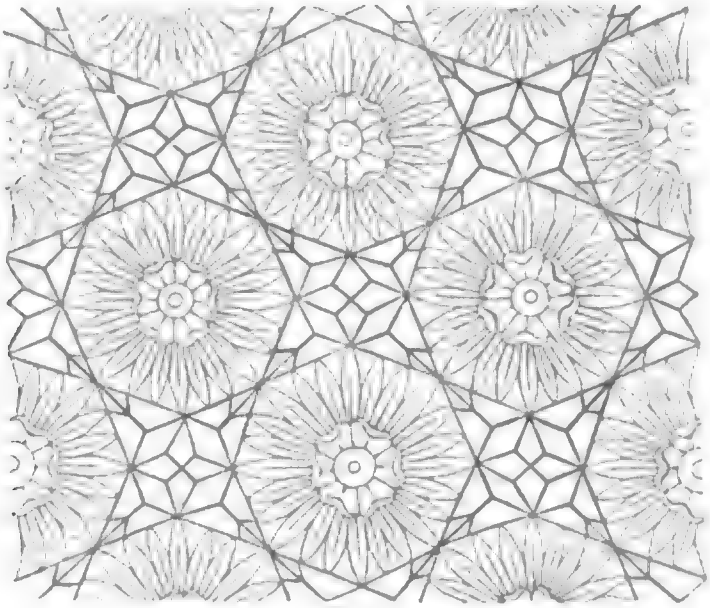

Fig. 4.

Thus the design inserted (G F, fig. 4), intended for a printed muslin, is founded on combinations of the octagon and its ordinate lines. As combining geometrical forms with a thoroughly flat floral treatment it is very ingenious; the size of the pattern (one-half larger than the block) is very well considered for the texture of the fabric, and it will serve to illustrate the subsequent remarks on *quantity*, as the pattern covers well without being crowded, is *broad* from the absence of harsh contrasts, whilst a sufficient amount of surface is left uncovered as required by this material. The colours, much wanted for the proper expression of the pattern, were delicately rendered in pink and green, and the design had a character of much elegance for a light fabric such as muslin; it was exhibited by Florence Collins, among the works of the students of the Government School of Design.

Geometry then is the basis of symmetry, leading the way to those arrangements which best govern the general distribution of *form*. If this view of the value of geometrical arrangement is correct as to the distribution of *form*, it is still more so as to colour; some colours require definite arrangements in juxtaposition with one another for harmony, and are governed by their own laws of relative quantity, having reference to their power of mutual neutralization, as three yellow, five red, and eight blue; such arrangements being more easily obtained and regulated on a geometrical basis, than on those dispersed patterns which arise out of repetitions of the accidents of growth, or natural imitations.

The subject next in importance is *quantity*, by which, in the decoration of garment fabrics, the taste of the designer is so largely made known. The due appreciation of quantity regulates the amount of the surface of the ground to be covered by the ornament, the interspaces between diapered forms, and the size of the ornamental details, especially in relation to the geometrical bases which govern the grouping; thus in the figs. 1, 2, and 3, the spots which are regulated by the ordinate lines might be larger or smaller, or, instead of them, the lozenges might be filled wholly or partially with ornament, as in the design inserted (G F, fig. 4), the beauty and elegance of the design largely depending on the proper quantity admitted. Here the taste of the designer is exercised where rules help him no longer, but where he is guided by the considerations before mentioned as to textures of stuffs and qualities of surface, very important considerations which will be further spoken of. A study of the Indian tissues will show how well understood *quantity* as a source of excellence is in the East, their quantities being generally extremely suitable to the colour and texture of the material sought to be ornamented.

To recur to the subject of textures and surface as important considerations regulating design. It is too much the custom with designers to imagine that the patterns applicable to one quality of surface may be used indiscriminately for another, and that which is successful in one material, or by one process, must necessarily be a success in another; thus, no sooner does a pattern in silk or worsted obtain the notice of the public than it is immediately copied in printed cottons, without any regard to differences of material or modes of production, to the lustre and richness which belong to the former, and must be wanting in the latter. In adopting the patterns of the weaver, the progress by squares necessary to the weaving process is imitated in printing where it is neither suitable nor required; sometimes the whole texture and treatment is copied on the cylinder. As an observable instance, no sooner did alpacas make a strong impression on the public and become popular, than their low tones and broken tints were imitated largely in cotton prints, which almost changed their character from this circumstance, a low-toned surface or ground being adopted with slightly contrasting figures; they lost their own character to take up an unsuitable one. Cotton prints are capable of being easily cleansed, and the whiteness of the material is a great cause of beauty, from its appealing to our sense of purity; this source of excellence is heightened rather than diminished by such a treatment of the ornament as contrasts with the general ground without covering it too much (see G F, fig. 4); when the ground, therefore, is entirely covered, as in these imitations, this appeal to the eye is lost, and, however suitable such patterns may be for the poorer classes, they take from the true beauty of the fabric. The contrary is the case with woollens; the material does not admit either of the same easy purifying, nor has it the same native whiteness; the whole ground, therefore, may be coloured, or where its native hue is retained it must be more largely covered with the pattern. Thus fig. 2 (p. 1669) is a pattern of a de-laine manufactured by Dolfus Meig and Co., (1191, p. 1234) and shows not only a proper flatness of treatment, but an agreeable quantity and a due amount of the surface covered by the ornament, and is therefore suitable for such goods.

The consideration of texture and surface is necessary in the application of design to other fabrics as well as cotton, and to other means besides printing; thus colour, which has such effect on printed woollen goods, and shows with such richness and fulness in the absorbent material of de-laines and flannels, where it may be used broken over nearly the whole surface, is apt to destroy more valuable qualities when applied in varied tints to the decoration of silk, and should be used more sparingly on this material either in woven or printed patterns, leaving large spaces of the ground untouched, so much of the true beauty of silk residing in its lustrousness and the textural beauty of its surface. Of course this remark does not refer to self-coloured silks or to figured brocades in a self-colour, where the greatest brilliancy of colour does not interfere with the textural beauty, but only to weaving or printing patterns, consisting of many colours, too largely over the surface; the fact is, that a variety of colours tends to vulgarize both cotton, woollen, and silk fabrics, and, although least objectionable in woollen goods, they want an attention to laws of harmony which either has not been given them, or is not easily attainable by those hues which chemistry has placed at the command of the manufacturer as comprising durability among their other qualities.

The proper treatment of texture has other considerations as respects the ornamentation of garment fabrics which may find a place here, although a little irrelevant to the present matter; graceful and elegant foldings are very important in all goods intended for personal wear, and many of the most beautiful qualities of materials are brought out by the interchange of light and reflection playing over their surface on the motion of the wearer; it is important, therefore, that no mode of decoration should be adopted to destroy this quality, even irrespective of the sacrifice of proper utility which takes place in all works so overcharged with decoration or stiff from embroidery as to impede ease of movement and freedom of action in the wearer: the full lustre of silk more especially is dependent upon the folding, and every fabric is more or less influenced by the same cause. When gold or silver threads are introduced in the weaving, stiffness must result from it, and the skill of the designer should be so exercised as to give the greatest effect from the least possible use of such materials. This has been particularly understood in the Indian tissues, which exhibit the best effects under folding in a remarkable degree, while the opposite error was noticeable in many costly priests' robes exhibited in the North-East Gallery, so stiffened with gold and covered with raised embroidery that the wearer must be encased in them as in a suit of armour; the whole were not only vulgarized by excess, but were perfectly unsuited for use, and for the best display of those ornamental qualities sought for. The priests' dresses exhibited in the Mediæval collection had not this error; they were soft and flexible as the tissues of India, yet rich withal and fully decorated, suitable for use, and adapted to give the best effect in that use.

The restrained use of means has often been before adverted to, nor is it unnecessary to recur to it in this section also; under the old and simple methods of cotton printing, when the resources were few and the means limited, the style was in some respects better than at present obtains. Thus block-printing by hand required flat forms and flat tints diapered regularly over the surface, and some simple flower or leaf so used had a pleasing and just effect, of which Peel's well-known parsley-leaf may serve as an instance. It will at once be seen that these qualities are herein advocated as *principles*, to be filled up and enriched by more modern resources, yet as ascertained truths not to be departed from. In the place, however, of the former limited means, printing from metal cylinders has put at the command of the designer all those powers of more perfect imitation enjoyed by the engraver, and, instead of using them as they should be used, consistently with the requirements of manufacture and the principles of ornamental art, they are wasted on the *imitation* of flowers, foliage, and accidents of growth, quite out of ornamental character and opposed to just principles.

Having thus remarked upon the principal excellences and defects of design in this section, it is felt that the difficulties before stated, arising from the varied principles adopted by one and the same manufacturer, the large number of the works exhibited, and the impossibility of referring to any particular work alluded to, almost entirely preclude any comment upon individual works. Generally, however, it may be stated that there is less dereliction from true ornamental art in woven than in printed goods, the powers of the weaving process being more limited than those of the printing process, so that varied tints and complicated forms fortunately present greater difficulties in production in the former than in the latter case. Thus, whilst the skill of the designer, and, irrespective of principles, the taste of the printed silks of F. Choquebl (1148, p. 1233), must be admired, a comparison with woven silks of much simpler pattern would certainly result in the favour of weaving. Of this some of the silks exhibited by Campbell and Co. (Classes XII. and XV., 201, pp. 495-96), are examples, as well as the Irish poplins of Reynolds and Co. (Classes XII. and XV., 266, p. 498), and Atkinson and Co. (Classes XII. and XV., 256, p. 498). In these latter goods there is evidence of much taste, and a greater adherence to the principles herein laid down than in almost any other fabrics except the Indian. The mixed materials of Bradford and Huddersfield, and some of those of the same kind exhibited in the Zollverein by Messrs. Rurmann and Co. (1 Zollv., 580, p. 1082), are also very satisfactory where those manufactures are not too attemptive; they bear the addition of crude colours ill, and the low tone and quiet contrast of such goods are greatly in their favour. Silk, as has been before stated, is so rich a material in itself, that colour is hardly needed, and where used it should be with great caution; the silk which forms the pattern on woven *mixed* fabrics is in itself a bright contrast to the more absorbent woollen ground, and should not be forced into opposition by bright colour; and in all cases the chance of error is diminished by abstaining from colour in pattern rather than the contrary: that crude colour is most dangerous in silk goods is shown in the very feeling that prompts to moderate it in chiné silk, wherein the pattern is blurred and made more undefined by the process of dyeing to get rid of the crudeness that must be caused by printing in colour on the finished material, and which would almost reduce silk to the grade of glazed cotton or chintz.

Shawls.

In the section of garment fabrics, design as applied to shawls has been reserved for a separate head; not so much from the importance of the manufacture, although even for this reason it would call for careful consideration, as that it leads to the examination of the principles on which these fabrics were decorated in the countries from which this article of dress has been derived to us.

The exhibited "designs" come first under notice: these are almost exclusively by French designers. The beauty, excellence, and costliness of the shawls imported into Europe from the East have united the Cashmere pattern so intimately with these fabrics in the public mind, that it has become almost a fixed idea connected with them, and it is consequently thought indispensable to the manufacture that Eastern forms and Eastern treatments should be applied to these goods. Thus for a long time such works were but mere imitations, and the invention of the artist was less taxed than the laborious skill of the copyist. It is due, however, to the French designers to say, that they have of late made earnest study of the works from Cashmere and Persia, not with an intent to continue mere imitators, but to obtain the principles on which the Eastern artist designed; and among those who have studied the Indian mode of ornamentation, the Messrs. Berrus (France, 55, p. 1174), must be spoken of as having greatly distinguished themselves where many are competitors.

There is nothing more difficult than to disabuse the world of a rooted error, and as the multitude, who rarely understand the true cause of excellence, have adopted the idea that the form called the *Indian pine* is the distinguishing characteristic of Cashmere patterns, this form is supposed to be necessary to the sale of shawls of this fabric, and is therefore the prominent or leading feature in all the European imitations and repetitions of these goods. But there are principles of excellence in the designs from India and the East that are the real causes of their beauty, apart from any leading form, and, unless these are understood and practised, the forms alone will help but little towards the rich effects so constantly found in those works.

The Indian pine, moreover, is not present in all Cashmere shawls; in some it is either greatly suppressed or entirely absent. Whatever may have been the cause of its introduction there, whether as a sacred or national symbol, or as used only for the supposed beauty of its curves, its constant repetition in works intended for European wearers is, to say the least of it, a cause of great monotony, and implies a want of invention on the part of the designer, whose skill should supply some novel application of ornament to such fabrics to wean the public from this stock idea on the subject. But in doing this, care should be taken to keep in mind those *principles* which are the true cause of the beauty of the Indian fabrics, comprising their treatment of form, treatment of colour, beauty of line, and due consideration of the material. The treatment of form is one of the essential excellences of the Cashmere designs. The objects used in ornamental decoration are always, for woven fabrics, treated quite flatly, as is the case, indeed, in all the Eastern and Indian works, whether these consist of ornamental forms having no apparent relation to natural objects, of flowers, foliage, or even of birds or animals. There is hardly any instance in which this rule has been overlooked. Moreover, excepting in the ground, large masses are rarely introduced, but large leading forms (as the Indian pine, before spoken of) are filled in with a minute diaper of smaller forms, mostly floral, and the beauty is enhanced by the graceful curves and elegant flow of these leading lines. The colours also are subject to a general rule; they consist of simple flat tints without shading, each flower, or petal, where flowers are used, each leaf in foliage, being rendered by one tint. In the best Cashmere shawls these inner diapering forms are very minute, and thus a broken texture of colour is given to the surface ornamented. The tints, where in large masses, as in some of the embroidered ornament, have rather a tendency to secondaries; thus purple, green, and gold prevail, and the red is inclined towards the colour of the pigment called Indian red, or in some cases to pink, which is a diluted crimson (a red with blue in it): thus the general hue has rather the direction of coolness; this is particularly seen in the carpets also, both Indian and Persian, as has been before remarked. In the Cashmere woven shawls, if pure tints are used, which may be the case, these tints become broken by the mixture of colour produced by the threads of other tints coming to the surface in them in the process of weaving, thus neutralizing their force and producing the same negative tendency; invariably flat forms without perspective or imitative rendering, flat tints without shading, and single hues of the same colour, are the principles of the designer. The due consideration as well of the material as of the use to which the fabric is to be applied is evident both from the nature of the ornament, which never draws peculiar attention to itself, and from the texture, since, notwithstanding the use even of metallic threads in the ornamental design, the Indian fabrics seem never to lose the property of flowing in beautiful folds, and adapting themselves to every motion of the wearer, an excellence not so constantly present in the European manufacturers. Now the French designers, to whom it seems clear that manufacturers are almost wholly indebted for their designs, although they have made much study of principles, seem either to have overlooked some, or to have willingly ignored them; either in deference to the ruling idea entertained by the public, or in order to obtain novelty; but novelty should never be sought at a sacrifice of truth. Let the designer throw away, if he pleases, the Indian forms—the Indian pine form, perhaps, the sooner the better, since it never had any symbolical significance with us, and it has long ceased to have beauty of line, tormented as it is into every possible variation, from the normal form—and avoiding mere imitations endeavour after a treatment in harmony with European taste and feelings.

Thus, for instance, geometrical leading forms are sometimes used in the Cashmere shawls, and such treatment might be most successful in the hands of European artists, considering the varied and complicated combinations of flat forms open to their choice. The Byzantine tracery, guillochés, or even the graceful forms of the Renaissance, if perfect flatness were preserved, might be diapered with colour in the Indian manner; but the tide seems to have set in quite the contrary direction,—the leading forms of the Eastern patterns are kept, the just principles are disregarded: the Indian pine, exaggerated often to extreme caricature, is applied not merely to shawls but to other goods; the diaper, moreover, instead of being flat, is composed of flowers often the size of nature, imitatively and perspectively drawn, and sometimes most elaborately shaded. Thus simplicity is lost—the principle of flatness is totally disregarded—the colour not being in flat tints, and the broken *texture* of surface entirely done away with; the result has a certain showy beauty, but it is meretricious and unsound; it may be the novelty of a season, but it is built on a false foundation and will never last.

There is a circumstance connected with floral ornament which hardly seems to have had proper consideration; it deserves, however, some attention. Many of the flowers used by us as ornament are not in a state of nature, but have already been subjected to another art, the art of the horticulturist, subjected by him to a process of cultivation which unnaturally stimulates the growth of the parts, and by means of which, the stamens being converted into petals, the flower becomes doubled and rendered artificial —more beautiful, perhaps, as a flower, but less tractable as ornament, and far less simple, far less fitted for that flat display which is required by some fabrics. By these means the five-petalled rose, the five-petalled pink, &c., become a bunch of petals; and if we would see how entirely some flowers are thus rendered artificial, the dahlia may be instanced as an example: in its simple state it has a single border of petals with a central disk,—by cultivation it is a cluster of petals, so regularly disposed as hardly to be distinguished from a rosette of ribbons made up by the milliner. Flowers in this state are already conventionalized by another art ere the designer takes them in hand, and the result is analogous to the case of the artist who copies the actions and passions of the stage instead of seeking them in their simple reality in common life. Moreover, flowers in a natural state have simple and clear characteristics which they often lose in cultivation, and it is the difficulty of duly expressing them, as artificially changed by cultivation, that seems in some degree to have led to the false manner of treating them in the ornamentation of woven or printed fabrics.

To return to the consideration of the fabrics themselves. The new mode of varying the Indian treatment above described is not so prevalent among the "designs" as it is in the fabrics exhibited, only one exhibitor of designs for shawls showing example of this extreme departure from the true style in his works. The *relaxation* of just principles is, however, seen, even in those which purport to be simply imitations of Cashmere designs: it is shown in the introduction of small landscapes on the spaces of the ground between the large leading forms; in representing in the pattern borders of ornament quilled or gathered in the manner of a fringe; and in the spaces filled up with small diaperings being imitative of foliage, palm-trees, &c., instead of being merely flat, graceful, and flowing ornamental forms. So far from endeavouring to suppress novelty, it is most desirable to encourage it as far as possible, since true novelty is not an extreme characteristic of the present time, but it must be sought by other means than those reprobated; the designer must not suppose that by exaggerating a secondary characteristic of style into undue importance, and adding new materials entirely out of harmony with it, anything really beautiful and new will be likely to result.

In the shawls exhibited this new manner is seen to be very widely spread. The greater number of those on the Foreign side, both printed and woven, are thus ornamented, and Norwich and Paisley are following in the same track. One French house exhibits two woven shawls in juxtaposition, which may serve to compare the two systems. The one is an imitation Cashmere shawl, consisting of straps or bands filled in with gracefully-curved ornamental forms, powdered over with colour in the usual manner, the Indian pine being slightly visible only in the border. The other design is in the new manner; it displays very great ability and cleverness, and is most skilfully manufactured. In it the Indian pine form, exaggerated in all its peculiarities, is filled in with imitative flowers, the size of nature, naturally drawn and shaded, with such minute imitation that even insects have been depicted on their surface. The variegation of some flowers, as tulips and asters, and the shading of others, as roses, &c., is substituted for the diapering of colour which is characteristic of the style; simplicity of tint is therefore lost, and flatness wholly abandoned; great pains and labour have evidently been bestowed on the design, yet the result contrasts unfavourably with the neighbouring Cashmere pattern, the negative colour of this last being much more satisfactory than the hot unpleasant hue of the former, arising partly from the shades containing more colour than the local hue of the flower, instead of being more negative, and more especially from the impossibility of introducing the contrasting and harmonizing tints exactly where necessary, which can so easily be done by the simpler methods of India. It is sincerely to be hoped that this false manner will be abandoned; that when imitations are intended they will be in a pure style, and when novelty is sought for it will not be attempted by thus outraging true principles.

Ribbons.

In examining design applied to ribbons it is necessary to have especial regard to their use, and the purpose which they are intended to fulfil; for although many of the principles which have been laid down as regulating the decoration of garment fabrics are equally applicable to them, these principles are modified by the place which ribbons hold, largely partaking, as they do, of the nature of *ornaments added* to the other portions of the dress.

It may be said that, when the dress itself has much pattern, ribbons, which serve as bands marking the leading lines, or as borders, should be plain in colour and without much enrichment; their office is contrast, and either simple colours or stripes in that case are most desirable; but when the garments themselves are plain and unfigured, or figured without strong oppositions of light and dark or colour, then the ribbon may become a true contrast by its ornamentation, and require marked forms and colours to give that expression which is so requisite. When regulated by good taste, ribbons, beside giving effect to form by their contrasts, serve another important purpose, by being the means of introducing brilliant portions of pure colour complementary to the general masses of the dress, thereby, when the pervading tone of the dress is negative, giving that brilliancy and heightening which, when judicious, is a great means of enhancing its effect, and giving richness without gaudiness. This use of ribbons points out their proper ornamentation, which should be in simple forms, permitting the introduction of pure tints; these require a geometrical arrangement to give them adequate force and expression, and for this purpose the patterns of the Indian tissues offer most valuable suggestions to the ornamentist; even the introduction of gold and silver may be taken advantage of as a very suitable enrichment for these ornamenting fabrics. It is to be regretted that the great prevalence of natural floral treatments as the decoration of garment fabrics has caused the adoption of the same style in ribbons, where it is more peculiarly out of place, and that the rarest efforts of the designer, and the greatest manufacturing achievements, have been misapplied to overcome the difficulties this treatment induces. The design of the Coventry ribbon, for instance, apart from the style adopted, is one of great merit, more successful than the best foreign efforts in the same direction; but while it is a rare proof of difficulties attempted and successfully overcome, it is also a proof of misapplied excellence and unsuitable ornamentation, being based on the artistic principle of imitation rather than on those proper to the ornamentist, abstract beauty of form and colour.

There is an evident tendency to gaudiness and over decoration in the greater number of these articles exhibited, and it largely arises from the above cause. The increased width these goods are now manufactured, and the wrong direction of the decoration applied to them, have greatly altered their character, and we find landscapes, figures, portraits, and all kinds of natural imitations, applied as their ornament. It is pleasant, in the face of so much that is erroneous, to notice the just taste exhibited by one manufacturer of these fabrics; the silk ribbons of Buisson, sen. (France, 1125, p. 1232), have a character entirely their own, the ornament consisting of geometrical figures in gold-coloured silk, diapered over a plain ground of some delicate tint, or borderings of geometrical ornaments on the same principle, having an analogy to the Indian patterns without imitating them, and being very appropriate for the intended use of such fabrics.

Lace.

The concluding subject of this section of garment fabrics is lace design. Lace is assimilated to certain other classes of fabrics by its uses as well as by its peculiar qualities; thus, to worked muslins, for instance, in its general lightness, and in being usually without colour either in itself or in its ornamentation; and to ribbons as being an ornamenting fabric to other parts of dress. It is one of the peculiarities of lace that it is necessarily ornamented, since, without some pattern upon its surface, it would hardly retain its name. Its characteristics of lightness and filminess of texture should never be forgotten in its ornamentation, which should essentially be light, elegant, and flowing; all straight lines should be avoided, not only from the necessities of the manufacture, but because graceful forms are required to pervade its ornamentation. At the same time this textual lightness may lead into the opposite error, and the ornament be so flimsy as entirely to lose proper point and expression; and thus, where lace is used as a trimming, the line which it is intended to enforce or enrich be inefficiently marked from this very meagreness. The old point lace, worked with the needle, was often too heavy in character, from too equal a distribution of the masses of its ornament; it wanted less crowded spots to give value by contrast to the general surface; whereas the modern lace, from the object of the manufacturer being to cover large spaces with little work, too frequently errs in the opposite direction, and wants parts of more full enrichment to give it point and character. The border or edge, which in reality constitutes the true lace, should have the most solid and marked ornamentation, out of which should grow graceful curved forms, less marked and pronounced, gradually passing, in wide lace or in veils, &c., into diapers of sprigs or small ornamental forms over the remaining space. While the natural lines of the growth of plants may be adopted as the ornament of lace—for which they are very suitable from their elegance and variety—subjected to a symmetrical arrangement, however, in the succession of pattern, almost all imitations of flowers are to be avoided; floral forms being the rule, flowers imitated quite the exception. The petals and leaves should rarely be filled in solid, but treated with stitches of varied forms of the nature of a diaper of texture, so as to give lightness, variety, and richness at the same time.

The great excellence of the French and Belgian lace seems to consist more in the truer appreciation of beauty of line and delicacy of form, than in any very marked superiority of design over the English. In the work itself these characteristics are even more evident than in the designs, since they are most carefully and faithfully attended to and preserved. There is, moreover, a more just appreciation of *quantity* in the ornamental arrangements of the Brussels and Valenciennes laces than in our own; the patterns of Honiton lace are generally too heavy, the form rather too large and overcrowded, and the whole effect a little too solid and equal, although this partly arises from the mode of manufacture.

As compared with the important exhibition of the manufactured article, there are few "designs" for lace on the Foreign side; and the best of those are more remarkable for execution than for any particular originality, viewed relatively to the beautiful fabrics themselves. On the English side there are some designs for lace curtains, and one for a lace veil, founded on Brussels patterns, by H. Heald (Class XIX., 269, p. 570), of Nottingham, which has merit. There are also several designs exhibited by the students of the Government School of Design, some of the most elaborate of which, by C. P. Slocombe (10, p. 821), and T. Rawlings (10, p. 821), have been extremely well executed in Honiton lace by Mrs. Tredwin, of Exeter (Class XIX., 55, p. 561), and Mr. Gill, of Colyton (Class XIX., 386, p. 573). The designs are novel, but a little too architectural in their general arrangement, resulting in a slight degree of stiffness, and a want of that flowing ease which should characterise the ornament of the material. The female students also have some clever designs for lace. The beautiful *fabrics* exhibited will have their due share of attention from the Jury of the Class for the manufactured article. Some of the best design is to be found in the works of Groucock and Co. (Class XIX., 3, p. 559-60), Forrest and Son (Class XIX., 45, p. 561), and those already mentioned. The Nottingham lace curtains, although not to be commended for their design, show a tendency in a better direction than the Swiss worked muslins; the treatment is generally flatter, the borders better considered for quantity, and, in some of these works, a diaper over the central field has been adopted with good taste. In these goods, and in machine lace, some of the best designs are to be found in the fabrics of Heymann and Alexander (Class XIX., 25, p. 560); and R. Birkin (Class XIX., 20, p. 560), has one or two well-adapted designs for narrow machine lace also. On the Foreign side the Belgian and French lace, from the grace and flow of the leading lines of the ornament, and the greater delicacy and refinement of the forms, together with the better appreciation of just quantity in the distribution of the parts, upholds the acknowledged superiority of their manufacture. The English lace, especially the hand-worked lace, seems rather to call attention to the labour bestowed on it as a part of the excellence; the foreign lace, even when greater labour has been employed, strikes us as rather elegant and beautiful than as laborious and costly, from the more easy and playful forms of its decoration. These qualities entirely accord with the nature of the fabric, and charm us more when, on examination, we become sensible of the curious elaboration which often accompanies them. The lace cuffs and berthes of B. Vander Kelen (Belgium, 313, p. 1161) include some of excellent design; and also the lace exhibited by Van Haelen (Belgium, 299, p. 1160), B. Duhaijon (Belgium, 314, p. 1161), and F. Audiat (France, 1545, p. 1250). On the whole there are fewer errors in the design for lace than prevail in most other manufactures, partly arising from its circumscribed nature. Besides the faults enumerated in the foregoing remarks, the tendency to the natural imitation of flowers is seen in some of the Honiton lace.

Having passed in review the various sections and subsections into which this Report has been divided, it might, before concluding, be thought desirable to consider the best means of obviating the various faults observed and commented upon in the course of this examination: this, however, would be too large a subject, and one not necessarily within the nature of the Report itself. The public and the manufacturer, both equally interested, and whose improvement is equally necessary—for to be useful it must be mutual—are now awake to the necessity of better education in design; and the question naturally arises, whether the means adopted in the Government schools are the best possible for the proposed end, or whether it would be desirable to extend their scope, so as to make them not only schools of design, but in some degree workshops, where the specialties of design may be fully explained, and the due application of ornamental art to manufacture thoroughly exemplified and carried into practice.

This question, however, is twofold, and has reference to two classes, whose functions and qualifications are not necessarily identical—the designer and the art-workman. That the designer should be acquainted with certain of the means of production and the peculiar processes of the manufacture for which he designs can be doubted by no one, since without a knowledge of the *general* conditions of the manufacture his art is to be employed upon his labours would be useless. But the question is one of amount, and the consideration to be arrived at is, shall this knowledge be given in the course of his art-education? or is it best acquired when, having obtained a thorough knowledge of ornament, he turns his attention to some *special application* of his powers?

That the art-workman should know *all* the processes of the manufacture he is engaged upon is absolutely necessary; it is his starting point as an education in the technicalities or processes of ornamental art is the starting point of the designer. What the art-workman has to add to his manufacturing knowledge is, such an amount of art as will enable him thoroughly to appreciate and perfectly to carry out the work of the designer, without which, indeed, he is imperfectly educated in his trade; while, on the contrary, the designer (not necessarily a workman) has to obtain such an insight into the processes of the workman or the machine as will enable him to fit his design to the difficulties of production. Like the artist and the ornamentist, the two classes, whilst generally distinct, sometimes merge into one another, from which cause the question has been unnecessarily obscured. The truth is, that while, in *some cases*, it would be most desirable that the designer should understand the *minute* specialties of the manufacture, in others it is nearly unnecessary: while the art-workman's province is quite apart from the imaginative, and all that *he* requires is a full acquaintance with the *technical means* of art, such as drawing, modelling, chasing, painting, &c. In these he cannot be too fully educated; but since the large mass of those who are to be instructed are of this class, it is obvious that the principles and practice of *design* need not necessarily form a part of the education in *all* schools of ornamental art.

This view of the question does not interfere with those *special* cases so often alluded to in this Report, wherein, from the high requirements of the material, or of the object itself, the artist-designer is at the same time the artist-workman also, and embodies and produces his own conceptions by his own skilled handicraft.

The general truth seems to be, that when a designer has thoroughly mastered the technical language of art, and the general principles of design and its application, the amount of *special* knowledge sufficient for *his* purpose is speedily acquired in any branch of manufacture to which he may devote his attention; and in all cases more strict adaptation to uses, more originality, and greater aptness to mould the power of production to the best and most beautiful results, will arise rather from a full insight into the means at the manufacturer's command than from any technical education in those means.

This, however, is not the case with the art-workman; to give him proper instruction in *carving*, *chasing*, *embossing*, *painting*, &c., it should go on consecutively with his learning the technical elements of art, and his perfection as a workman will be measured by his power of embodying his art-knowledge in his trade labours. The process, moreover, is a tedious one, requiring the hand to be educated as well as the eye and mind, to enable him successfully to combine art with handicraft; and it would seem, therefore, that such labours are essential parts of true schools of *ornamental art*.

Yet the several requirements enumerated are partial and local, and not to be made a part of general so much as of local education. Thus, since London and its vicinity are the seat, more or less, of *all* manufactures, and of the highest efforts of those manufactures, for this reason, and as a central normal school, it would be advantageous to embody in the course of the London head school instruction in all such matters; but they could only be partially useful in the provinces; as die-sinking and chasing, for instance, at Birmingham, chasing and embossing at Sheffield, modelling and painting in the Potteries, &c.; and it being ascertained which are the proper localities for central provincial schools, their peculiar art-handicraft should be taught therein, and the instruction obtained in the surrounding districts be of such a character as to prepare best for the higher instruction of the central provincial school. The truth is, that our schools have all been *accidentally* founded, rather than on any general, comprehensive, and well-defined principle: and before proceeding further, it is very desirable to have some well-arranged distribution of the means of instruction for the whole kingdom, laid down in accordance with local wants and local seats of manufacture, to control and regulate the whole, so that schools, when founded, should fall in with a pre-arranged and predetermined system. These remarks are made with no intention to dogmatise on the subject, which should rather be viewed practically than theoretically, and the solution be based on known results, rather than inferred from any supposititious points of view. The great public establishments of France, both of the Gobelins and Sèvres, would on this account demand especial attention and consideration, since the fabrics produced therein have attained a greater excellence, both of design and manufacture, than is seen elsewhere; and it would be desirable to gain full information as to the knowledge of art obtained by the workmen, as well as of the processes of manufacture by the designers in those celebrated manufactories. In the same view, the schools founded for the instruction of the bronzists of Paris, and in which they mostly obtain their art-education, should have a full share of attention, both on account of the reputation gained by these works for artistical completion, as well as the great fancy and invention displayed in the Parisian bronzes. While our own Mediæval Court and the clever revivals it contains will show the influence on manufacture of an educated designer acquainted with the various processes of the manufactures for which he designs, and apparently controlling both the manufacturer and his workmen in their production, we have to learn, in the former instance, whether the workmen have any, and what amount of, education in *design*, and whether their *inventive* powers have been stimulated, or only the most perfect technical acquirements obtained; on the other, we pretty well know that the workmen have obtained but little even of the technical *language* of art, and that in invention they are entirely led by the designer.

The condition of the schools at Lyons also, and their routine of instruction, would furnish much valuable information on this subject, since, in the manufacture of silk, the relations between the art and the means of execution are most intimate and complicated. They would show whether the education of the workman in art, and in many cases the exalting him into the place of the designer, has resulted in a pure and just ornamentation of the fabric, or whether it has led to the skilful appliance of manufacturing means to the production of difficulties of execution in these fabrics, rather than to the simple and the beautiful in their ornamental decoration.

In conclusion, the Reporter may be permitted to express his sincere regret at his own shortcomings. It will be evident, on the perusal of the Report, that there are many omissions, and that important subjects have been treated with great brevity. Almost entirely deprived of counsel or assistance from his fellow Jurors, this task being nearly altogether out of their jurisdiction, and only undertaken by him after the Jury labours were concluded, he has to ask for a large share of indulgence. He trusts, however, that a proper spirit of inquiry into the sources of true excellence in ornamental art may be elicited from his brief labours, and lead to the rejection of what is meretricious and false, and to a more simple, grave, and earnest style in modern ornament.

London, November 1851. RICHARD REDGRAVE, R.A., Reporter.

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ADVERTISEMENT.

PREFACE TO THE OFFICIAL DESCRIPTIVE AND ILLUSTRATED CATALOGUE.

Perhaps no statement connected with the appearance of this work is calculated to create more surprise than that the greater portion of it was actually in type prior to the first of May. Its condition at that period may be thus described. The manuscript accounts of the articles of a large number of the Exhibitors had been compiled, set up in type, and subsequently condensed, annotated, and revised, and required but a little more attention to fit them for publication. In addition, a large proportion of the illustrations were completed and fit for printing. But at that moment, what was the condition of the Exhibition Building itself? Only on the morning of the first of May were tickets affixed to a few articles in a few Classes, and the position of many Exhibitors, even on the British side, was not finally determined. This arose out of the efforts made to obtain a strictly classified arrangement of articles on this side. Many articles placed in the hurry of preparation in the space allotted to one Class were improperly thus placed, and required to be removed to other Classes; and a large number of explanations were found to have been received from Exhibitors who had ultimately not been able to send in their goods in time. Whilst many Classes were arranged rapidly, others remained, owing to peculiar difficulties, in a state of great incompletion, and incessant alterations of the numbers and positions of the Exhibitors were necessary before they could be considered perfect. During this time, which is to be reckoned by weeks rather than days, the number of additional manuscripts received from Exhibitors who had neglected sending them in until long after the opening of the Exhibition, was immense, and the adjustment of the additional matter thus created was in itself a difficulty not to be easily subdued.

While an amount of order—surprising in its extent, though imperfect in the degree requisite for the publication of a work so costly in its preparation as the present—reigned on the British side of the Building, the state of that devoted to other nations could scarcely be entitled to that term until a month subsequent to the day of opening. Many foreign states had not sent in their catalogues, and the arrangement of their productions was very imperfect.

The peculiar nature of the Catalogue, also, as a work produced by many thousand authors, naturally brought upon it, through the medium of the small Catalogue, the corrections of a large number of those whose manuscripts formed its foundation, in addition to those rendered necessary, in order to obtain some degree of uniformity in the literary composition.

The combination of the elements of disorder thus presented has never before arisen to oppose the publication of any work in this or other times; and its effect upon its preparation is only to be estimated by those who have watched its progress, and are familiar with the complicated arrangements necessarily preceding the production of any printed book containing illustrations. The great extent of the Catalogue rendered the disturbance of any of its parts absolutely fatal to its publication in a reasonable time, and even in a moderate condition of accuracy. In the midst of all these adverse circumstances an attempt was made to publish it as speedily as possible after the opening of the Exhibition; but this attempt was rendered fruitless in consequence of the ceaseless accessions of additional matter, and of the alterations of position in that already set up.

Under these circumstances the Contractors, anxious to produce so extensive a work in as perfect a condition as possible, resolved, at considerable loss to themselves, to delay its appearance until every alteration of importance had been made in the arrangement of the Building and by Exhibitors themselves. In this state it is now published, and is intended to serve as a lasting memorial of the splendid collection of which it professes to be the exponent. When its magnitude is considered, and due regard had to the great difficulties inseparable from the production of an illustrated book of this kind, it must be acknowledged that the period occupied in its publication has been comparatively brief and its preparation rapid.

The due appearance of the smaller Catalogue, on the first of May,—in itself, perhaps, one of the most remarkable instances of rapid typographical execution ever accomplished,—is also an indication of the substantive pre-existence of the present work before that date, since the smaller Catalogue is only a very condensed summary of the present, and was derived from the material forming the illustrated edition. The difficulties attending the publication even of that work, may be gathered from the fact, that only three days before it appeared was the order of succession and temporary arrangement of the Exhibitors in the Building determined on; and in that short interval, and before its publication, their arrangement in the Catalogue had much of it to be made.

For an account of the method adopted in the preparation of this Catalogue reference should be made to another page. It is, however, due to those whose valued assistance has added so much to the permanent interest which will attach to this work to state, that there are several portions which could not, by pressure of time, be submitted to the benefit of their revision, and for such, and the general scientific accuracy of the work, the subscriber to this notice must be considered alone accountable. That the following pages are to be considered free from technical and scientific inaccuracies could scarcely be expected; but much care and labour have been expended to give them, as far as possible, this character.

The consideration just named may also render expedient, if not necessary, a simple statement of the part fulfilled by the writer in connection with this work. The production of the general plan of the book, its development, after sanction by the Executive Committee, and literary construction out of the crude material obtained after compilation from the manuscripts of Exhibitors—this material resulting from the official instructions given for the compilation of the Catalogue, and the term compilation including, in this case, merely the rough preparation of Exhibitor's manuscripts for setting up in type, the resulting matter being consequently in a very imperfect state—with the general literary and scientific superintendence and management of the work—these have formed the occupation of the writer in connection with it, and for these he may be held responsible. As the result of the combined labours of the scientific annotators and of the writer, and after having received official sanction and revision on the part of the Executive by the officer appointed, this Catalogue is now put forth. The constant effort of the writer has been to prepare a work of permanent value and enduring interest. May it be shown in the issue that the labour bestowed upon it has not been in vain.

At the period when this work makes its appearance in a complete state, the Exhibition is about to close. The first function of a Descriptive Catalogue can therefore scarcely be fulfilled ere the great spectacle it illustrates will pass away. To those wonders of Art and Industry which man, taught by God, has been by Him enabled to accomplish, it will prove a guide but for a brief period. But its more permanently valuable offices then commence; and it may be reasonably hoped that, as a record of the most varied and wonderful collection of objects ever beheld, and as a book of reference to the philosopher, merchant, and manufacturer, it will constantly prove both interesting and instructive to the reader.

It is probable that, with the return of the Exhibitors and of the articles to the numerous localities abroad whence they were derived, copies of this Catalogue will be sent, and taken also, and that these pages will be read in many lands long after the Exhibition shall have become matter of history. May they be found, on examination, to contain nothing which is not in harmony with the spirit of the motto on the title-page; and, while descriptive of the successful labours of man, may it not have been forgotten that the glory and praise are due to God alone.

ROBERT ELLIS.

OPINIONS OF THE PRESS.

Times.

"No work published of late years has a history so remarkable as that of the *Official Catalogue*. The work was already designed in 1850, and the right of publication sold for a considerable sum. No definite idea was then entertained of its plan, or even of its authorship. Ultimately it was decided that the exhibitors themselves should be the authors; and with a view of assisting the tyros in literary composition elaborate instructions were given for their guidance. The result of such a decision can be more easily imagined than described; and the labours of the editor, Mr. Robert Ellis, in reducing the mass to an intelligent shape may be classed with those of Hercules.

"The three volumes may be divided into four parts. First, the introductory matter, comprising a history of the enterprise by Mr. Henry Cole, an account of the building by Mr. Digby Wyatt, and of the compilation and revision of the *Catalogue* by Mr. Robert Ellis, a classification of the objects by Dr. Lyon Playfair, and a map by Mr. Petermann. After the introductory matter come, *secondly*, the catalogue proper, written by the exhibitors in the manner above described; *thirdly*, the system of introduction to classes and countries, with scientific annotations; and, *fourthly*, the illustrations. Of these four quarters, the chief popular interest will probably attach to the first, and especially to Mr. Cole's introduction, which tells the tale of the origin and progress of the Great Exhibition. The author glancing back observes that such institutions as industrial displays, in which the race is for excellence, and direct commerce is not the primary object, have taken place during the last century; and he dwells with proper emphasis upon the fact, that from the first they have been entirely originated by individuals or societies, independently of any Government assistance. He then gives a sketch of the various minor exhibitions instituted by the Society of Arts and other societies, with a passing allusion to the important subject of the national exhibitions of France. Perhaps a greater detail was desirable on this part of his task, considering the importance that was attached to a report on the last French Exposition by Mr. Wyatt, which undoubtedly furnished valuable elements in matters of detail towards the development of the Great Exhibition itself. To this succeeds a complete history of the undertaking, showing its adoption by His Royal Highness Prince Albert, the origination by him of the great idea of summoning all civilised nations to take part in it, the early difficulties through which the promoters of it had to struggle, and the arrangements necessary to its proper ordering and final institution. Mr. Cole evidently considers the great feature of this Exhibition to be the thorough development of the self-supporting principle on which it was established. We may take the following as the expression of a very general feeling on the part of the Royal Commissioners upon this subject:—

"Those who have had experience only of the Continental systems of exhibitions, which are managed and paid for wholly by their Governments, find it difficult to understand the self-supporting and self-acting principle of the present Exhibition, which has hitherto depended wholly upon the voluntary subscriptions of the British people; the heavy liabilities which still hang over the undertaking rest wholly upon individuals in their private capacity, and not upon the Government. The British people, as well poor and working men as the richer classes, have had the undivided responsibility, not only of conducting the first experiment of an Exhibition of their own works on a national scale, but of collecting funds to pay all the expenses of an Exhibition of the Works of all Nations. Our National Exchequer has not been charged with any portion of the expenses, but the contributions of the most remote towns have been received and applied, even in payment of the military and police assistance which the Government has permitted to be employed on the occasion. So completely spontaneous has been the organization for the Exhibition, that not even the several municipal councils throughout the country were employed, but an independent organization was created for the express purpose wherever a locality was disposed to form its own local committee. Without the assistance of the local committees of the United Kingdom no Exhibition of the Works of Industry of all Nations could ever have been accomplished."

"The result has demonstrated the wisdom and the success attendant upon this career of honourable independence, and has taught on a grand scale the truth of the popular aphorism—Heaven helps those who help themselves.

"Mr. Wyatt's account of the construction of the Crystal Palace is a good specimen of an architectural paper, partially popularised, and rendered intelligible to the general reader. It is divided into two parts—the first treating of 'the building as it stands;' the second, 'of its creation.' The progress of the structure is traced in this paper from the erection of the first column to the stopping in of the last pane of glass. The subjoined extract will indicate the general character of the paper, and contains an interesting allusion to one of the constructive phenomena attendant upon the progress of the Exhibition Building:—

"The glazing of the nave roof presented formidable difficulties, from the great extent of work to be got through in so short a space of time. The ingenuity of the contractors was, however, brought to bear upon the subject, and provisions were made by them for the simultaneous glazing of large areas, entirely independent of variation of weather. Seventy-six machines were constructed, each capable of accommodating two glaziers; these machines consisted of a stage of deal about eight feet square, with an opening in its centre sufficiently large to admit of boxes of glass, and supplies of sash-bars, putty, &c., being hoisted through it. The stage rested on four small wheels, travelling in the Paxton gutters, and spanned a width consisting of one ridge and two sloping sides. In bad weather the workmen were covered by an awning of canvas, stretched over hoops for their protection.

"In working, the men sat at the end of the platform next to whatever work had been last done; from which they pushed the stage backward sufficiently far to allow them to insert a pane of glass, and as soon as that was completed they moved again far enough to allow of the insertion of another. In this manner each stage travelled uninterruptedly from the transept to the east and west ends of the building. The dexterity acquired by the men in working the machines was very remarkable. By means of them 80 men in one week put in upwards of 18,000 panes of glass, being not less than 62,600 feet superficial. The greatest number of panes inserted by a man in one day was 108, being 367 feet 6 inches of glazing."

"The third introductory article treats of the difficulties through which the *Catalogue* had to pass, from its first stage, as exhibitors' manuscript, to its completion in its present form. No person can read it without wonder that after such a complication of perplexities the book ever made its appearance. The following gives an outline of one of the first troubles into which it fell in its progress towards perfection:—

"So soon as the work actually commenced, a mechanical difficulty of no common proportions presented itself. On the distribution of proofs for the purpose of annotation and correction, they were necessarily cut up into separate portions, which had destinations as far distant as Germany and remote parts of the United Kingdom, whither they were despatched for the purpose of insuring their scientific and technical accuracy. Many thousand proofs were thus scattered in various directions, yet all were required to be gathered together again, and arranged precisely in the same form and order as that assumed prior to their dispersion. Some of these proofs were not more than three inches long, and not broader than a narrow riband, containing only two or three lines; the difficulty of determining and immediately affixing the proper place of such a minute strip in a work of such magnitude as the present, seemed to be great. A simple method of ascertaining, not merely the place in the *Catalogue*, but its entire history, its destination, annotator, and return, was, however, contrived, and the history of every proof has thus been accurately recorded. The information thus obtained was so accurate and precise that on the temporary delay of very small proofs their destination was instantly discovered, together with the date of transmission and the name of the annotator to whom they had been sent. Much punctuality characterised the return of the dismembered portions of this large volume. Had not such been the case, the original plan of scientific and technical revision could not have been persisted in."

"Of the classification of objects compiled by Dr. Playfair, with the assistance of eminent persons in the various arts, we can say no more than it is an elaborately accurate skeleton of the philosophy of industry and art.

"The Catalogue Proper is thus arranged:—1. United Kingdom, classes 1 to 30; British Colonies and Dependencies, which are thus subdivided—*a*, British possessions in Asia; *b*, in Europe; *c*, in Africa; *d*, in America; *e*, in Australia. To these succeeds the portion of the work devoted to Foreign States, commencing with Austria and ending with the United States. The British Catalogue extends over 1,002 pages, the Foreign over 470. In the former are included the united catalogues of almost all of our colonies and dependencies, with that of Great Britain; in the latter are the distinct catalogues of every Foreign State, even when, as in some cases, these were not represented by more than two, or even one, exhibitor in the Industrial Palace.

"It would be impossible to give an adequate idea of this portion of the work without such copious extracts as would swell this notice to an unusual and inconvenient length. Besides it might happen that the sacrifice of our space would receive no adequate compensation in the approbation of our readers. The vagaries of exhibitors, which would undoubtedly have proved amusing in their original shape, have necessarily been toned down to an uniform monotony, and the task of selection would be advantageous neither to reader nor reviewer. Something, however, should be said of the annotations, which form a series of short and pithy notes, which will always make them not less interesting than instructive to readers of every class and position in society. Their essential character is less commentatorial than elucidatory. They are explanations and additions—not criticisms. They are intended to give value to what might otherwise have escaped appreciation, and importance to subjects whose significance the general reader might not have otherwise caught. They often consist, it is true, of simple enunciations of known facts; but they are so associated with the text as to give unusual force and prominence to the most universally accepted truths. At the same time the actual amount of information they embody offers a very complete view of the sciences which are now daily ministrant to industrial progress.

"We regard the introductions to the different classes and countries as among the most valuable portions of this work. They are all, with one exception, the production of the scientific superintendent of the work, Mr Robert Ellis, who has contrived to indicate distinctly in a single page the most prominent objects of every class or dependency.

"The addition of an index of names and a separate one of subjects adds great value to this *Catalogue*. The system of classification renders the work of easy reference to the end of the Catalogue of the United Kingdom; but beyond this it would have been of little use to the reader without the indexes. In fine, these volumes may be accepted as a very valuable addition to the stock of useful practical knowledge. Independently of the extraordinary undertaking which they are intended to commemorate, they form a collection of facts connected with the industrial progress of the civilized world which cannot fail of producing important results for the future; and even admitting that greater care and more leisure might have produced a more complete work than the *Official Catalogue* which lies before us, yet it must equally be admitted that the production itself in the short space of a few months is not the least wonderful event among the wonders of the Great Exhibition."

Observer.

"A work of immense magnitude, and most carefully and elaborately compiled. Produced with the assistance of men of science, it is intended to form a scientific, historical, and illustrated record of this gathering of the arts, products, and industries of the world; and when finished, it is likely to be one of the most interesting manuals of general information in the English language."

Globe.

"This will be a *κτῆμα ἐς ἀεί* for all men's shelves; and the *Annus Mirabilis* 1851 will live in its pages, long after the longest assignable duration to Mr. Paxton's prodigy of glass and iron."

Sun.

"In the compilation of this catalogue, the official contractors have evinced not only enterprise and activity, but an extraordinary amount of care and of conscientious application. Nothing scarcely could be more clear than the whole arrangement of the contents, more easy of reference, more complete even to minuteness, or more comprehensive in their entirety. Those touching and majestic lines of Holy Writ are with a solemn significance inscribed upon the title-page—"The earth is the Lord's, and all that therein is: the compass of the world, and they that dwell therein."

Leader.

"The two 'Official Catalogues' must not be overlooked; they will be historical monuments. The larger catalogue, which is descriptive and illustrated, is a work interesting in itself. The introductory chapters give a lucid account of the story of the Exhibition, from its first conception through all the stages of its execution; and the illustrative woodcuts will render it a delightful work to turn over hereafter, when the images have somewhat faded in our memory."

Examiner.

"Jules Janin has been lately eloquent on the theme of British punctuality, and there surely never was a more marvellous exemplification of the quality that so startles the lively Frenchman than the appearance of the Catalogues of Messrs. Spicer and Clowes for sale on May-day morning. Up to a late hour on the previous day the thing not only seemed impossible, but would have been so to any printer whose dictionary contained *ce bête de mot*; but, precisely as promised, the goodly quarto of three hundred and twenty pages made due appearance for a shilling, and will remain a really striking monument of the zeal and determination employed in this great enterprise."

Morning Advertiser.

"The progress of the human race,
Resulting from the common labour of all men,
Ought to be the final object of the exertion of each individual.
In promoting this end
We are carrying out the will of the great and blessed God."

"Such are the lofty sentiments recorded in imperishable print, upon the page of a mere catalogue, which, or our prescience is wofully at fault, will be treasured among the most remarkable records of this age of rapid progress. To this dry list, as it seems at the first glance to be, will many a future reference be made. The subject-matter, we need hardly say, rises above and goes beyond the mere scope of review. It is simply the dictionary of art and industry, the guide and expositor of man's progress, the indication of his state of civilization, the lexicon of his luxury, the symbol of his peaceful intercourse, the catalogue of his demands and aspirings, their position, number, and supply in the *annus mirabilis* '51. The initial year of the second half of the nineteenth century sees the completion of the first 'census' of commerce, art, and industry; the first marked epoch, whence hereafter shall date the history of pursuits as yet without chart, chronology, record, or the means of comparison and estimate. Such are some of the many thoughts suggested by a sight of the uninviting and multifarious catalogue of the objects assembled beneath the crystal bow in Hyde Park. But, above all, and superseding other ideas, arises wonder at the vast labour of revision, the unsparing severity of excerption, the kind yet cruel pruning redundancies that must have been herein exercised, ere the crude and undigested mass of material furnished by the various exhibitors could be reduced to the concise form in which we here possess it.

"To omit mention of the diligence, enterprise and executive ability here shown by the contractors, Messrs. Spicer Brothers, and Clowes and Son, would be more than an oversight, it would be a positive injustice.

"As a whole, the 'Official Catalogue,' like the great vitreous palace which stores the invaluable treasures, deserves study as one of the monuments of the national industry in the year which gives it to the world."

Examiner.

"Here in three handsome volumes we have the Exhibition itself upon paper *minus* the pleasure of the sight, and *plus* a great deal of information. What the eye loses, pictures, abounding in these volumes, do a good deal to supply; and what the understanding gains is the concentrated aid of about forty of the best attainable guides (writers employed for the purpose), who tell the story of the building thoroughly, and take us through it, giving interesting information about everything that it contains.

"These three volumes, in short, are of a size somewhat commensurate with their subject, and of a quality that does not throw discredit on their size. They are also most liberally indexed. There is a directory of names connected with the undertaking, as exhibitors or otherwise, which occupies about ninety closely-printed three-columned pages. There is an index of all the articles exhibited; and really it is quite an amusement to look down this index merely, and note the strange variety of articles contained in the grand *omnium gatherum* which come into opposition under the laws of alphabetical affinity. For example, here is a succession of things—Tinsel Ornaments, Tintern Abbey, Tiptree Hall Farmery, Tire Bars, Tissue Paper, Tissues, Tobacco, Tobacco Boxes, Tobacco Pipes, Toilet Box, Toilinets, Tombacs, and Tombs; from which we go on through Tonnage in Ships, Tools, Toothpicks, and Tow, to Towelling.

"The volumes of Messrs. Spicer and Clowes will of course be necessary furniture in every large library; and being anything but an uninteresting catalogue, being truly a real living, talking record of the Exhibition, and talking moreover in a very pertinent and interesting manner, it will be a pleasant book for any man to have upon his shelves.

"We need say no more to recommend this catalogue as a work most worthy of its object; a work that will remain for ever as the record of the famous undertaking. We do not know with what pecuniary results the 'official contractors' may have brought their labours to a close; but it is certain that they have perfectly kept faith with the public, and that among those who have largely contributed in various ways to the completeness of our industrial triumph they have established a strong claim to be remembered."

Morning Herald.

"Among the many wonders which the Crystal Palace contained, the Catalogue itself, from the extensive arrangements attendant upon its compilation, and the gigantic encyclopedical size to which it necessarily swelled out, is not the least. We have now before us three goodly-sized volumes, containing about 2,000 pages of engravings and letter-press, the result of the literary industry of many months, and the fruits of the skill and intelligence of a whole army of editors, commentators, and correspondents, whose services were called into requisition for their production. We know of no department of literary labour which is at once so onerous, so uninviting, and so thankless as the compilation of catalogues; and yet there are many points of interest to the public involved in the complicated and extensive arrangements connected with the collection and arrangement, from so many thousand contributors and so many countries, of the varied and valuable mass of information contained in these volumes. It may be stated, in the first place, that the work is without a parallel or a precedent in the annals of our literature, and the design and means of execution being novel, rendered the publication a task of extraordinary, and, we may add, unforeseen difficulty.

"Every branch of science, art, and industry is here fully and efficiently represented. The most striking and remarkable features, and the whole scope and significance of the Exhibition, are here embodied, divested of all the promptings of partiality and all the infirmities of judgment. The literary department has been presided over by men fully conversant with the various processes in our manufactures, and the character and uses of the immense variety of objects collected in the building in Hyde Park; and the work will thus have an enduring interest in the mass of valuable information of almost every description which it contains, inasmuch as original information of great interest and novelty has been obtained from foreign countries which have taken a prominent part in the Exhibition.

"In addition to these difficulties, which have been surmounted to an incredible degree, it must be observed that the Catalogue embodies to a large extent the science of commerce. The changing and inaccurate conventional terms of trade are here, in many instances, converted into the precise and enduring language of science; and we have no doubt that this improvement will not be without its fruit in the promotion of the objects of industry; because hitherto obstacles have been experienced by commercial men in their endeavours to introduce into trade any new materials of industrial importance.

"Of the manner in which the wood engravings, amounting to upwards of 1,200, have been executed it is impossible to speak too highly. They have all the delicacy and finish in many instances of steel; and from many months' personal observation, we can bear testimony to the accuracy with which forms the most complicated and elaborate have been transferred to paper. Unlike a catalogue, in the ordinary acceptation of the term, it abounds in sources of amusement and instruction for every class and every taste, the vast collection of the Exhibition here finding its literary type, and furnishing matter for entertainment and reflection, as well to the fashionable reader, the student, the man of science, as to the hard-handed sons of labour, by whose energies and industry the vast pile and its contents have been brought together. That the respectable contractors, Messrs. Spicer and Clowes, have amply fulfilled all the stipulated requirements and conditions of the agreement cannot, we think, be questioned. Indeed, we have reason to think that they have felt something of the dignity and importance of the occasion, and have acted with a spirit and liberality beyond, perhaps, what the pecuniary results would justify. One of the great obstacles to the progress of the work, as well as one of the chief causes of the great additional expense incurred, was the incessant necessity for the alterations of descriptions and places, and insertions of fresh material. In its preparation, however, an amount of literary labour has been expended which communicates to it a value enduring beyond that of the occasion of its production. The vast and wonderful accumulation of the production of human industry, of which it is the type and the exponent, was collected only for a time. Its intention accomplished and its objects achieved, the industrial store is being again rapidly scattered among the nations of the earth. The Illustrated Catalogue, the record of the history and objects of the Great Exhibition, will form an enduring memorial, which few of those who have rambled through the vast collection and can afford the means will willingly be without. It is somewhat remarkable, as evincing the judgment that presided over the objects selected for illustration, that the bulk of them have been the recipients of prize medals. We have only one other observation to make, and we feel called upon, in justice to the contractors, to offer it for the consideration of the executive committee. During the time this large series of publications was in progress, the greater portion of the ordinary business of the contractors was suspended—the Catalogue itself was put in type at least three or four times over; thus adding another very serious item to the expenses incurred. We think when so many of those who have rendered good service to the Exhibition are being rewarded, it would be a graceful and appropriate act of liberality, on the part of the executive, to waive the claim for royalty, which the terms of the contract implied, even if they do not consider the contractors entitled to any further remuneration."

Athenæum.

"A few weeks more, and of the visible glories of the Great Exhibition but a visible wreck will remain. Memory, as we have said, may reproduce—and will—many a picturesque section and selected object; but less uncertain records are required to inform us of the actual value, industrial and scientific, of those contributions from every quarter of the world which we have seen assembled in Hyde Park.

"In the 'Official Descriptive and Illustrated Catalogue' we have such a record. The work is without a precedent in the annals of literature; and when we regard the circumstances of difficulty that surrounded the task of its execution, the praise bestowed on those who undertook it can scarcely be too great. The contractors, in that enlarged spirit which appears to have entered into all that belongs to the Exhibition, engaged men of reputation and authority in every department of science and manufacture to contribute such descriptive notes as should render the work eminently instructive. It, thus, contains a body of annotations which express the condition of human knowledge and the state of the world's industry in 1851:—and is a document of the utmost importance, as a summary report of this vast international 'stock-taking,' which no great library—nor any gentlemen's library, of those who aim at the collection of literary standards—can hereafter be without. It is not the work of a day, a month, or a year: it is for all time. Centuries hence it will be referred to as authority on the condition to which man had arrived at the period of its publication. It is at once a great Trades-Directory informing us where we are to seek for any particular kind of manufacture—a Natural History, recording the localities of almost every variety of native production—and a cyclopædia, describing how far science has ministered to the necessities of humanity, by what efforts the crude products of the earth have been converted into articles of utility or made the medium of that refined expression which belongs to the province of creative art.

"Let it not be thought that because the Exhibition is over it has fulfilled its purposes. It stands to the world in precisely the same relation as do the philosopher and his works. The individual will die; but the thoughts which have been born of him, the truths which he has discovered, live on, quickening and kindling other thoughts and truths. The Exhibition has lived its allotted time, and died; but this Catalogue is the sum of the thoughts and truths to which it has given birth—and which form the intellectual ground whereon the generations that we are not to see must build."

"It will be evident from what has been already stated that a more important contribution to a commercial country than the 'Official Descriptive and Illustrated Catalogue of the Great Exhibition' could scarcely have been offered;—and this will be yet more strikingly shown when we come to the consideration of the manufacturing sections and of the contributions of foreign states. Regardless of expense, this work has been completed by the aid of a band of no fewer than twenty-six annotators, selected, as we have said, from eminent professors of science, and skilled manufacturers. In addition to these, and independently of the editor's staff of assistants, some ten other gentlemen were called on to furnish technical information and lend the assistance of their knowledge:—so that all possible means have been taken to render the 'Official Descriptive and Illustrated Catalogue' worthy of the wonderful gathering of which it is the permanent record."

Observer.

"It may be truly said that this is the most extraordinary work that has been ever brought forth in this or any other country, containing, as it does, a mass of information relative to the natural and artificial productions to be found in every quarter of the globe, with descriptions of the nature, use, and history of each. If the object of such a publication had been merely to serve the purposes of an ordinary descriptive catalogue, it might justly be observed that for such purposes it has come forth too late, seeing that the objects therein described have been already withdrawn from our view; but these volumes are designed to serve purposes at once more important and more enduring. They are designed to preserve and to fix in the public mind a lasting record of the results to which the industry, the ingenuity, and the invention of the world had reached in the year 1851, and to establish a starting point whence future ages may proceed onward in the march of improvement.

"The first volume opens with a list of the illustrations. This list, simple as it may appear to the eye of an ordinary observer, is suggestive of the extraordinary character of the work in which it appears. The space devoted to this simple 'list' would suffice of itself to form a respectably sized volume; and hence may be inferred the enormous number of illustrations dispersed throughout the work, and which, when examined, are found to be in the beauty and the perfection of their execution, as well as in the judgment by which appropriate objects for illustration were selected, worthy of the occasion which these volumes are designed to commemorate.

"In noticing this Catalogue, we purposely abstain from attempting to particularise any of the innumerable and able descriptions of works of art or of fancy, or the admirably-executed illustrations with which these volumes abound. Our reason for this abstinence will be appreciated when we remind the reader of the almost countless subjects which are here described; and of the fact, that of these subjects some thousands are rendered the themes of artistic illustrations, the execution of which reflect the highest credit on the engraver. The publication of this Catalogue was a necessity, which, if left unsupplied, would have incalculably marred the benefits derivable from the great occasion which has called it forth. Great as was the good of calling all nations together to aid in a display such as that which has so long maintained an attraction as deserved as it was unparalleled, a still more substantial, though possibly a less brilliant result, will be found to consist in the valuable record which these volumes contain. To have produced such a Catalogue at an earlier period is now shown to have been impossible. The very magnitude of its merits conduced to create that impossibility; but even at this period, and at future times, however remote, it will be not less welcome, or less wanted. It was not at the time when a gathering of millions during a period of excitement caused by the feelings incidental to an occasion so unparalleled—it was not at such a time that such a record could have been productive of its destined good to the reader, however pecuniarily profitable a hurried work might have been to the publisher; and, so far from regretting the delay, we rejoice at it; for by that delay the intrinsic merits of the work were enhanced, and its value stamped with an enduring character, which will remain as the best and most morally profitable result of the great industrial display of which it is a worthy and most invaluable record."

Weekly Dispatch.

"In addition to the medals to be awarded by the Jurors to those exhibitors the excellence of whose productions may entitle them to that highly-coveted distinction, it has been decided to present each exhibitor with a medal commemorative of the great event. In connection with this decision, we have received a suggestion which we deem well worthy of the consideration of 'the powers that be.' It is, that each medal should be accompanied by a copy of the Official Illustrated Catalogue. The Illustrated Catalogue contains a mass of valuable information upon every branch of science, art, and manufacture, which renders it an invaluable work of reference; and its extensive diffusion among the industrial world, could not but be productive of the most beneficial results. And we cannot doubt that Messrs. Spicer and Clowes, the contractors, who have throughout carried out their arduous undertaking in so spirited and satisfactory a manner, would still further aid the views of the Royal Commission, by not permitting the question of expense to be altogether an insuperable element in the carrying out of what appears to us a very admirable idea."

Atlas.

"An enduring and valuable record of the industrial marvels which the Crystal Palace contained. The time taken by the editors in preparing this Catalogue has been excellently bestowed. It was, indeed, not a work to be done in a hurry. By way of *vade mecum* to the Exhibition visitors, there was many another volume of more manageable size devoted to special countries, departments, or branches of industry, besides that marvel of high pressure — the Official Catalogue. In the Illustrated Catalogue the attribute most desired was the permanency of its interest. By accurate well-sifted information, lucid arrangement, and wealth of explanatory designs, this end has been effectually achieved. Long after the rare and curious contents of the Crystal Palace have been scattered over the world, this work will be valued as a memento and reflex of that marvellous collection. And if at some distant jubilee year another Exposition of human industry should take place under other conditions, and occupying, probably, a vaster space even than that which is now presented to our eyes, the exhibitors of that day will eagerly turn to the Illustrated Catalogue as supplying a standard by which to measure the advances they shall have made in their several *metiers* since the memorable year of 1851.'

Times.

"Although, in compliance with the original design of its projectors, the Great Exhibition has itself only an ephemeral existence, it is satisfactory to think that the most ample and complete records will be preserved of its character and details. Few events have attracted such an amount of contemporary publicity. The pen and pencil have both been incessantly at work in perpetuating its industrial triumphs, and when all the material vestiges of the display are removed from our eyes, it will still live in a form the most valuable and enduring. The reports of the Juries in each class will obviously prove an important *repertoire* of facts and observations, and the information which has been collected in newspapers, in periodicals, and in other channels of instruction, may also be turned to excellent account; but it is to the 'Illustrated Catalogue' that we must look as capable of being made the most complete and satisfactory work of reference hereafter on the great industrial pageant of 1851. That publication now approaches its completion, for three parts of it have already appeared, and the fourth will soon be ready. It is intended that it shall be issued in three volumes, the first two of which will be dedicated to the products of Great Britain and her colonies, while the last embraces the contributions of foreign countries. As far as our own exhibitors are concerned the work is complete, and from the portions that have already been given to the public we are enabled to form a pretty fair estimate of its character and the style of execution. Of all literary labours, that of getting up books of reference is, perhaps, the most tedious and the most thankless. The bare name of a catalogue kills the interest of the most indefatigable bookworm, after the collection of objects to which it was intended as a guide has ceased to be accessible. The present, however, is an exceptional case, and we predict for the 'Illustrated Catalogue of the Great Exhibition' a standard reputation, and a large share of public patronage, when the grass has once more grown over the site of the Crystal Palace, and the great event of this year has become a thing of the past. From unavoidable causes, the contractors, Messrs. Spicer and Clowes, are only completing the last pages of their work as the spectacle to which it relates is about to close; but they need be little alarmed at such a consideration. It has an enduring interest in the mass of valuable information of almost every description which it contains. To put the industrial products of the world under a glass case was a wonderful feat to perform; but here we have a still more extraordinary example of condensation, partly executed and in process of successful completion. The Great Exhibition is reduced within the compass of three not very unwieldy volumes, and to the intellect in all respects, and in most important respects to the eye, its features and significance are preserved. Every object in the collection will be found noted down and described with the amount of particularity due to it. The promptings of partiality and the infirmities of judgment are equally excluded from this unbiassed record. An extensive series of illustrations is made to embrace every object worthy of elucidation by the artists' power; and in order that the instructive character of the work may be fully sustained, annotations written by men of the highest qualifications are introduced to explain processes, point out the character and uses of objects, and develop in brief terms the *rationale* of the more remarkable or least understood branches of human industry. With these features of interest, the popularity of the 'Illustrated Catalogue,' when completed, seems secure. It will prove a complete literary type of the original to which it refers, opening up sources of amusement or instruction to every class of taste, and proving equally at home on the drawing-room table, handled by fashionable dilettanti, in the study, pored over by the scholar or the man of science, at the merchant's desk as a book of constant reference—in the factory, the foundry, the workshop, as a *repertoire* for designs, and as highly suggestive for future progress. A more pleasant work to dive into during an idle hour can hardly be imagined, for wherever it is taken up there is something new and striking, and worthy of attention. The necessity for condensation renders prosing impossible, and the classification of subjects secures an agreeable variety of subjects without monotony on the one hand, or a miscellaneous effect upon the other. Illustrations have been sparingly resorted to in the first portion, which relates to raw materials, but, as a substitute for this, we have tables and statistics of great value, and a large mass of information entirely original in its character. In the second part, which is devoted to machinery, numerous diagrams and sketches are introduced explanatory of the different objects exhibited. The chief interest of the Catalogue, however, in this respect lies in the third and fourth parts, the latter of which is still unfinished. The three volumes will contain, altogether, about 1,200 illustrations, and the greater number of them will be given in the last volume, which will be dedicated to the foreign half of the Exhibition.

"This is the proper course to pursue, for the foreign contributions are those which it is most important to have sketched. We are informed that original information of much value and interest has been communicated to the compilers of the Catalogue from the different countries which have taken part in the Exhibition, and that this will form a prominent feature of the work when completed. At present, while the public mind is saturated with the subject, the introductory position of the book may not attract the notice to which it is entitled; but when we are able to look back upon the whole undertaking from a point in the future, and proceed to take its exact measure as an historical event, we shall not fail to be duly impressed with the remarkable character of the information there contained. Within the limits of 107 pages are compressed Mr. Cole's account of the way in which the Exhibition was got up; Mr. Digby Wyatt's description of the Crystal Palace; Dr. Lyon Playfair's classification of the artificial world; the directory of the scheme; the list of jurors; and the preliminary notice of the Catalogue by Mr. Robert Ellis, its editor. Mr. Cole's narrative is especially worthy of attention for the insight which it affords into the machinery, by which vast projects like the Exhibition can be successfully carried out. Even in this country, where the principle of association is so thoroughly understood, that machinery must be pronounced to be a master-piece of skilful combinations.

"Let us recall for a moment its chief incidents. A small body of men, without any influence of rank or wealth, and forming the council of what had previously been regarded as a useless society, conceived, as early as 1845, the idea of an Industrial Exhibition, national in its character. After one fruitless attempt, they engaged in a series of preparatory measures calculated to render their scheme acceptable to the public and secure of its support. Four years of indefatigable labour elapsed, and they had gathered around their undertaking an amount of support which they conceived justified them in again bringing it forward. They had placed it under the direct patronage of the Crown, and had secured for it, as an appropriate head, the name and the personal exertions of the Prince Consort. A Royal Commission was appointed, in which men of all parties, irrespective of politics, were included. In the meantime, the views of the projectors had expanded, and they resolved to give their scheme a cosmopolitan character. The great seats of our manufactures were successfully canvassed for aid, and foreign Governments responded to the invitations given to them, and promised co-operation. Yet even this powerful combination did not exempt the undertaking from perils that more than once threatened to be fatal. The question of ways and means was for some time a stumbling-block in the path, and the Commission long hesitated to assume the pecuniary responsibilities which, in some way or other, it was necessary to provide for in consequence of the determination of Messrs. Munday's contract. At a most critical juncture Mr. Peto came forward, and, with a degree of public spirit and liberality which cannot fail to be appreciated, pledged his name for a startling amount. Then, when other difficulties had been overcome, the question of a building presented almost insuperable obstacles. At the last moment Mr. Paxton and Messrs. Fox and Henderson rushed to the rescue of the perplexed Commission, and after a succession of dangers, the scheme of the Exhibition was in safety. Had Mr. Cole's narrative been more detailed, it might have been rendered still more attractive; but the author, no doubt, prudently preserved silence on points which would perhaps have been indiscreet to touch upon; and the leading men in the Council of the Society of Arts having gained their object, are seen quietly resigning to more exalted names the honour and glory of an enterprise which they not only originated, but rendered practicable by their exertions. Of Mr. Digby Wyatt's account of the building, and of Dr. Lyon Playfair's classification, it is unnecessary to speak, as the public is already well informed on these subjects; but to the directory of the Exhibition and to the list of Jurors some amount of attention is fairly due. In these names are comprised an extent and variety of practical and scientific talent, the union of which on any one occasion, and for any given purpose, is altogether unprecedented. As the eye glances over the seemingly uninviting array, it is impossible not to be struck with the curious combination of persons which they present. Leading tradesmen and manufacturers rub shoulders with the most eminent philosophers of the day, and science, descending from her pedestal, mingles freely and unostentatiously with the followers of hard-handed industry. Not only so, but all the nations of the civilized world send the most distinguished of their citizens in the peaceful arts to sit in judgment upon the comparative excellencies of rival products, and to determine at polyglot conferences the stage of industrial progress which mankind have attained. The directory of the Exhibition and the list of Jurors, taken together, form one of the most remarkable organizations that the world has ever witnessed—an organization which, considering its objects, implies not only an act of homage to industry, but a guarantee to civilization. The pages of the 'Illustrated Catalogue,' which contain these names, are as instructive and reassuring as any within its limits."

Literary Gazette.

"The philosophy of the Exhibition has yet to be written; but whosoever would wield his pen in this high theme must take the Catalogue as his text-book, and discourse upon the sections which are stereotyped in its pages. We heard a wise man say, 'I enter this place as I would a church: the wonders of God are brought before me, and the achievements of man working in the spirit of truth are here displayed. I always leave this mighty building a better man than I entered it.' The contemplation in quiet—now the excitement of the Exhibition and its thousands of visitors is over—of the Catalogue which registers its stores must have too its ennobling influences. None can know the difficulties attending the construction of such a Catalogue as this who have not been actually engaged on such a work. Under all the circumstances of difficulty by which we know the undertaking to have been surrounded, we are bound to declare that the work has been most ably performed in every department. Mr. Robert Ellis, to whom the editorial superintendence was committed, has worked most assiduously; and most of those gentlemen who were selected as annotators have added much to the value of the work. On the whole, we much question if in any country, in the same time, any book of the same extent, presenting so various a character, could have been so well produced. The letter-press is unexceptionable; the wood-cuts are good and faithful; the registration, as far as regards the Exhibition, is correct, and the notes of value. This is no ephemeral catalogue: centuries to come it will be referred to as marking an epoch, and indicating the point to which man had arrived in the industrial arts in the Year of Grace 1851."

Morning Advertiser.

"The reader, on glancing over the pages of this great production, is struck no less with the number than the value of the pictorial subjects on which the prodigious outlay, untiring energy, and vast industrial and commercial resources of the contractors, have been expended and employed. Apropos of the contractors, it is but just to observe that they have more than kept faith with the public. They were indeed bold men, but bold with judgment too, who, while the success of the Exhibition itself was yet a problem of doubtful solution, stepped forward with the 3,200*l*. (then much needed by the now plethoric-pursed Commissioners) for the privilege of printing the Catalogue, and further engaged to pay a 'royalty' of 2*d*. on each shilling, which, on 250,000 copies of the smaller shilling Catalogue, would amount, with the first-named sum, to 5,200*l*.

"To them, then, the public owes a debt of gratitude, as aids—and no mean one—in the fruition and perfection of an experiment of such magnitude and novelty of conception. Not only have they kept to the letter of their duty with the most scrupulous exactitude, but they seem to have been stimulated with the dignity and importance of the undertaking, and to have risen in spirit, and liberality, and energy as the task enlarged and new difficulties rose before them. A 'List,' a 'Catalogue,' a 'Guide,' a 'Hand-book,' was talked of—but lo! the demand was for an 'Encyclopædia.' The learned labours of academicians, the scientific researches of the chemist, the glories of sculpture and plastic art, the skill, activity, and the discoveries of the studios, the laboratories, the libraries, and the workshops of the world, are to be transferred to the pages of a book: and no object worthy of pictorial permanence, or requiring, from its nature, either portrait, view, plan, explanatory section, or diagram, is to be omitted from its contents. Add to this the Egyptian task of refusing that necessary ingredient to artistic and literary, as well as typographic excellence, 'time.'

"Yet, how the difficulty has been grappled with, and almost utterly overcome, a careful collation of those vast volumes will show the wondering examiner, who shall honestly and diligently set him down to the task. As a Catalogue we fearlessly pronounce it a miracle of accuracy, a model of methodical arrangement. This will be well understood only by those who have experience in the difficult task of definition and classification. The collective idiosyncracies, the varying varieties, the clashing characteristics of 18,000 people of every class and of every nation, for such is the number of exhibitors, are here epitomised, arranged, compressed, chronicled, and, in many hundreds of instances, given to the eye in faithful, elaborate, and costly engravings.

"And all this is achieved, so that the last pealing anthem on the evening of the 11th of October had but just died away along the huge ribbed curve of the transparent transept, ere the gorgeous gilt-edged record, which is all that shall remain permanently of one of the world's wonders, is laid, in its gay livery of blue and gold, upon the tables of its subscribers. In the words of Charles Dickens, applied to the smaller and cheaper issue, we have here 'the composition of fifteen thousand authors; most of them authors for the first time, who have had their excrescences pruned, and their diction occasionally mended. Now, the first production of an author, if only three lines, is usually esteemed by himself as a sort of Prince Rupert's drop, which is destroyed entirely if a person makes upon it but one single scratch. Some thousands of authors, therefore, must be dissatisfied with the attempts to make it available for public use.'

"Thus far Boz's pleasantry as regards the cheap shillingsworth; but the 'Illustrated and Descriptive' essays a yet bolder experiment. While it retains the terseness of description, it adds annotations of equal perspicuity, ability, and impartiality. These aids to a full comprehension of the Exhibition, from pens of the most qualified writers, set forth in succinct phrase the peculiarities, beauties, and characteristics of the various objects enumerated. This alone must insure the permanent value of the 'Official Catalogue.'"

Daily News.

"The 'Official Descriptive and Illustrated Catalogue' has now been issued in the form of three not over-bulky volumes. In the front pages of the first volumes are contained a neat array of industrial charts, of comprehensive indexes, and introductory matters, which, along with the 'raw materials' and 'machinery,' form, on the whole, a pretty solid mass of information. The whole of volume the second deals as exclusively with all that is connected with the United Kingdom, as the third and last does with the industrial contributions of the 'foreign states.' Following so closely as does the present publication on the heels of so many nimble forerunners, it must necessarily follow, that much that it contains is not of a strikingly novel character, and to a certain extent, the present catalogue has lent its powerful aid in diminishing its claims to priority. Mr. Robert Ellis, the diligent and able editor, has let us into all the secrets of the Catalogue's gestation. Its type, he tells us, was actually ready, and so were most part of its illustrations, before the memorable 1st of May. One vast drawback, however, soon made itself manifest, inasmuch as that which, to the casual observer, might have seemed to contain all the necessary elements of order and symmetry, was, at least for the true purposes of the Catalogue's registry, confusion worse confounded. While some exhibitors had taken up positions which were clearly untenable, others neglected altogether to be at their posts. In this terrible dilemma, which it seems, lasted not days, but months, the contractors, Messrs. Spicer and Clowes, wisely adopted the plan before mentioned, of using the main text work of the costlier Catalogue for the shilling one, which thus acted as a feeler and test of substantive correctness. By degrees, as every one knows, successive editions were issued, in which lacunes were filled up, and inadvertancies properly corrected. And thus, by joint addition and elimination, we are now furnished with the most trustworthy industrial chart that has ever been issued. Besides these considerations, other notable influences were at work to retard progress: there were not merely self-laudatory encomiums to prune, unintelligible technicalities to lop off, and scientific jargon to pare down, the contractors had undertaken a higher, a more arduous, and more comprehensive task, that of being faithful exponents of the most striking features and instructive lessons derivable from the international gathering. The task, we are bound to add, they have executed in a lucid and masterly manner, which warrants the assertion of the catalogue's having been carefully revised by scientific hands. It is pleasant for once to find science descending from its lofty curule chair, and cheerfully lending its aid to the sister arts. Somehow, one fancies that this is the auspicious dawn of another era; that the learned will no longer muffle themselves sullenly in the sheets of the encyclopædia; and one hails, as it were, the downfall of exploded and abstruse problems. Be this as it may, and without drawing any further distinctions between the commonly wise and the remotely sapient of this or any other generation, it may be fairly said that an immense fund of varied knowledge and sound gratification may be derived, almost at random from these volumes, and the countless facts disseminated throughout their 1,431 pages.

"Those versed in chemistry, or endowed with a mechanical comprehension, will naturally revert to the first portion of the 'Illustrated Catalogue,' wherein we notice with satisfaction, not only indicated, but also illustrated, those specimens of human skill and ingenuity to which of late, especially, the public mind has been attracted, since the long-expected awards of successful competition. In this respect, the promoters of the 'Descriptive Catalogue' seem almost to have been endowed with an intuitive, not to say a prophetic sense of individual merits. It must be acknowledged that, even looking at the succeeding volumes from the same point of view, they will be apt to convey impressions of greater interest. Many to whom the most brilliant mechanical achievements are neither more nor less than singular contrivances, will have a tolerably accurate perception of purely ornamental achievements; these will dwell once more, if only in the faint recollection of them, on the glories connected with the 'Milanese window' and the 'Veiled statue,' the 'Prussian shield,' and other illustrations, which, amid the universal pictorial deluge, seem to have been withheld by their proprietors for exclusive insertion in the 'Official Catalogue.' It may here be stated that the embellishments to the letterpress have combined the lithographic process, steel engraving, and wood engraving; though the latter, as usual, preponderates. The archaic pencil of Mr. Tenniel has given extra dignity to the cover as well as the frontispiece, the latter of which is decidedly Maclisean in design. Let us turn over the tempting page. The arrayed list of contents and their exhibitors greet one, as it were, on the threshold, and by their twin aid we can steer through the troubled industrial sea. Thus people, anxious to discover what species of heating apparatus has been rewarded by a medal, may search under either headings of 'stoves,' or 'Metternich,' and will at once be directed to the 'Austrian Section, No. 413.' Then, nearer home, may be found under either title of 'Tapestry,' or 'Sibthorpe'—the latter, no relation we hope to an M.P. namesake—and so on it goes throughout works of more or less universal interest.

"After dwelling in a sufficiently philosophical strain on the strangely varied host of individual characters contained in the list, and elbowing each other with alphabetical respect and order, from His Royal Highness Prince Albert to Herr Zwickl, we next encounter a few brief but telling accounts of the rise and progress of the Great Exhibition. Mr. Henry Cole throws into his introductory notice of the first stages of the proceedings, some novel traits which redeem its hackneyed character. The construction of the building is narrated by Mr. Digby Wyatt in mingled facts, figures, and sketches. And lastly, Mr. Robert Ellis imparts to us a sense of the alarming difficulties he had to surmount in gathering together the thousands and one little manuscript slips of paper out of which one homogeneous work has arisen; justly remarking at the same time that the fact has hitherto been unexampled of bringing to successful issue a work of such monstrous complexity.

"The plan adopted in the long run was to direct attention at the opening paragraph of each section to the staple manufactures of the particular country or district; reserving, nevertheless, purely exceptional facts to be appended to that which was often its sole illustration. If the calm and venerable town of Frankfort exports the powerful ingredient known as 'Creosote;' if Hesse sends over that noxious weed 'chicory;' if the quiet city of

Leyden prides herself on her rigging; if Amsterdam, besides herrings for the million, produces horse-hair for the fiddlebow; Belgium, mill-stones as well as linen; all these facts, great and small, are carefully scrutinised, and the weight in the balance of universal utility tested. Following out the spirit which seems to have dictated a graceful impartiality towards our foreign rivals, the third volume, relating more specially to their efforts, has been evidently got up with extreme care, and a more lavish expenditure of illustration. Their jewellery, their damascene work, their laboured groups, their ingenious furniture, have received equal honours at the hands of the draftsman. We can only join in the hope expressed by the contractors, that with the *élite* of the exhibitors and their contributions, to the numerous localities abroad whence they were derived, copies of this catalogue will be not only sent but taken also, and these pages read in many lands long after the Exhibition has become matter of history. The 'Illustrated Catalogue,' in its present comprehensive form, now affords almost the sole industrial source of future investigations which are professedly or in any way connected with the yet undeveloped resources of the nineteenth century."

Chemical Record.

"The list of annotators of the Catalogue, who have brought their practical knowledge to the elucidation of the various departments with which they were most conversant, comprises men whose names are guarantees of the value of the information furnished by them, and the appendage of whose initials to the articles described, stamps the work with that degree of authority, without which its practical value to the philosopher, the merchant, the manufacturer, or the general reader, would have been greatly lessened.

"We must not, in our notice of the introductory part of the work, omit to mention the valuable and interesting series of maps which adorn the commencement of the first volume, and on which the various manufacturing districts of our own and other countries are accurately delineated, and their natural productions shown.

"We cannot conclude our brief and imperfect notice of this important work, which Dr. Whewell commended in his inaugural lecture at the Society of Arts, on Wednesday evening, without stating that the highest credit is due to the publishers for furnishing so complete a record of the Great Industrial Exhibition. When we consider the immense difficulties attendant on the production of such a work—the joint production of more than 1,500 authors, whose varied contributions, in many languages, had to be classified and arranged, and, as far as practicable, annotated and explained—when we consider that this vast amount of matter was actually in type at the opening of the Exhibition, before even the articles were fully arranged in the building, we cannot but regard the 'Official Illustrated and Descriptive Catalogue' as being itself one of the wonders of the Exhibition. As respects the general style and getting up of the work, we need only say that it is worthy of the publishers, who have evidently spared neither cost nor pains to bring out a work every way worthy both of the great industrial undertaking and of public patronage and support. The library of the philosopher, the merchant, the manufacturer, the man of science and of refined taste, will be incomplete without the possession of a copy of this truly national work, which, interleaved, will serve the valued purpose of a record of the varied additions to our knowledge which every day present themselves to our attention, but which, from the want of a suitable place for their immediate record, pass from the memory almost as soon as received. New facts and discoveries, in any department of art and science, whether at home or abroad, would here find a local habitation—a place in which to be recorded, always easy of reference and access—and thus a vast amount of practical and useful information, now lost, would be stored up for the future advantage of ourselves and others."

Mining Journal.

"Of all the various publications professing to treat of the Great Industrial Exhibition, none have in any way approached, either as regards accuracy or completeness, the work now before us. We believe there never was a work, the preparation of which was attended with so many difficulties; and we consider that the highest credit is due to the publishers, who preferred rather to run the risk of pecuniary loss, than to present to the world an inefficient record of an event, which—whether as regards the magnitude of its operations or the complete success which has attended it—is without a parallel in the history of the world.

"The annotations on the articles exhibited in the class of greatest interest to our readers, were wisely intrusted to Professor Ansted and Mr. Robert Hunt, and the result has been the production of a compendium of mining and mineral products, containing 70 pages of valuable matter, deserving of publication in a separate form. The account of the nature and extent of the different deposits of mineral fuel in various parts of the world, written by Professor Ansted, is replete with information. The remarks of Mr. Blackwell, on the series of iron ores contributed by him to the Exhibition, form a valuable treatise on the iron-producing districts of the country and the ores obtained therefrom, and elicited the marked commendation of Sir Henry De la Beche in his recent lecture at the Society of Arts. Mr. Sopwith's detailed account of the lead mines at Allenheads forms a useful treatise on this department of mineral produce, especially as illustrative of the various stages of progress from the mine to the market. Mr. Hunt contributes a store of information on the tin and copper of Cornwall, whilst the general mineral produce is ably annotated by Professor Ansted.

"The objects in the class of machines for direct use are illustrated in a very superior style, and their description is replete with sound practical knowledge. The specimens of successful application of mechanical skill to objects both great and small, and their adaptation to useful purposes in the leading manufactures of our country, form one of the most valuable portions of the work before us, containing, as it does, a history of the enterprise and industry of the mechanics of Great Britain, not to be met with elsewhere.

"The general style and character of the work throughout is very superior, and the profusion of well-executed engravings with which it is adorned greatly enhances its practical value. The library of every Englishman will be incomplete without a copy of this truly national work, which will be handed down from generation to generation, as an enduring record of an event, which excited the wonder of the civilised globe, and formed one of the brightest phases of the present century.

"We have from time to time heard various suggestions put forth, as to the most useful mode of appropriating the surplus of 150,000*l*. in the hands of the Royal Commissioners. We consider that in the distribution of the surplus, no country which took part of the Exhibition should be overlooked; and we see no practicable way of accomplishing this desideratum, more likely to give general satisfaction, than that of presenting a copy of the 'Official Descriptive and Illustrated Catalogue' to each mechanics' and scientific institution and public library throughout the United Kingdom, and also to the public libraries and institutions of the principal towns of the foreign countries which contributed to the success of the undertaking. Such a present would be a graceful acknowledgement of the assistance rendered by each town to the promotion of the general good, would meet with universal approbation, and give such an opportunity of including foreign countries in the distribution of the fund, as could not be well obtained in any other manner."

Spectator.

"But it is not as a catalogue, in the common sense of the term, that the three large and handsome volumes before us were ever intended to be considered, or could be used in the nature of things. They are not an introduction, but a comment; they follow, not precede, the vast collection which occasioned them, and our experience of it. The purpose of the catalogue is fulfilled if it moulds and enlarges our views and strengthens our recollections: for neither has it in fact accompanied the general mind to any large extent in the study of the Exhibition itself, nor did it mainly profess such an aim.

"The 'Descriptive and Illustrated Catalogue' is, then, a memorial of the Great Exhibition: and if that was nothing less than a compendium of the industry of the age and a concrete of its tendencies, this is a cyclopædia condensed. It is well known that the best assistance was secured to render it a scientific no less than an accurate representation of the Exhibition in its several branches. France with her exquisite art, Austria with her proofs of wide and diverse empire, Northern Germany with her multiform thought, Russia with her massive productiveness, America with her practicality, India with her gorgeousness, Egypt and Tunis with the lesson of their grand taste, as old as the world and as unalterable in its basis, our Colonies with the elements of their future—the nations from the four points of the compass are returning from our shores; England herself is resolving her congregated industry into its thousand constituents; the phenomenon is gone, and its habitation knows it not—too dubious of its own existence for long; but with these volumes in our possession, the fact will remain still a present fact. It has stamped itself not on the retina only and the memory—though it will not fade thence yet awhile, but here also, copiously and enduringly, to be referred to as yet with us. And if the record is valuable to us, its historical worth to future generations as a picture of the nineteenth century, in its products and results, in its ideas of itself, its belief of what it has done, and its expectations of how that is to be applied and rendered fruitful, and of what remains to do, is not easily to be estimated at the present day. We cannot match with it any so complete expression of a period, material and inventive. The age has impersonated itself, and sat for its daguerreotype. Whether we shall be judged as eminently moral or spiritual, or truly progressive, we must leave to the future; but in one many-sided aspect we may expect to be known.

"The work, as we have said, has been ably got up. It presents a very sufficient view of the transactions relative to the Exhibition, as well as of its actual components: but we could wish, as the publication was of necessity postponed to so late a period, that it had been delayed some fortnight longer to admit of a list of the awards. Yet this, again, might be deemed by some to detract from its character for impartiality,

"And to party give up what was meant for mankind."

Athenæum.

"The third volume is devoted entirely to Foreign States; and to us as a manufacturing nation this volume is even more important than the other two. It furnishes the merchant and manufacturer with a copious Trades' Directory to all the great producers of the old and new continents. It gives intelligence in connection with the exhibition of particular manufactures—of the natural history, the locality, and the amount produced,—of substances employed,—such as we could not by any other means obtain. This is particularly the case with the Austrian Section of the Catalogue. The notes are most extensive, and convey information of the greatest importance on every variety of articles exhibited within the section of the Exhibition building devoted to that extensive empire.

"Such is an analytical review of the 'Official Descriptive and Illustrated Catalogue,' compiled and arranged, as we have said, amidst a complication of difficulties which greatly enhance the merit, though not the value, of the work. The descriptions furnished by the exhibitors were in nearly all cases, of necessity, to be altered before publication: and it was for some time, even after the opening of the Exhibition, difficult to fix the class and number to which many of the exhibitors belonged. Things were falsely named,—there was much grammatical confusion,—scientific terms were seldom correctly applied,—technical terms were frequently such as could not be understood—and these were often wrongly translated from the foreign returns made to the Editor. Amidst these and a thousand other difficulties Mr. Robert Ellis has steadily pursued his work; and it cannot be denied that he has brought it to an issue for which he deserves all praise. We do not mean to say that the work could not have been better done; if the labour had to be again gone through, there is no doubt that many improvements might be effected. But under all the circumstances of the time and the occasion, we regard the Catalogue as worthy of the great phenomenon which it records. A work of permanent value and enduring interest has been produced; and to all parties concerned it must be satisfactory to know that the labour which has been bestowed on it has not been in vain. To the philosopher, the manufacturer, and the merchant, we repeat, this Catalogue must, for ever, prove an invaluable work of reference.

"The 'Illustrated Catalogue' is, it is true, but an echo of the Great Exhibition. Three volumes can furnish but a faint reflex of the varied works of industry that were crowded together in an area of nearly twenty acres. Such, however, is the power of graphic and typographic art, that in these volumes are contained the essence and very pregnant soul of that so vast body. Tons of roses may be compressed into a few drops of the most precious *attar*,—a vast volume of vapour may be condensed into one drop of water. Such is the relation which may be assumed to exist between the Great Exhibition and this its Catalogue. Should this record of human industry survive some thousand years, what a picture will it present of the universal activity, the fiery energy, and the indomitable aspirations of this truly iron age! When generations yet unborn, in turning over its pages, may yet reflect on the wonders of engineering skill and mechanical refinement which were concentrated within the glassy walls of the Crystal Palace, and remember within how brief a period they had attained to such extraordinary development, the conclusion will be forced on their minds that if the will and energies of the public and the artists of the present day had been directed with corresponding intensity towards carrying the Fine Arts forward to the same degree of perfection, a result might have been realized equal to that which characterized the palmiest days of Greece."

Weekly News.

"Among a profusion of excellent designs by first-rate artists, very carefully engraved, each highly deserving of attention, we cannot help calling to view the following as among the most striking:—An Axminster carpet for Her Majesty's drawing-room; a drawing-room stove-grate, by Pierce, London; a sumptuous four-post brass bedstead, clothed in green silk, and a gorgeous bronze candelabrum, by Winfield, of Birmingham; a rotatory knife-cleaning machine, by Kent, of the Strand; the Tweeddale testimonial in silver, by Hunt and Roskell; the costly and tasteful silver goods by Smith and Nicholson; porcelain statuary, by Copeland; a magnificent cabinet, made for Her Majesty by M. M. Holland; and Taylor's Oriential towers in vegetable ivory. In the 4th Section, or Class XXX., relating to the fine arts, we have been much pleased with the statues by T. and Mary Thorneycroft, representing the Prince of Wales as a shepherd, and the Princess Royal as a gleaner; the Greek Hunter, by John Gibson; the handle of Murat's sword, by Hope; Titania and Ariel, two beautiful statutes, by Lough; and a fountain, by Messrs. Seeley and Co. The artists employed to design these numerous specimens, and the engravers by whom the wood has been cut, have greatly contributed to exemplify and adorn this pictorial book."

Boston (American) Post.

* * * * * "I will tell exhibitors, and particularly the successful ones, what books respecting the Great Exhibition they will find valuable in showing the part they have acted. The Great Exhibition 'Official Catalogue' (costs about fifty cents) contains all the contributors and contributions in brief mention of all nations. Then the 'prize list,' or as the title reads, 'List of Awards granted by Juries,' an octavo of 166 pages, (price half a crown, or about seventy-five cents,) contains the names of all the contributors from all nations who took the 'council medal,' or the 'prize medal,' and also those that were 'honourably mentioned.' By far the most valuable, complete, and ornamental list of contributors, articles and all, is the 'Great Exhibition Official Illustrated Catalogue,' in three volumes, octavo, at three guineas (about $15.) The 'List of Awards granted by

Juries,' is the same size pages, and could be bound with it. In this magnificently illustrated work there are several thousand woodcuts engraved in the first style of the art, representing all of the most striking and beautiful objects shown at the exhibition. It will be, with the 'List of Awards granted by Juries,' the only complete, valuable, and enduring record of the 'Great Exhibition of 1851.' I doubt not but there are several score of exhibitors in the United States that will get this work. The articles in the United States department that are illustrated by engravings are the American Chair Company's chairs, Chilson's furnaces, Cornelius and Co.'s chandeliers, Dennington's floating church, Philadelphia, Ericsson's nautical instruments, Goodyear's India-rubber goods, the Maryland cabinet of woods and other products, and Watson's gazelle carriages.

There were few of those splendid works of art from the United States that shone so conspicuously in the departments of many of the old nations of Europe. Powers's 'Greek slave' not long ago (1850) was engraved in the London Art Journal, with a most fair, candid, and every way complimentary criticism. I will mention that Part V. of the 'Illustrated Official Catalogue' is done up as a separate part, and sold at fifteen shillings sterling, (some $4.) and that contains the United States part of the exhibitors, with those of two or three other foreign countries. In the 'Illustrated Official Catalogue,' all, or nearly all, the articles are described much more *in extenso* than in the brief one-line paragraph of the 'Shilling (50 cent) Catalogue.' These 'Official Catalogues' are the only ones published that are deserving the name of *catalogues*, the one called the 'Art Journal Illustrated Catalogue' being a mere list of a few prominent contributors, with engravings, without one-twentieth part of the contributors being mentioned. * * * * * No person now, who reads this, can say he does not know 'where to find himself' in the printed records of the Great Exhibition. I learn that a lot of the Official Catalogues (small), the Illustrated Catalogue in three volumes, and Part V. of the Illustrated Catalogue (separate,) have been sent over to the United States. Let those who have or have not been successful as contributors, that wish a permanent record of the Great Exhibition of 1851, send to his bookseller and get a copy of any or all of these works. As time flies away their value will increase with years."

Arbroath Guide.

The statistics furnished by Messrs. SPICER and CLOWES, the enterprising contractors for the Catalogues, and, next, to numberless other works connected with the Exhibition, show the gigantic and formidable nature of this part alone of the undertaking. These statistics present, *ex facie*, somewhat of a barren, repellant appearance, being given in long columns of uninviting figures; but it is the very carefulness and minuteness of detail thus manifested that give to Messrs. Spicer and Clowes' statistics an added charm. Before proceeding to notice the actual sales of, and the sums realised for, the Catalogues, Official and Illustrated, Hand-books, Synopsis, &c., it should not prove unprofitable to say something of the preparatory steps necessary to be taken before these publications were fit to be placed in the hands of the visitors to the Crystal Palace. And first as to the trades necessary for the production of the Catalogues: these were, type-founders, printers' joiners, iron-founders, paper-makers, wholesale stationers, letter-press printers, printing-ink makers, composition roller-makers, engravers on wood, lithographic printers, hot-pressers, and bookbinders—in all twelve. Then as to the quantity and value of new type manufactured, and the quantity of type actually used for the publications. The technical names given by printers to the different kinds of type required we consider it useless to state, as being unintelligible to a general reader. The quantity of type necessary sorely taxes credibility; but the facts are incontrovertible. In addition to the usual resources of Messrs. Clowes' establishment—the extent of which can be judged of from their employing from 500 to 600 workmen—the supply of new type was 37 tons: the cost of which, and other necessary material, amounted to above 6,000*l*. Adding the type required for the Report of the Commissioners (the work from which we gather these interesting facts), and for the Jury Reports, a weight amounting to nearly *forty-eight tons* was set apart for the service of the Exhibition of 1851. For each of the three small Official Catalogues—in the English, French, and German languages—from *three to four millions* of types were required; for the "Priced Lists," upwards of *four millions*; and for the "Illustrated Catalogue," no less than *seventeen millions*. As illustrative of the amount of type in use in the several publications, the combined quantity, it may be observed, should be equal to the printed surface of 116 single *Times* newspapers. Next, as to the paper required for the Official Catalogues, and Reports of the Juries and Commissioners. For the small Official Catalogues 24,173 reams, or 507,631 lbs. weight were required; upon which, and 357 reams of coloured paper for covers to these catalogues, the paper duty, at the rate of 1½*d*. per pound, amounted to 3,260*l*. 12*s*. 6*d*. For the Illustrated Catalogue were required 100,000 lbs. weight of super-royal—the duty paid upon which was 625*l*. The entire weight of paper used for the Catalogues and Reports immediately mentioned was 758,098 lbs., the duty on which was, in round numbers, nearly 4,740*l*. Of the small Official English, French, and German Catalogues, 305,000 were printed; of the Synopsis of the Contents of the Building, 89,500; of the Popular Guide, 26,000; of the Illustrated Catalogue, 8,250; of the Reports by the Juries, in two different types, 20,550; and of the various smaller publications, such as Hunt's Hand-book, Keys to the Catalogues, Priced Lists, &c., somewhere about 30,000. The cost in the different departments, for the price of compositors' labour, engraving, lithography, hot-pressing, binding—is also noticed by Messrs. Clowes. As to the *sale* of the different volumes—Plans, Keys, Hand-books, Guides, Catalogues—the number sold, it may be briefly stated, was 473,731, realising 19,014*l*. 8*s*. 4*d*.—a sum which, we have grave doubts, will prove anything but an adequate return to the spirited Contractors for their immense outlay.

EXTRACT FROM THE FIRST REPORT OF THE ROYAL COMMISSION.

Catalogues.—It was obviously necessary that a complete and accurate Catalogue should be made of the articles exhibited, not only for the use of visitors, and of the Commissioners, Jurors, and others during the continuance of the Exhibition, but also as an enduring record, in the most perfect shape, of the Exhibition itself. The Commissioners considered that these advantages would be best secured by submitting to public competition the exclusive privilege of preparing and selling the Official Catalogues. Of these the cheaper one was, in accordance with the conditions of tender laid down by the Commissioners, to be sold to the public at the price of one shilling, and to contain not less than 320 pages of foolscap quarto (printed in double columns). Out of the above sum a royalty of twopence per copy was to be paid to the Commissioners.

In addition to the Shilling Catalogue, an Illustrated Catalogue (also official), extending to two or more volumes, was to be produced, the price and manner of printing of which was left to the discretion of the contractors. An option of preparing more editions than the two above mentioned was also given.

The Commissioners adjudged the right of printing and sale of these Catalogues to the joint tender of Messrs. Spicer Brothers and Messrs. Clowes and Sons, who offered the sum of £3,200 for the privilege (besides the royalty payable on the sale of the small Catalogue). The difficulties necessarily attendant upon the execution of the engagements entered into by the Catalogue contractors (owing not only to the extensive nature of the undertaking itself, but also to the changes consequent upon the continual arrival of additional articles from foreign countries for a long period after the opening of the Exhibition) were surmounted by them in a very satisfactory manner, and the volumes that accompany this Report will serve to show, both by their accuracy, completeness, and their general execution, that the Commissioners have every reason to be satisfied with their having intrusted the preparation of the Catalogues to Messrs. Spicer and Clowes.

Appendix No. XXVII. contains a statement furnished by the contractors, showing the extent of the sale of the different Catalogues, and other works illustrative of the Exhibition, which they were authorized to sell in the Building.

Statistics of the Catalogues, extracted from the Appendix to the First Report of the Royal Commission.

Trades necessary for the production of the Catalogues.

- Type-Founders.
- Printers' Joiners.
- Iron-Founders.
- Paper-makers.
- Wholesale Stationers.
- Letter-Press Printers.
- Printing-ink Makers.
- Composition-roller Makers.
- Engravers on Wood.
- Lithographic Printers.
- Hot-Pressers.
- Bookbinders.

Type-Founding. The first step towards the mechanical production of the Catalogues was the preparation of type on a scale commensurate with the magnitude of the undertaking. Two sizes were selected—one for the Small Catalogue and the French and German translations; the other for the Illustrated Catalogue. Of each of these types it was estimated that not less than six tons would be required; making a total of twelve tons, to be manufactured within the short space of six weeks.

As these works progressed, a larger supply was found necessary. New works illustrative of the Exhibition were contemplated: and the supply of new type was eventually increased to 37 tons, in addition to the usual resources of the house. The cost of this large quantity of type and other necessary material amounted to above £6,000. And, adding the quantity required for the Report of the Commissioners and for the Jury Reports, a weight amounting to nearly 48 tons was set apart for the service of the Exhibition of 1851.

The following Table shows the Quantity and Value of New Type manufactured, and used for each Publication:—

TITLE OF WORK.	Weight in lbs.	Number of Types required for each Work.
Small Official Catalogue—English –	5,664	3,877,008
Ditto Ditto French –	5,712	3,909,864
Ditto Ditto German –	4,604	3,103,460
Synopsis of Contents of the Building	425	202,400
Ditto Ditto French –	425	202,400
Popular Guide – – – – – –	984	210,944
Index to Official Catalogue – –	2,780	1,555,710
Priced Lists – – – – – –	5,376	4,199,062
Hunt's Hand-Book – – – –	4,114	2,301,120
Plans of the Building equal to – –	195	225,888
Key to the Catalogue – – – –	31	19,200
Illustrated Catalogue – – – –	28,210	17,345,120
Reports and Awards by the Juries (large type)	30,107	11,513,336
Ditto Ditto (small type) –	14,124	8,903,280
Report of Commissioners – – –	3,752	1,824,084

The printers of the Catalogues are type-founders as well as printers, and by working night and day, with relays of hands, they produced a great portion of this quantity themselves: the assistance of other founders, however, was necessary; and the Messrs. Miller and Richard of Edinburgh, and the respective firms of Besley, Caslon, and Figgins, of London, supplied the remainder.

As an illustration of the amount of type in use in the various publications, it may be observed that the combined quantity would be equal to the printed surface of 116 single *Times'* newspapers.

A great subdivision of labour is necessary in the manufacture of type: the persons employed are usually in the proportion of 5 men to 3 boys. The following statement shows the weight of four descriptions of type manufactured in one week by 20 men and 12 boys, and the number of separate types in each quantity:—

360	lbs.	Small Pica,	equal	124,720	separate types.
240	,,	Bourgeois,	,,	122,880	,,
190	,,	Brevier,	,,	113,280	,,
168	,,	Minion,	,,	109,200	,,

Although type is much lower in price now than it was some few years back, it is still an expensive article, not so much from the cost of the raw material—a compound of lead, antimony, and tin—as from the amount of labour necessary for its production, five operations being required to complete a single type; while, from its natural softness, and the heavy pressure of the machine in printing, it soon wears out. In the case of the small English Catalogue, from the large number of copies printed, the value has been deteriorated at least 60 per cent.

The price of type varies according to its size; each page of the small English Catalogue cost 20*s.* 6¾*d.*, and of the Illustrated Catalogue 21*s.* 9¾*d.* Large as these prices may appear, they are exceedingly low, when compared with the average market price, and are such as could only be obtained by contracting for the manufacture of large quantities.

Paper.—The manufacture of paper includes a variety of processes—from the sorting of the rags to the production of a complete sheet of paper. Two sizes only were necessary, described as super-royal and double-foolscap: the folding of the sheet into 4, 8, and 16, forming the different-sized books. For the convenience and economy of printing the small Catalogue, the double-foolscap was, however, made into four sizes, the sheets folding into 8, 12, 16, and 24 leaves. The Synopsis, consisting of 96 pages, was printed on one of these large sheets, at one impression. The entire quantity of paper manufactured was 338 tons; and its production required labour equal to 338 hands (men and women) for three months. Messrs. Spicer Brothers, (Wholesale Stationers,) joint contractors in the production of the Catalogues, supplied the whole of the paper; and so efficient were their arrangements with the various mills engaged in its manufacture, that not a single failure occurred in the appointed times of delivery.

The small Official Catalogue, with its cover, before the edges were cut, weighed 1 lb.; the duty on each copy was therefore 1½*d.*, or ⅛th the selling price: equal to 12½ per cent. on the cost of the Catalogues, but 21 per cent. on the manufacture of the paper.

Compiling and Printing.—The Catalogue Forms issued to the Exhibitors (in order that they might supply their own descriptions of the articles exhibited) were printed in four colours, representing the four great divisions of the Exhibition; on the receipt of those forms they were examined by the compilers, who made such alterations as they considered requisite; determined, to the best of their judgment, the Class to which the article exhibited more especially belonged; and forwarded the returns thus corrected to the printers. On Jan. 30 the first portion of these returns was placed in the hands of the compositors, and speedily set up in type for the Illustrated Catalogue: keeping each of the *four* divisions separate; and distinguishing, by a figure at the end of the last line of each article, the presumed Class to which it belonged. Proofs of these returns were forwarded from time to time to the compilers, who examined them as to their general correctness, and returned them to the printer for such emendations as were necessary: these effected, 30 proofs were printed, and forwarded to the Executive; to the editor, who transmitted copies to the various annotators; to the compiler of the small Catalogue, in order that the descriptions might be reduced; and to the French and German translators, for the same purpose of reduction and translation. Ten weeks now had elapsed—the 26th of April had arrived—the whole of the exhibitors' returns received up to that date were in type, amounting to nearly 2000 pages: this mass, however, was still unarranged; and it was not until four days previous to the opening of the Exhibition that any defined plan of classification could be determined upon. The contractors were bound under a penalty to produce a certain quantity of the small Catalogue on the first of May; to effect this within four days seemed almost impracticable. It was originally intended by the contractors that the Illustrated Catalogue should also appear at the same time, but all hope of producing anything more than a specimen Part was abandoned.

The classification, which should have been the labour of literary men, became the task of the operative printer: the type was arranged in 368 slips, each representing a page; slip after slip was taken up by the compositor, and the exhibitors' returns, as numerically distinguished, collected together, until the whole 30 Classes of the United Kingdom were arranged. The same arrangement necessarily took place for the Colonies and Foreign States; for although each State had but one numerical order for all the articles exhibited, they stand in the Catalogue in the respective State in the same order as the 30 Classes of the United Kingdom; upwards of 100 distinct arrangements had to be effected: the classification completed, revises were forwarded to the compiler, to receive the numbers by which the articles were to be distinguished in the Building; 320 pages was the prescribed limit of the small Catalogue, and 368 pages were in type; a further reduction had to take place in the description of the articles exhibited; and it was not until the midnight immediately preceding the opening of the Exhibition that the small Catalogue was finally "ready for press."

The first or specimen Part of the Illustrated Catalogue was also proceeded with on the same principle laid down for the production of the small Catalogue; and on the morning of the 1st of May both these works were on sale in the Exhibition Building.

The printing in itself would have been but a small affair for the number of persons employed, could the matter have been placed before them according to the usual routine of authorship and printing: this, however, was impracticable; and no better plan could perhaps have been suggested than that followed to a most successful termination and through most extraordinary difficulties.

After the opening, additional returns came in. The first edition was found exceedingly imperfect: the superintendents of Classes undertook the examination of the proofs, supplied omissions, and corrected the numerical arrangements; many articles were found in one class that belonged to another; the exhibitors' descriptions had again to be curtailed to make room for additions amounting to 41 pages; and a second edition was produced, with greater labour and exertion than the first.

New returns continued to come in—removals from one class to another were still found necessary, and it was not until a *third* edition was produced, at a cost of labour equal to the two preceding, that a correct Catalogue of the Exhibition could be said to exist.

Under these circumstances it was found impracticable either to produce the Illustrated Catalogue in a complete form, or the French and German translations, until a late period of the Exhibition: and as the labours of the printer did not really commence until within four days of the opening, so neither did they terminate until within four days of the close of the Exhibition.

A detail of the progress of the Illustrated Catalogue would be a repetition of the circumstances connected with the small Catalogue; inasmuch, however, as the larger work is five times the size of the smaller, and the care and attention required more minute, the cost and labour in the printing-office were at least ten times greater.

French and German compositors were employed on the foreign translations. The Exhibition of all Nations, however, had created a demand for foreign papers; and the compositors, knowing that the employment on the Catalogues would not extend over a long period, accepted other engagements; and those works were finally and successfully brought to a close by men who knew not a word of the respective languages: French and German readers, however, were employed to insure correctness. The repeated alterations and transpositions in the English Catalogue created a great amount of confusion in the foreign Catalogues. The same mechanical classification, applied to the English, could not be effected: a number of persons were therefore employed to cut up each return separately, and paste them on sheets of paper under their respective class and country, and again place them in the compositors' hands for reproduction. Of the French Catalogue 146 pages, and of the German 62, were in this manner a second time set up in type.

The time occupied in printing the various works was 216 days. The whole of the other employments necessary for their production were also completed within the same period.

Every alteration in the small Catalogue created a corresponding alteration in the Illustrated Catalogue, and in the French and German translations.

The cost of these alterations, compared with the usual cost for setting up the types, was—

On the small Catalogue as *four* to *one*.
„ Illustrated Catalogue as *five* to *two*.
„ French Translation as *five* to *two*.
„ German Translation as *two* to *one*.

And to this must be added, as an increased element in the expense of printing, the extra amount received by the workmen for night-work, equal to 10 per cent. on the wages paid.

Compositors are paid by the 1,000 for setting up the types; and by the hour for corrections: the complete arrangement of 10,000 types is considered an average day's work for one person. Tabular Statements similar to the Priced Lists are attended with extra trouble, and are paid double the price of other work; and works in Foreign Languages a small increased price per 1,000. From the circumstance of all the types used for the Catalogues being new, the Compositor had an advantage of about 10 per cent. on the day's work.

The hours of attendance are from 8 in the morning until 8 in the evening. When the men are employed during the night they receive extra payment, equivalent to 40 per cent. on their earnings.

To this branch of printing must be added readers and reading boys, in the proportion of one reader and one boy to each 12 compositors.

From the extraordinary number of proofs required during the progress of the Catalogues, four proof-pullers were constantly employed so long as the compositors were at work : 54 reams of paper, equal to 27,864 sheets, were consumed in proofs only.

There are two descriptions of machines employed in printing: the cylinder machine, attended by one man and two boys, producing on the average 7,000 impressions per day of 10½ hours; and the platten machine, managed by one man and four boys, averaging 4,000 impressions per day. The machinemen and boys are paid by day-work.

Pressmen are paid by the ream of 500 sheets, printed on both sides (or 1,000 impressions), the price varying according to the quality of the work required. Each press is worked by two men: and it is estimated that, on the usual description of printing, two men would produce 1,250 perfect copies of one sheet (or 2,500 impressions) per day. The Illustrated Catalogue was printed entirely at the hand-press, and required so great an amount of care, that 500 sheets, or 1,000 impressions, were scarcely obtained from the men in one day: and of the separate engravings, eight of which were printed on one sheet of paper, but 500 impressions were produced in a day, and, in addition to the men engaged in printing, four men were constantly employed in what is technically called "bringing up" the engravings on wood, preparatory to the printing.

To the Press and Machine Departments must be added persons to wet the paper before printing, and others to dry and press it after printing, and deliver to the binders. The average number of persons employed in "wetting" paper was equal to 6 men for 90 days.

Comparative Power of Production of Hand-Presses and Steam-Machines.—Comparing the press and the cylinder machine, the size of the paper and the quality of the work being the same, the press will produce 1,250 copies and the machine 7,000 in the day, at about the same cost for labour; and comparing the press with the platten machine, the press will yield 1,000 copies, and the machine 4,000, at the same cost; the quality of the work always being in favour of the press.

This high rate of production, however, is only attainable where the number of copies required is large: where the numbers to be printed do not exceed 2,000, not more than one-half these quantities can be obtained on the average; and when less than 2,000 little advantage is gained by using the steam-machine.

The machines, however, have an advantage over the press in size, which doubles, and in the larger machines, trebles the quantity produced; while the press can only print 8 pages of the Catalogue at each impression, some of the machines printed 48 pages at one operation.

Taking the small Official Catalogue as an example:—290,000 complete copies were printed at 15 cylinder machines, in 42 days; it would have required 47 hand-presses 97 days to have produced the same result; or, while 15 machines, with 15 men and 30 boys, produced 7,000 copies of the Catalogue daily, 47 presses, and 94 men, could have produced but 3,000.

The following Table shows the average number of persons engaged in editing, compiling, and printing the various Catalogues, &c.—

Editor	1	
Compilers	17	
French Translators	2	
German Translator	1	
Annotators	30	
Indexers	20	
	—	71
Compositors	44	
Readers and Boys	8	
Pressmen	32	
Machinemen and Boys	55	
Wetters of Paper	2	
Warehousemen and Boys	11	
	—	152

Printing Ink.—The cost of this article forms no inconsiderable item in the expense of printing. The ink used for the Catalogues was manufactured by Messrs. Shackell and Edwards; the quantity required for the small Catalogue amounting to nearly 4,000 lbs.; for the Illustrated Catalogue about 400 lbs.; and the entire quantity consumed on all the works printed for the Exhibition not less than 6,000 lbs. The ink for the Illustrated Catalogue is a fine specimen of black, made purposely for the printing of wood engravings. Printing ink varies much in price, according to the quality: that used for the Illustrated Catalogue is nearly four times the cost of the ink used for the small Catalogue; but as a less quantity of the finer description is necessary to cover the same amount of surface, the comparative increase of price is somewhat reduced.

Engraving.—Three classes of artists are necessary for the production of an engraving—the designer, the artist who transfers the original drawing to the wood-block, and the actual engraver. The designer is usually considered the superior artist, although the elaborate workmanship exhibited on some of the engravings in the Illustrated Catalogue would make this point somewhat doubtful: two, three, and even four weeks having been occupied on a single illustration. Engraving is a profession followed by both sexes: many engravers are also designers; and where this is the case, the highest point of excellence exhibits itself in their productions.

Upwards of *six thousand pounds* have been expended on this department: it would be difficult to form more than an approximate estimate of the number of persons engaged, but as a Supplementary Volume is in the course of preparation,—probably not less than 200, from the commencement of 1851 to the present time.

Lithography. The art of printing from stone also contributed towards the embellishment of the Illustrated Catalogue. The Plan of the Building was lithographed in three colours, and employed a draughtsman 10 days to complete three stones: 96,417 impressions were therefore necessary to obtain 32,139 copies, and was equal to the work of 3 printers for 108 days: 22,187 of the Plans were mounted; this operation employed 6 persons 40 days.

The Prince of Wales' Shield occupied one draftsman 9 days, and the Liverpool Model 6 days, in lithographing; and printing 9,000 copies of the former, and 11,000 of the latter, required 2 men 36 days.

The Kieff Bridge—a beautiful specimen of tinted lithography—employed the artist 14 days. To produce the desired effect, three stones were used; and as each impression was the result of three printings, 6,000 copies employed 3 men 24 days.

When the numbers to be printed are large, *transfers* to other stones can be made: and by this means, with the aid of additional presses, copies can be rapidly multiplied. This process, however, is only applicable to ink drawings, such as the Shield and Liverpool Model; but for chalk drawings, similar to the Kieff Bridge, it is scarcely practicable.

The entire impression of the Kieff Bridge, and the greater portion of the other lithographic illustrations, were executed by Messrs. Day & Son, and the remainder by Messrs. Standidge.

The coloured map of the Geographical View of the Great Exhibition, by Mr. Petermann, was engraved on stone (a process combining despatch and excellence of execution). It was found necessary to refer to at least 150 different maps and books, in order to identify the various localities from whence the contributions to the Exhibition were supplied; and occupied 3 persons upwards of two months in compiling and engraving; printing 7,000 copies (and for which two printings were necessary) occupied 4 men 70 days; and the colouring 6 persons about 50 days.

Hot-Pressing restores the fine gloss and smoothness that the paper originally possessed before printing; and which the wetting and the impression from the type destroys. After the printed sheets are thoroughly dried they are placed singly between highly-glazed thin card-boards, called Pressing Papers, and at certain intervals a hot iron or zinc plate is introduced. When a sufficient quantity has been thus prepared, the *batch* (as it is technically termed) is placed in an hydraulic press of great power, for 8 or 10 hours. In cold pressing the only difference in the process is in the use of cold instead of hot plates. The pressing of 6000 reams employed 4 men and 4 boys for 75 days.

Binding. The services of 12 binders were retained to effect this last operation in the production of the small Official Catalogue; and, by the united efforts of not less than 500 persons, 20,000 copies were sewn and covered in the course of a few hours.

The binding of the Illustrated Catalogue was intrusted entirely to Messrs. Remnant, Edmonds, & Remnant, and the Messrs. Westley & Co., in addition to the binding of a very large portion of the small Official Catalogues.

Presentation copies of the small Catalogue, and of the first Part of the Illustrated Catalogue, were also prepared for Her Majesty and H.R.H. Prince Albert, on the opening of the Exhibition. These books were elegantly bound, with gilt edges, by the Messrs. Westley & Co., in the short space of six hours.

The division of labour in binding is great: the various processes are performed by men, women, and young persons of both sexes. To complete the small English, French, and German Catalogues—the Priced Lists—Index—and the English and French Synopses—nine operations were necessary for each book; the binding of these various works gave employment to 20 men and 100 women for 80 days.

The Illustrated Catalogue required 17 operations to produce a complete volume; and binding the whole impression afforded occupation to 40 men and 90 women for about 48 days.

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